LESOTHO

Sustainable Energy for All

COUNTRY ACTION AGENDA

SUSTAINABLE ENERGY FOR ALL

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UNDP

COUNTRY ACTION AGENDA

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Abbreviations and Acronyms

BoS	Bureau of Statistics
CFL	Compact Fluorescent Lamp
DSM	Demand Side Management
DoE	Department of Energy
EE	Energy Efficiency
EDM	Electricidade de Moçambique
EMP	Electrification Master Plan
ESKOM	Electricity Supply Commission of South Africa
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Green House Gas
GoL	Government of Lesotho
GWh	Giga-Watt Hour
HECS	Household Energy Consumption Survey
HPP	Hydro Power Plant
INDC	Intended Nationally Determined Contributions
IPP	Independent Power Producer
KM	Kilo-meter
KM2	Square Kilo-meter
kW	Kilo-Watt
kWh	Kilo-Watt Hour
LEA	Lesotho Electricity Authority
LEC	Lesotho Electricity Company
LEWA	Lesotho Energy and Water Authority
LHDA	Lesotho Highlands Development Authority
LHWP	Lesotho Highlands Water Project
LPG	Liquefied Petroleum Gas
LSL	Lesotho Maloti
MASL	Meters Above Sea Level
MDG	Millennium Development Goal
MEM	Ministry of Energy and Meteorology
MHP	Muela Hydro Project
MOU	Memorandum of Understanding
MW	Mega-Watt
MWh	Mega-Watt Hour
NEMP	National Electrification Master Plan
NGO	Non-Governmental Organization
NSDP	National Sustainable Development Plan
PPP	Public Private Partnership
PV	Photovoltaic
QOSSS	Quality of Service and Supply standards
RAGA	Rapid Assessment and Gap Analysis
RESCO	Rural Energy Service Companies
RE	Renewable Energy
RET	Renewable Energy Technology
REU	Rural Electrification Unit
RRA	Renewable Readiness Assessment

SACU	Southern African Customs Union
SES	Sustainable Energy Strategy
SEforAll	Sustainable Energy for All
SHS	Solar Home System
SMME	Small, Medium and Micro Enterprises
SREP	Scaling-up Renewable Energy Project
SWH	Solar Water Heater
TAF	Technical Assistance Facility
TV	Television
UAF	Universal Access Fund
UN	United Nations
UNDP	United Nations Development Program
USD	United States Dollar
V	Volts

REPORT DATA SHEET	
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Country:	Lesotho
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EXECUTIVE SUMMARY

The Country Action Agenda for Lesotho is a strategy-driven and holistic document that will act as an umbrella for energy sector development at national level. It defines the national SEforAll objectives and determines how Lesotho aims to achieve the three goals of SEforAll, by taking into account the conclusions and findings of the developed RAGA[1] and identifying and proposing a set of actions that can be put in place so that the three goals of SEforAll can be achieved by 2030, namely

- To ensure universal access to modern energy services
- Double the overall rate of improvement in energy efficiency
- Doubling the share of renewables in global energy matrix

This Country Action Agenda for Lesotho was developed taking into consideration several documents and literature identified and provided, as well as the thoughts, knowledge and information gathered from the several meetings conducted with the relevant Lesotho Energy Sector stakeholders.

This document provides the long-term vision which ensures the overall sector-wide coherence and synergy of the accumulated efforts towards the three goals of SEforAll in the country by identifying the following targets for Lesotho:

ENERGY ACCESS

Electricity Access

- **Electricity Generation**: Increase installed capacity to about 300 MW by 2022;
- **Transmission**: Construct, expand and maintain transmission infrastructure to improve supply of electricity countrywide;
- **Connections**: Increase access to electricity through grid and off-grid solutions to ensure that 75% of households get access to electricity through grid and off-grid solutions by 2022.

Clean cooking and fuels

- **Clean, modern and renewable energy sources and technologies**: Ensure universal access through increased supply and distribution of clean, modern and renewable energy sources and technologies, 50% of LPG use, and 70% of rural clinics using SWH by 2022
- **Biomass, Biogas and Biofuels subsector**: Promote sustainable use and conservation of biomass resources (installation of at least 1000 bio-digesters by 2022) and strengthen research in biofuels and associated technologies

[1] SEforALL Lesotho Rapid Assessment and Gap Analysis (2012)

- **Energy efficient appliances:** Increase distribution of energy efficient cook stoves to achieve at least 70% household use by 2022, distribute 13,000 stoves by 2020.

RENEWABLE ENERGY

Renewable Energy generation capacity improvement

- Increase RE generation to 200 MW by 2020 and 375MW by 2030

ENERGY EFFICIENCY

Energy efficiency improvement measures

- Electricity systems improvement and network rehabilitation: Reduce technical losses from 10% to 5% by 2022
- Demand side management: Promote demand side management measures to lower electricity consumption.

The Country Action Agenda also identifies the priority action areas where efforts should be addressed to reach the proposed targets as well as high-impact opportunities with significant potential to advance the SEforAll objectives.

PREAMBLE

The Sustainable Energy for All initiative (SEforALL) is a partnership between Governments, the private sector and civil society. It was launched by the Secretary-General of the United Nations in 2011, has three interconnected objectives to be achieved by 2030:

- To ensure universal access to modern energy services
- Double the overall rate of improvement in energy efficiency
- Doubling the share of renewables in global energy matrix

These goals together should act as a catalyst for the creation of conditions for the development of income-generating activities and as an engine of development and anti-poverty instrument.

The main purpose of the Country Action Agenda is to serve as a strategy-driven and holistic document that will act as an umbrella for energy sector development at national level, in Lesotho. The Country Action Agenda defines the National SEforAll objectives and determines how Lesotho aims to achieve the three goals of SEforAll, by taking into account the conclusions and findings of the RAGA and identifying and proposing a set of Actions that can be put in place so that the three goals of SEforAll can be achieved.

The Action Agenda provides the long-term vision which ensures the overall sector-wide coherence and synergy of the accumulated efforts towards the three goals of SEforAll in the country.

The present Country Action Agenda follows the fundamental guiding principles contained in the Guidelines for the Development of National Sustainable Energy, namely:

i. Work on the basis of plans / Programs / existing strategies;
ii. Political commitment and leadership;
iii. A balanced and integrated approach;
iv. An inter-ministerial and inter-sectoral approach;
v. Adherence to the principles of sustainable development;
vi. Participation and meaningful involvement of all stakeholders;
vii. Gender equality and inclusion,
viii. Transparency and accountability.

The Lesotho Country Action Agenda was developed in a multi-stage process, to ensure maximum participation from all relevant stakeholders, as well as, ensure national ownership of the development process as a part of a coherent framework of SEforAll activities at the global and the regional level.

The Lesotho Action Agenda was funded by GEF[2] and developed by the Department of Energy (DoE) with the UNDP[3] support.

Since independence, Lesotho has used medium-term planning as the key instrument for coordinating development activities in the country. The six development plans[4] that have been implemented so far had planning horizons that did not go beyond five years. In 2000, Lesotho took a policy decision to formulate a vision to provide a long-term perspective within which national short to medium-term plans could be formulated. The specific objectives of the Lesotho Vision 2020 were to: establish a long-term vision for Lesotho by looking beyond the short-term plans and adjustments; explore the options for economic, political and human development to the year 2020; identify alternative development strategies suitable for the Lesotho situation; promote a process of open dialogue and consultation with socio-economic groups countrywide; create an environment whereby Basotho will actively participate in achieving the Vision 2020; and develop and focus along the horizon in the direction of which development plans could be rolled out.

The major strengths of the Country include the Government's commitment to development, widely accepted and respected constitution, cultural homogeneity, the electoral system and high adult literacy. Major weaknesses on the other hand include food insecurity, high rate of unemployment, poor strategic and operational planning and an underdeveloped SMME sector.

The external environment presents the country with opportunities on the one hand and threats on the other. Foreign Direct Investment, strong donor support, good bilateral relations and multilateral arrangements are some of the opportunities that Lesotho can exploit. Major threats that the Basotho have to contend with are, inter alia, increasing competition from the international markets, donor conditions, retrenchment of Basotho from the Republic of South Africa and declining SACU revenues.

Looking to the future, Lesotho has to find ways to compete in the international market on the basis of quality, efficiency, high productivity and high innovative capacity. The future vision of Lesotho is that "*Lesotho shall be a stable democracy, a united and prosperous nation at peace with itself and its neighbours. It shall have a healthy and well-developed human resource base. Its economy will be strong, its environment well managed and its technology well established*"[5]. Lesotho is at a crossroads and it is necessary an "*acceleration of the process of transformation and modernization of the society*". This process should be led by a competitive private sector, and able to create employment for the population and redistribute wealth.

The country faces important challenges such as high unemployment particularly among young people, scattered rural poverty and rising inequalities. Also, the external environment of great uncertainty and great risks has negatively influenced the evolution of the Basotho economy open to the world.

[2] Global Environmental Facility
[3] United Nations Development Programme
[4] Source: National Strategic Development Plan 2012/13 – 2016/17 – Growth and Development Strategic Framework
[5] Source: Lesotho Vision 2020

Lesotho being a country with limited natural resources, and with an internal market with reduced dimension, based the agenda of its Vision 2020 on innovation and creation of value. The Vision is based on the following strategic competitive factors – geographical position, stability and good governance, the young and enabled population and natural resources recoverable as, the water, the wind and the sun. It is therefore natural that the tourism, and also the use of renewable energies, are between the bases of support, of the economy and society, in the new agenda of transformation

The bet in renewable energies is considered essential to the country. First it ensures intrinsically the sustainability of the goal of universal energy access. In the context of Lesotho, the use of endogenous sources will allow, on the one hand, greater energy independence and, on the other, access to energy at competitive costs for families and for companies. Secondly, the ambitious goals pursued are a proposal for a profound transformation of the energy sector, implying change of technologies, processes, and markets and their agents. Taking into account the scale of the challenge, the Government of Lesotho will need to innovate in terms of technical capacity, as well as in the processes, management and financing models and technical, social, and environmental monitoring.

This Country Action Agenda for energy is a document coherent and aligned with the current Energy policies and strategies, namely the “Sustainable Energy Strategy and Action Plan”, the “Energy policy 2015 – 2025” and in the “National vision 2020”.

INTRODUCTION

Lesotho is a mountainous country with a land area of 30,355sqm landlocked and completely surrounded by Republic South Africa. It has a population near 2,007 million[6] which has been growing at a constant rate from 1980 to 2017. Currently 66% of the population lives in rural and scattered areas, and the remaining 34% living in urban areas (Figure 1).

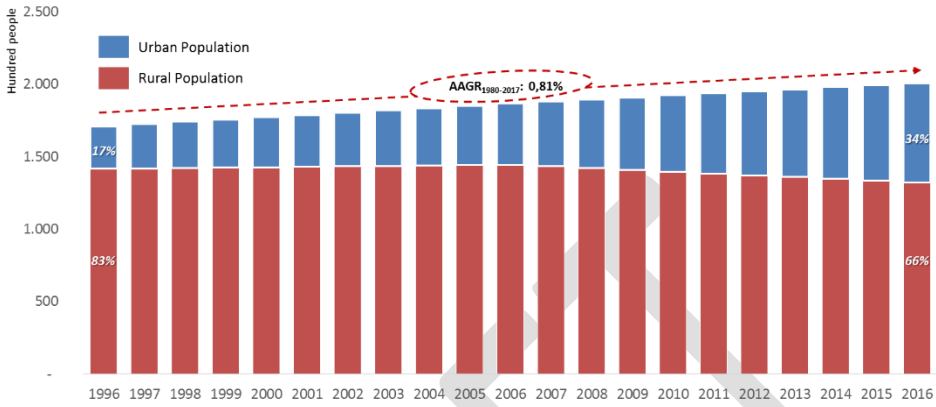

Figure 1 – Historical Evolution of Population in Lesotho (1996 – 2017) (Source: Lesotho Bureau of Statistics)

Due to its high altitude the country has a temperate climate with hot summers and severe cold winters with temperatures reaching 30ºC in summer and winter temperatures as low as -7ºC in the lowlands and -18ºC in the highlands (mean summer and winter temperatures are 25ºC and 15ºC respectively). The annual rainfall ranges between 600mm in the lowlands and 1200mm in the northern and eastern parts of the country.

Lesotho is moving from a predominantly subsistence-oriented economy to a lower middle income, diversified economy exporting natural resources and manufacturing goods, presenting a 2016 GDP of 24.244 million Maloti at 2012 constant prices[7]. GDP contributions per Sector are presented in Figure 2.

[6] Source: Lesotho Census 2016 (BoS)
[7] Source: Lesotho BoS website www.bos.gov.ls (as consulted in Sep 10th 2018)

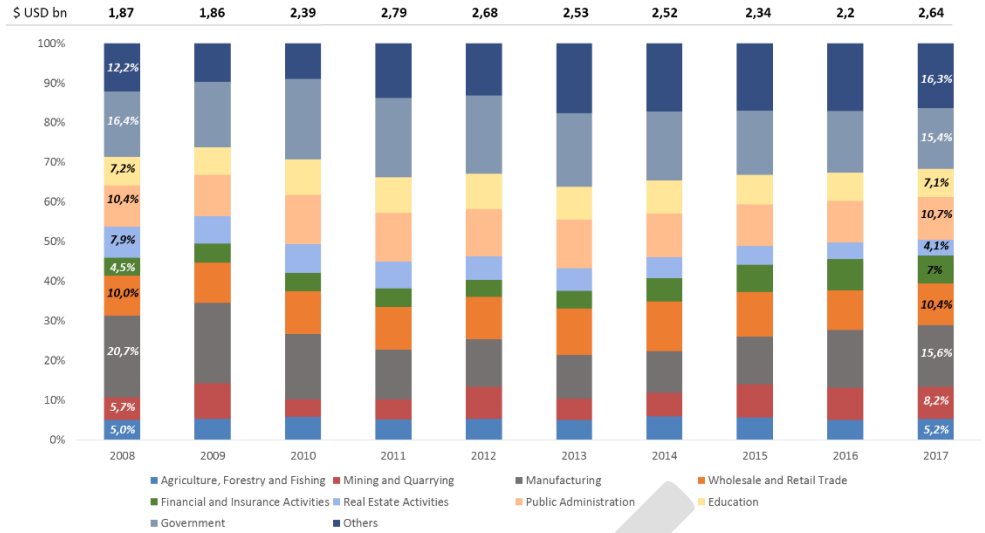

Figure 2 – Lesotho Sectorial Contribution to the GDP (Source: Lesotho Bureau of Statistics)

Within the scope of the SEforAll initiative, a "Rapid Assessment and Gap Analysis" report was prepared, and it focused on the Country assessment and gaps identification.
The Lesotho SEforAll Rapid Assessment and Gap Analysis (RAGA) document pointed a number of key gaps, barriers and additional requirements to achieve SEforAll goals.
Since then, Lesotho has already taken relevant steps to fill those gaps:

General

RAGA GAP	STATUS	MEASURE TAKEN
Weak Policy and Legal framework as evidenced by the absence of an approved policy and strategy for energy, renewable energy and energy efficiency promotion.	solved	New Energy Policy (2015)
Fragmented institutional and legal framework resulting in inadequate multi-sectorial approach in the country.	ongoing	EU Energy Support Reform Program
Lack of incentives for retentions of skills in key energy organizations.	Not addressed	

Table 1 – Lesotho SEforAll Rapid Assessment and Gap Analysis (RAGA) – General Key Gaps

RAGA GAP	STATUS	MEASURE TAKEN
Lack of baseline data for proper analysis of the access to modern	solved	Households Energy survey report (2017)

energy services particularly for thermal applications and productive use at small scale production levels.		
Inadequate private investment in modern energy supplies and technologies for cooking and other thermal applications.	ongoing	• Cornerstone Public Policies and Institutional Capacities to Accelerate Sustainable Energy for All (SEforAll) Project • EU Energy Support Reform Program
Short term initiates by donors and NGOs that need to be sustained.	Partially addressed (ongoing)	Constitution of a National Energy Fund
Electricity supply is a limitation to meet the growing demand both in households and industry	ongoing	New installed capacity under development: • LHDA Hydro Power Plant (Phase II) development • 20MW Mafeteng Solar PV Power Plant • 70MW Mafeteng Solar PV Power Plant
Rural connections limited by restrictive grid extension/maintenance, Energy efficiency	ongoing	Electrification Master Plan (2018)
Lack of energy efficiency strategy and programs in the country.	Not addressed	
Inadequate access to finance by the energy end use consumers combined by low household income by rural populations thus affecting willingness and ability to pay for modern energy services by rural communities.	ongoing	• Cornerstone Public Policies and Institutional Capacities to Accelerate Sustainable Energy for All (SEforAll) Project • EU Energy Support Reform Program • SREP programme
Low application of demand-side management (DSM) and energy efficiency measures for modern energy in the productive sectors.	Not addressed	

Table 2 – Lesotho SEforAll Rapid Assessment and Gap Analysis (RAGA) – Energy Access Key Gaps

RAGA GAP	STATUS	MEASURE TAKEN
High capital costs of Renewable Energy	Not addressed	
Low awareness about RETs[8] and access to information on RETs	ongoing	• Cornerstone Public Policies and Institutional Capacities to

[8] Renewable Energy Technology

		Accelerate Sustainable Energy for All (SEforAll) Project • EU Energy Support Reform Program • SREP program
There is also low involvement of the private sector in new on-grid and off-grid renewable energy power generation capacity (especially for energy efficiency and renewable energy).	ongoing	• Cornerstone Public Policies and Institutional Capacities to Accelerate Sustainable Energy for All (SEforAll) Project • EU Energy Support Reform Program • SREP program
Uncertainty on resource potential of hydro in the country and required assessment of wind, solar and biomass potential.	ongoing	• Development of a Resource Map (Italian Government support) • FAO Climate Change Project • SREP to develop hydro potential for up to 10MW

Table 3 – Lesotho SEforAll Rapid Assessment and Gap Analysis (RAGA) – Renewable Energy Key Gaps

PART 1: VISION AND TARGETS UNTIL 2030

Lesotho Energy Policy Vision:

Energy shall be universally accessible and affordable in a sustainable manner, with minimal negative impact on the environment.

1.1 ENERGY SECTOR TRAJECTORY

1.1.1. ENERGY SECTOR OVERVIEW

Lesotho's most relevant energy sources are currently Biomass, Coal, Petroleum and Electricity.

Lesotho's energy mix is dominated by biomass. As shown in the leftmost chart on Figure 3, biomass constitutes over half of Lesotho's energy balance. The rightmost chart on Figure 3 shows that most biomass derives from wood. Fossil fuels such as coal and petroleum also make up a substantial portion of Lesotho's energy mix while electricity contributes very little.

Since Lesotho has no proven reserves of oil or gas, it imports nearly all its fossil fuel from South Africa. Because of dwindling forest reserves Lesotho has also started importing fuelwood to meet energy demand. In 2012, fuel imports accounted for 13 percent of total trade from South Africa, and 7 percent of Lesotho's GDP.[9]

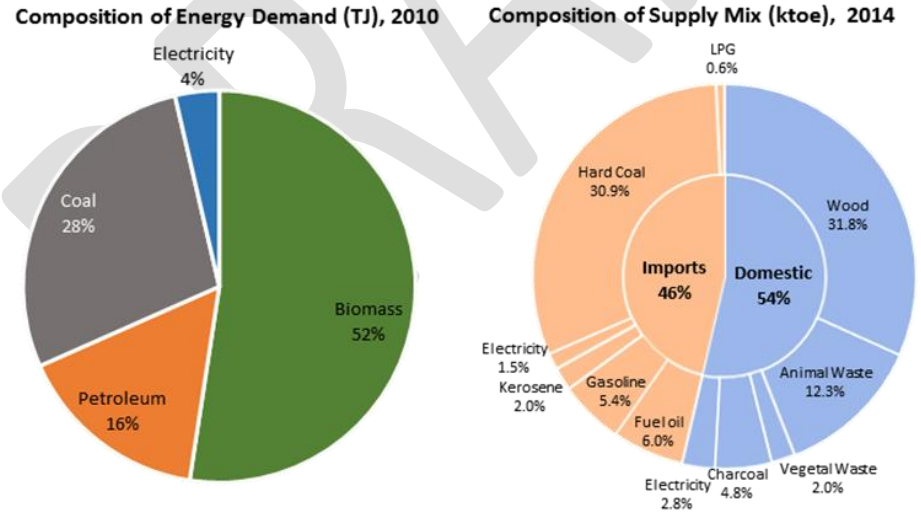

Figure 3 – Energy Demand and Supply in Lesotho (SREP - RE Options Study - March 2017)

In terms of energy consumption, the households of Lesotho require energy mainly for lighting, cooking, and space heating. Data shows that there is a difference in level of energy access hence consumption between urban and rural households in Lesotho, with a higher

[9] UN Comtrade Database, accessed February 14, 2017, https://comtrade.un.org/data/
Data derived from SITC revision 2 classification; since Comtrade uses current dollar values, the GDP comparison is based on current 2012 values. In terms of constant PPP USD, fuel imports represent 3% of Lesotho's GDP.

proportion of urban households having access to more modern forms of energy compared to rural households where access to modern forms of energy is low.

Households use a combination of traditional fuels (i.e. fuelwood, agricultural residues and dung), intermediate fuels (i.e. coal and kerosene/paraffin) and modern fuels (i.e. electricity and LPG).

Electricity is mostly used for lighting rather than for cooking and therefore represents a small share of the domestic energy consumption. Paraffin is mainly used for cooking, space heating and lighting while the use of solar energy such as solar photovoltaics (PV) for lighting is growing

Because many households in Lesotho lack access to electricity (electricity access rate of 38% in 2016[10]), they rely on traditional fuels such as biomass for their energy needs. Biomass (wood and dung) is used for cooking and space heating, especially in rural areas. Urban households are less reliant on biomass and mainly use paraffin and gas for space heating and cooking. Paraffin (kerosene) is the main source of fuel for lighting: 60 percent of all households use paraffin while the rest use electricity or candles.[11]

The following subsections present a more detailed overview on 1) Energy Use, 2) Renewable Energy and 3) Electricity Sector.

1.1.1.1 Energy Use

Lighting

Regarding household lighting, according to the 2016 energy statistics, 48% and 14% of households in Lesotho use paraffin and candles respectively for lighting (Figure 4). All households connected to the national grid use electricity for lighting. The use of solar energy for this application is averaging less than 2%.

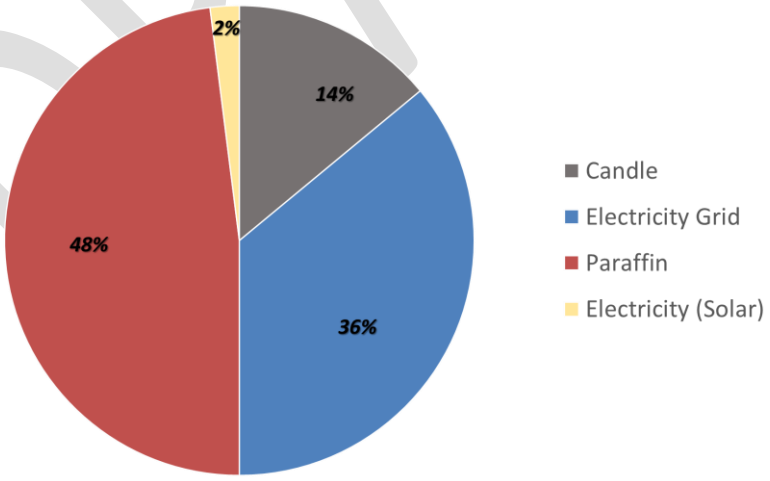

Figure 4 – Percentage Share of Households by Main Energy Sources for Lighting for the Year 2016 (Source: BoS 2017 Energy Report)

[10] Lesotho Bureau of Statistics "2017 Energy Report" (Pg.13)
[11] Lesotho Bureau of Statistics, "2011 Lesotho Demographic Survey: Analytical Report, Vol. 1," 2011.

Space Heating and Cooking

In terms of space heating, while most African countries need fuel primarily for cooking, in Lesotho it is also essential for space heating, and is used in large quantities for this purpose by the majority of rural households. The fact is that Lesotho is a very cold and mountainous country with some of localities residing at altitude of 1,800 meters or more with temperatures often falling below freezing point during winter[12].

Concerning space heating, the majority of households in Lesotho (over 95%) use traditional forms of energy for space heating such as fuelwood, dung and coal.
Fuelwood and dung are used by rural households while coal and gas are mainly used in urban households.

Recently, paraffin gain advantage for space heating purposes because a wider range of fuels became more available in rural areas and appropriate appliances became more accessible to low income households. In 2016 the number of households that used the electric grid as a power source reach more than thirty thousand households (Figure 5)

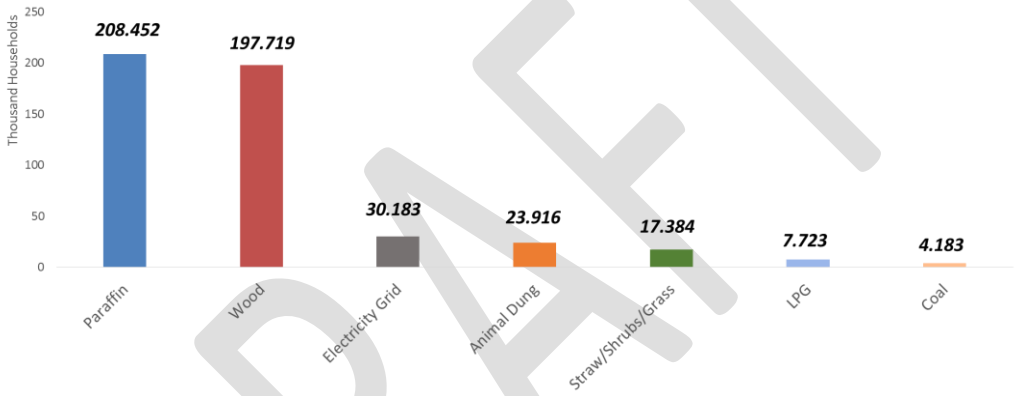

Figure 5 – Number of Households by Type of Energy source used for heating for the year 2016 (Source: 2016 Population and Housing Census)

In terms of cooking, in developing countries, especially those in Africa, more than two billion people rely on wood fuel as the main source of fuel for cooking, particularly in households in developing countries. It represents the only available and affordable source of energy (FAO, 2014).

Concerning energy used for cooking, the majority of households in Lesotho (over 74%) use wood as fuel, however LPG consumption is growing and becoming the preferred solution (where distribution is available).
Figure 6 presents the Lesotho's household energy use for cooking by type.

[12] Population and Housing Census, 2016

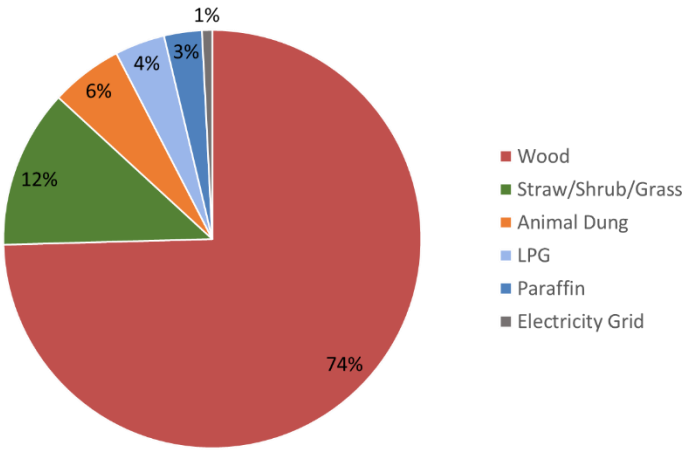

Figure 6 – Lesotho's household energy use for cooking (source: Lesotho Bureau of Statistics)

Table 4 presents the estimated percentage of households by district using each type energy sources for cooking for the year 2016 evidencing the different consumptions and type of energy use across the Country.

Districts	Energy Sources					
	Electricity Grid	LPG	Paraffin	Wood	Animal Dung	Straw/Shrunbs /Grass
Botha-Bothe	8,21%	21,15%	21,97%	0,49%	16,08%	32,11%
Leribe	11,38%	37,16%	28,58%	0,65%	10,66%	11,57%
Berea	6,16%	25,93%	25,53%	0,76%	10,13%	31,49%
Maseru	7,17%	25,56%	18,39%	0,51%	15,79%	32,57%
Mafeteng	3,85%	26,24%	26,24%	0,53%	33,80%	9,34%
Mohale'shoek	2,54%	50,03%	35,37%	0,70%	10,57%	0,80%
Quthing	7,18%	35,16%	24,27%	0,64%	22,61%	10,13%
Qacha's Nek	8,02%	23,45%	16,72%	0,41%	48,99%	2,41%
Mokhotlong	5,62%	55,43%	37,67%	0,82%	0,25%	0,23%
Thaba-Tseka	1,96%	58,73%	37,45%	1,34%	0,13%	0,38%

Table 4 – Percentage of Households by Districts and Energy Sources for Cooking for the year 2016 (Source: 2016 Population and Housing Census)

1.1.1.2 Renewable Energy for electricity

Renewable power (hydropower) makes up a large share of existing generation portfolio, although Lesotho is importing about 70 MW while it is generating 72,5MW.

Solar PV is seen as having a very high potential especially in rural electrification for off-grid installations in households, schools, hospitals etc. mainly on remote and mountainous areas with sparse population where grid extension is not economically feasible.
Solar energy is also seen as a means for water heating and the government has committed itself through the Energy Policy to install solar water heaters in the public buildings.

Wind measurements confirm that Lesotho has significant potential for wind power and wind farms are planned in the country.
Table 5 presents an estimate of the wind and solar potential in Lesotho.

Energy Resources	
Wind Potential (average)	35 – 25m/s
Annual average solar radiation per day	5,4 kWh/m^2

Table 5 –Wind and solar energy resources (Source: SEforAll RAGA for Lesotho)

1.1.1.3 Electricity sector

The following Table 6 summarizes the most relevant figures that characterizes the Lesotho Energy Sector.

Power Sector	
Electricity Demand	
Peak demand (2016)	153 MW
Energy Consumption (2017)	732 GWh
Electricity Supply	
Capacity	~75 MW
Energy Generation	~500 GWh
Share of Thermal	0%
Share of Hydro	99,7%
Power Imports (2016)	~70 MW
Imports (2016)	~370 GWh
Exports (Energy)	2.6 GWh
Electricity Access	
Electricity access rate (Total) 2016	38%[13] (36% grid connected+2% solar home systems)

Table 6 – Power Sector Situation Overview

Electricity supply sources

Most of the generated electricity is based on hydro power, namely on the Muela hydropower plant with a capacity of about 72MW.
The Muela Hydro Project (MHP) is owned and operated by the LHDA delivering the produced energy to LEC[14].
LEC owns two micro-hydropower plants: Semonkong and Mantsonyane. A backup diesel generator produced most of the electricity at the Semonkong plant during the 2015-2016 period because of drought.[15] The LHDA owns one micro-hydropower plant (HPP), the 500 kW Katse HPP.
Table 7 presents the generation assets currently under operation in Lesotho.

Asset	Connection	Technology	Installed Capacity (MW)	Available Hydro Capacity
Muela	Grid	Hydro	72	72
Mantšonyane	Grid	Hydro	2	0[16]
Katse	Grid	Hydro/Diesel	0,50 (0,8*)	0,50

[13] Census 2016 / Electrification Master Plan (Action&Investment Plan) 2018
[14] Based on a 1993 negotiated PPA with a frozen outdated tariff around 1cUSD/kWh
[15] Lesotho Energy Company (Pty) Ltd., "LEC Annual Report 2015-2016," 2016
[16] Beset due to technical issues and lack of maintenance according to information collected during the Stakeholder Consultation Mission

Asset	Connection	Technology	Installed Capacity (MW)	Available Hydro Capacity
Semonkong	Off-grid	Hydro/Diesel	0,18 (0,4*)	0[17]
Tlokoeng	Off-grid	Hydro	0,67	decommissioned
Tsoelike	Off-grid	Hydro	0,4	out of service[18]
		Total capacity	**74,72**	**72,5**

Table 7 – Generation Assets in Lesotho

* Note: Capacity of backup diesel generators

As already mentioned, Lesotho has a peak demand of approximately 160 MW and therefore needs to import more than 70 MW mainly from Mozambique (29% of peak demand) and South Africa (20% of its peak demand)[19].

Electricity access

Electricity access is still very low, in the rural communities, where electrification continues to be a major challenge. Even though Lesotho is a relatively small country (30,355 km^2), with an estimated population of just over 2 million, two-thirds of the country is sparsely inhabited, comprised of rugged mountains and deep valleys with small scattered villages on mountain sides.
The majority of the population (71%) lives in rural areas, but has strong links to urban centres in both Lesotho and neighbouring South Africa. The majority of these villages lack electricity or access to other means of energy besides traditional biomass to serve their cooking and heating needs.

Currently, according to the results of the Households Energy Consumption Survey performed in 2017, the Country electrification rate is 38% (36% grid connected + 2% solar home systems).

The following tables presents the electrification rate by settlement, ecological zone and district based on HECS 2017 survey.

Urban	Peri-urban	Rural
68%	43%	11%

Table 8 – Electrification rate by settlement (Households Energy Consumption Survey, 2017)

Lowlands	Foothills	Mountains	SRV
48%	6%	15%	15%

Table 9 – Electrification rate by Ecological Zone (Households Energy Consumption Survey, 2017)

Botha-Bothe	Leribe	Berea	Maseru	Mafeteng	Mohale'sHoek	Quthing	Qacha's Nek	Mokhotlong	Thaba-Tseka
7%	36%	42%	55%	31%	20%	31%	28%	16%	12%

[17] Beset due to technical issues and lack of maintenance according to information collected during the Stakeholder Consultation Mission
[18] This power plant may be refurbished in the future since a cascade damn scheme is being studies for that river
[19] Energy Master Plan, 2018

Table 10 – Electrification rate by District (Households Energy Consumption Survey, 2017)

Electricity Consumption

Currently the electricity annual consumption is 743,408 GWh/year (LEC).
According to the Load Forecast Report of the Electricity Supply Cost of Service Study (Feb.2018) the demand forecast is expected to grow at 3,2% grow rate (most likely scenario 2015-2030).
The Figure 7 presents the 3 scenarios considered in the above mentioned demand forecast study.

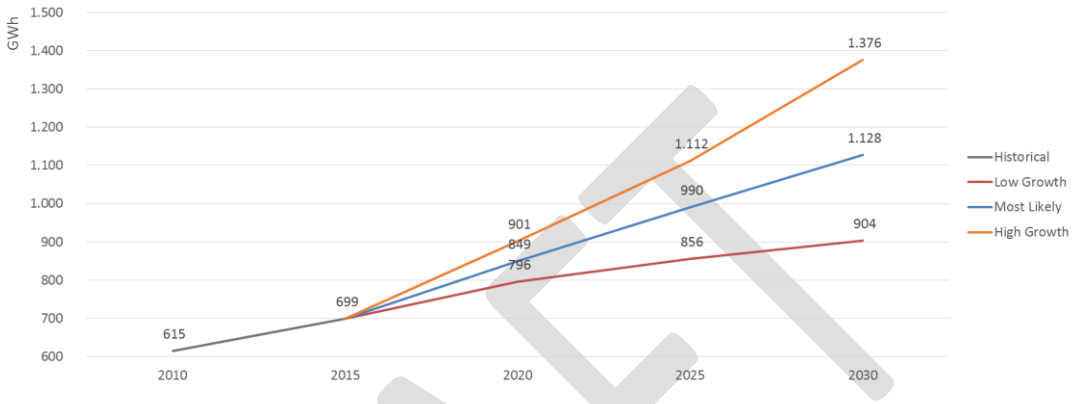

Figure 7 – Lesotho's electricity demand forecast study (Load Forecast Report of the Electricity Supply Cost of Service Study, Feb.2018)

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1.1.2. INSTITUTIONAL FRAMEWORK IN THE ENERGY SECTOR

The current energy sector of Lesotho is mainly a responsibility of the Ministry of Energy and Meteorology. The main actors in the sector are:

- The Ministry of Energy and Meteorology: The Ministry of Energy and Meteorology through the Department of Energy is responsible for the overall administration and coordination of energy sector in Lesotho.
- LEWA: From August, 2004 until April, 2013 the Authority was mandated with regulating the electricity sector. In 2007 the Government decided that the Lesotho Electricity Authority (LEA) should be transformed to be a multi-sector regulatory body assuming additional powers to regulate urban water and sewerage services in the country. LEWA officially started regulating both electricity and urban water and sewerage services sector on May, 2013. The Authority independently deals with matters such as electricity pricing, complaints handling and resolution and the supervision of the implementation of the Quality of Service and Supply standards (QOSSS) by its licensees.
- Department of Energy (DoE): Responsible for the development of policies, strategic plans, strategy formulation, formulation and development of programs in the energy sector, law and policy enforcement, as well as information dissemination.

- Universal Access Fund (UAF): Responsible for funding viable energy projects and research and development in the electricity sector
- Petroleum Fund: Responsible for funding viable energy projects and research and development in the petroleum sector
- Rural Electrification Unit (REU): Build, operate and transfer of electricity transmission, distribution network grids. Mainly develops projects funded by the UAF which is primarily funded by GoL, and then transfers them to LEC
- Lesotho Electricity Corporation (LEC): Lesotho Electricity Corporation (LEC) transmits and distributes electricity. The company also owns and operates hydro power stations. LEC is wholly owned by the Government of Lesotho (GoL).

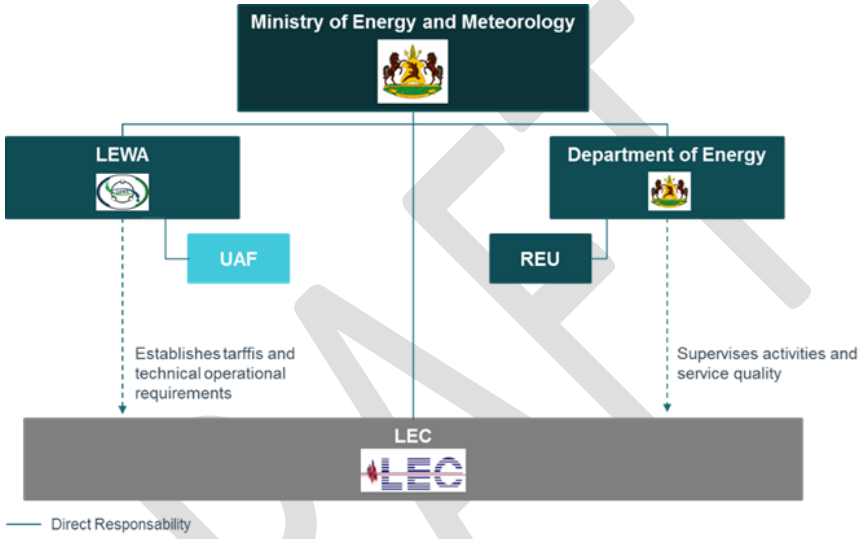

Figure 8 – Current Electricity Sector Framework in Lesotho

The energy sector in Lesotho face challenges which include: low access to modern and clean forms of energy, reliance on imported electricity and fuels (an energy security problem), and dwindling forest reserves. The Government of Lesotho recognizes that these challenges are a barrier to the country's development and has set targets to expand electricity access and increase generation. The Government of Lesotho (GoL) is also committed to promoting the safe use of biofuels, reversing environmental degradation, and increasing the use of renewable energy sources to increase energy security.

1.1.3. KEY ENERGY POLICIES, LAWS AND REGULATIONS

Lesotho has three policy documents for the energy sector which support achievement of the goals described in Vision 2020 and the NSDP I. The main energy sector policies are:

- The **Lesotho Energy Policy 2015-2025** has 15 policy statements in support of reliably and affordably ensuring energy access in order to improve the economy of Lesotho and the livelihoods of its citizens. Policy objectives include: introduction of an appropriate institutional and regulatory framework for the sector; sufficiency and availability of energy sector data; sustainability of bioenergy resources; improved access to renewable energy services and technologies; promotion of energy efficiency; security of electricity supply; development of a reliable and efficient transmission network; increased access

to electricity for all socio-economic sectors; development of a transparent and competitive electricity market; creation of an enabling environment attractive to investment and financing; and introduction of a transparent price-setting structure that ensures cost recovery. The Energy Policy must still be enacted into law.

- Lesotho's **Intended Nationally Determined Contributions (INDC) (2015)** outline the country's commitments towards mitigating and adapting to climate change. Policy objectives related to the energy sector include: continued development of hydropower resources; implementation of demand-side management techniques to ensure efficient use of existing distribution infrastructure; promotion and development of renewable energy, particularly wind and solar; improved distribution efficiency; and development of a low energy IP. Lesotho's INDC also sets certain targets for the energy sector including targets to improve energy efficiency, increase electricity coverage, and increase renewable energy generation by 2020

Table 11 provides an overview of the relevant Lesotho's energy sector laws.

Legislation	Overview
Lesotho Establishing and Vesting Act (2006)	Establishes the Lesotho Electricity Corporation as the Lesotho Electricity Company, vested with all of its assets, liabilities, rights, and obligations as the national electricity transmission and distribution company
Lesotho Electricity Authority (LEA) Act (2002)	Establishes the Lesotho Electricity Authority as regulator for electricity sector
LEA Amendment Act (2006)	Amends LEA Act (2002) regarding composition of Board, funding, powers to enter and use land for regulated activities, and acquisition of land required for regulated activities
LEA Amendment Act (2011)	Amends LEA Act (2002) to give the Authority power to regulate Lesotho's water and sanitation sector and renaming the regulator as the Lesotho Electricity and Water Authority

Table 11 – Key Sector Legislation

The LEA act 2002 gives LEWA the authority to draft economic regulations for the electricity and water sector.

The Ministry of Energy and Meteorology is responsible for approving the regulations.

Table 12 presents an overview of the Lesotho's Energy Sector's relevant regulations.

Regulation	Purpose
Electricity Price Review and Structure Regulations (2009)	Regulates reviews of tariff structure and prices
License Fees and Levies Regulations (2009)	Regulates funding Regulator activities via licensing fees and customer levies

Resolution of Disputes Rules (2010)	Regulates dispute resolution between licensees and customers
UAF Rules (2011)	Establishes a fund for electrification and sets administrative rules
Application for Licenses Rules (2012)	Sets procedures and requirements for license applications and exemptions

Table 12 – Key Regulations and Guidelines

1.2 ENERGY ACCESS TARGET UNTIL 2030

The Government of Lesotho recognizes that energy plays a pivotal role in driving socio-economic development of Lesotho. It is the goal of the government to ensure that energy is accessible for all socio-economic demand sectors. In this regard, both the National Strategic Development Plan and the Vision 2020 points out energy and energy access as a key issues to be addressed by the Government of Lesotho.

Energy is central to sustainable development and poverty reduction efforts. It affects all aspects of development; social, economic and environmental, including livelihoods, access to water, agricultural productivity, health, population levels, education, and gender-related issues. None of the Millennium Development Goals (MDGs) can be met without major improvement in the quality and quantity of energy services in developing countries. UNDP's efforts in energy for sustainable development support the achievement of the MDGs, especially MDG 1, reducing by half the proportion of people living in poverty by 2015.

The Energy Policy does not set specific targets for access, capacity, generation and energy security, however it is very clear in the desire of increase the number of connections and electricity utilization by end-users.

Policy Statement 10: Electricity Connections "*Government desires to ensure more connections and utilization of electricity by end-users*"

With this statement, the Energy Policy target the following objectives:

- Implement an electrification programme and projects
- Support area planning of electrification schemes in rural and urban areas

The Lesotho Energy Policy presents a number of strategies:

a) Develop and implement an electrification master plan
b) Review and revise or formulate a connection policy
c) Grid extension remains the obligation of the Government. In the case where an individual is involved in extension thereof, the public utility will determine appropriate refund if the grid is used for other purposes.
d) The financial mechanism applied to grid electricity to accelerate connections will be extended to include off-grid solutions, as well, such as solar home systems and thermal applications energy efficient cook stoves and LPG stoves.
e) Connection assets up to a meter paid for, by customers will remain in the custody of a distribution entity, which will be obliged to provide and sustain the service.
f) Negotiate for better planning of settlements to allow provision of basic electricity services.
g) Develop specific principles for the policy statement.

The Final Report of the "Support to Climate Change Response Strategy to the Kingdom of Lesotho", presents the National Sustainable Energy Strategy (SES) of Lesotho, which lays out the implementation roadmap of the Energy Policy 2015-2025. The SES is a 5-year rolling plan that addresses the implementation roadmap which comprises energy sector proposed solutions to be implemented in the near-term (2018-2020), and the medium-term (2018-2022) time horizons.
The sustainable energy strategy shall respond to the policy objectives and points out the following objectives for energy access:

- **Electricity Generation**: Increase installed capacity of about 300 MW by 2022
- **Transmission**: Construct, expand and maintain transmission infrastructure to improve supply of electricity countrywide
- **Connections**: Increase access to electricity through grid and off-grid solutions to ensure that 75% of households get access to electricity through grid and off-grid solutions by 2022.

Regarding long term targets, GoL aims to reach 100% electricity access by 2030 as per SEforAll Initiative objectives.

National Electricity Master Plan (NEMP) recommends a shift to commercial and renewable energy sources. However, upon realizing that the majority of the poor people will continue to use biomass as their primary fuel source, government is increasing the resources allocated to forestry and formulating mitigation options in the energy and forestry sectors to encourage sustainable development.
Additionally, there are plans to improve the availability of commercial fuels in rural areas and promotion of access to modern fuels that are less demanding from both an environmental and social perspective.

Regarding access to modern clean cooking technologies, the GoL aims to create a thriving National market for clean and efficient household cooking solutions in order to improve the livelihood of the Basotho people, empower women and protect the environment.
Lesotho is a Global Alliance for Clean Cookstoves partner which means that the government has ascribed to its principles, including a national commitment to support the adoption of clean cookstoves and fuels within their borders; to take a leadership role in employing clean cooking best practices and disseminating clean cookstoves and fuels; and providing in-kind services or funding to the Alliance for the execution of major clean cookstoves and fuels activities.

The sustainable energy strategy points out the following objectives for energy access to modern clean cooking technologies:

- **Clean, modern and renewable energy sources and technologies**: Ensure universal access through increased supply and distribution of clean, modern and renewable energy sources and technologies, 50% of LPG use, and 70% of rural clinics using SWH by 2022
- **Energy efficient appliances:** Increase distribution of energy efficient cook stoves to achieve at least 70% household use by 2022, distribute 13,000 stoves by 2020.

- **Biomass, Biogas and Biofuels subsector**: Promote sustainable use and conservation of biomass resources (installation of at least 1000 bio-digesters by 2022) and strengthen research in biofuels and associated technologies

1.3 RENEWABLE ENERGY TARGET UNTIL 2030

The GoL have set that the **growing percentage of the country's electricity supply should come from renewable sources**.
Lesotho has excellent renewable energy resource, ranging from mini hydropower potential, small-scale wind potential to abundant solar radiation and harnessing of these energy sources would make it possible for the GoL to meet the basic energy needs of the rural population and the foreseen electrification target.

The National Strategic Development Plan points as a strategic objective the increase in clean energy production capacity to attain self-sufficiency and export:

- Evaluate renewable power generation options and negotiate financing arrangements to expand national generation capacity
- Explore opportunities and negotiate regional power linkages
- Develop small-scale electricity generation models that are viable for communities, where connection to the national power grid is not cost-effective

Although no clear targets are set, the Lesotho Energy Policy presents the way forward for Renewable Energy development in the country making reference to the importance of Renewable Energy.

Policy Statement 4: Renewable Energies
"*Government will improve access to renewable energy services and technologies*"

There are three main objectives of this Policy Statement:

1- To improve the energy security situation by reducing reliance on fossil fuels and imported electricity
2- To increase access to modern energy for rural and decentralized areas
3- To reduce Greenhouse Gas (GHG) emissions from energy sector

Despite the fact that no clear target is defined, a number of strategies are pointed out as part of the energy policy:

a) Phase out the use of electric geysers in all existing public buildings and introduce solar water heating systems and heat pump systems.
b) Compel all new Public buildings which require hot water to install solar water heaters.
c) Encourage the replacement of electric geysers with solar water heaters in industrial, commercial, residential and general purpose sectors.
d) Facilitate the establishment of Rural Energy Service Companies (RESCOs).
e) Promote the application of renewable energy technologies to income-generating activities.
f) Promote passive solar design principles in buildings
g) Develop a renewable energy programme to support fuel substitution in different demand sectors.
h) Develop specific principles for the policy statement.

The Final Report of the Support to Climate Change Response Strategy to the Kingdom of Lesotho points out the following objectives for renewable energy:

- **Renewable Energy Technologies**: Roll-out solar water heating and solar street lighting programme
- **Renewable Energy**: Encourage and support private sector participation in the renewable energy sector. (Capacity building and financing facilitation)

According to the SREP Report, the Government of Lesotho has set targets to **increase RE generation to 200 MW by 2020 and 375MW by 2030** as part of efforts mitigate the effects of climate change and solve Lesotho's energy sector challenges in terms of generation capacity.

These objectives may be accomplished implementing different kind of projects:

Solar Photovoltaic (PV)

Due to the existent high solar resource, Solar PV has a very high potential in Lesotho. It is also accessible to rural communities hence can be used for off-grid electrification in the remote areas. Services relating to renewable energy technologies are currently provided by the private sector in Lesotho and there is no local manufacturing of PV system components in Lesotho. Solar PV has application in the following areas: solar home systems, solar PV for clinics and schools, water pumping and telecommunications.

Only approximately 2%[20] of total rural households currently use solar home systems and solar PV competes with kerosene or candles for lighting, and disposable dry cell batteries or charged automotive batteries for powering radios and TVs.

Hydro Energy

Lesotho boasts with plenty of water for electricity generation. Lesotho Highlands Development Authority was mandated to develop hydropower schemes as part of the LHWP[21], and operates the 'Muela Hydropower Plant (MHP) which has a total installed capacity of 72MW.

Lesotho Highlands Development Authority also operates a 500kW mini-hydro plant at Katse dam to supply the local power requirements and Phase two of the LHWP also plans to establish another hydro power station. Four minihydro plants, some of them with diesel back up, were also developed at Mantšonyane (2MW), Semonkong (180kW), Tlokoeng (670kW – already decommissioned) and Tsoelike (400kW – currently out of service[22]).

Currently LHDA is developing the PHASE II Mokhotlong multipurpose hydropower project (23.9 billion Maloti) currently at feasibility studies stage (financed by World Bank) with an expected installed capacity between 80MW and 110MW.

The construction is expected to start 2022 and commissioning date at 2026.

Wind Energy Potential

Despite the fact that there is a high wind potential and also some Private Sector Projects under development in Lesotho territory, currently there are no wind farms operating or in advanced stage of development in Lesotho.

[20] Based on "2017 Energy Report"

[21] Lesotho Highlands Water Project

[22] This power plant may be refurbished in the future since a cascade damn scheme is being studies for that river

1.4 ENERGY EFFICIENCY TARGET UNTIL 2030

The Government of Lesotho recognizes the importance of energy efficiency and conservation, and aims to develop strategies for demand-related areas in households, industry and commerce, government and transport. To achieve this, the Government of Lesotho (GoL) seeks to:

- Promote efficient use of energy;
- Promote thermally efficient buildings;
- Increase knowledge on EE and conservation;
- Ensure adequate investments for EE and Demand-Side Management (DSM);
- Ensure that appropriate technologies and practices are in place.

Although there is no comprehensive energy efficiency program, the Department of Energy disseminates information and supports energy efficiency initiatives.

In terms of the Energy Policy of Lesotho, it states the energy efficiency is expected to play a significant role and therefore appropriate programmes and activities will be supported by the GoL. The current Lesotho Energy Policy makes reference to the importance of Energy Efficiency.

Policy Statement 5: Energy Efficiency in Electricity "*Government will promote energy efficiency practices and equipment in all sector of the economy*".

There is no specific target established in term of energy efficiency, however two main objectives of this Policy Statement, they are:

1- To minimize losses in energy processes
2- To reduce energy imports in meeting demand

Again, no clear target is defined, although a number of strategies are pointed out as part of the energy policy:

a) Implement demand side management programmes and projects.
b) Introduce a metering system and tariff structure that will support energy efficiency and demand side management.
c) Discourage the use of intensive energy use devices and promote the use of energy efficient technologies.
d) Carry-out dissemination campaigns on wise use of energy.
e) Promote the adoption of renewable energy technologies that reduce total end-use electricity consumption.
f) Implement energy efficiency programmes in buildings.
g) Introduce incentives to support energy efficiency programmes and activities.
h) Support applied research and development in energy efficiency programmes and activities.
i) Develop specific principles for the policy statement.

The Final Report of the Support to Climate Change Response Strategy to the Kingdom of Lesotho, points out the following objectives for energy efficiency:

- Electricity systems improvement and network rehabilitation: Reduce technical losses from 10% to 5% by 2022
- Demand side management: Promote demand side management measures to lower electricity consumption.

Regarding long term targets, GoL aims to reach double the overall rate of improvement in energy efficiency by 2030 as per SEforAll Initiative objectives.

1.5 RELEVANT NEXUS TARGETS 2030

All the three energy targets (i.e. access, renewable energy and energy efficiency) are meant to improve the socioeconomic environment and the well-being of the target population.

As such, before grid power is extended to any community or locality, social and environmental impact assessment should first be conducted to ensure the environmental friendliness of the project.

Also, further economic analyses should also be conducted to understand and appreciate the aspects of productive uses of energy: the volume of consumption and consumption carriers; benefits it will provide, e.g. to schools, health facilities, agricultural services (e.g. small scale food processing), small scale industries (such as seamstresses, beauticians, artisans) and recreational centres and its total contribution to local (usually rural) development.

These are to ensure that the energy sector is appropriately linked with other socio-economic factors and contributes to the improvement of the standard of living, including the empowerment of women from the target community.

PART 2: PRIORITY ACTION AREAS

2.1 ENERGY ACCESS

2.1.1 CURRENT STATUS AND TRAJECTORY

Currently electricity supply to the household sector is a responsibility of Lesotho Electricity Company and the Rural Electrification Unit (REU) within the Department of Energy.

All petroleum products used in Lesotho are imported mostly by private multinational petroleum companies operating in the country and the pricing is regulated by the government through the Petroleum Fund.

Electricity Grid

The electricity grid of Lesotho transfers power from the generation sources, namely 'Muela hydropower plant, Eskom (South Africa) and EDM (Mozambique), to the load centres.
The supply from 'Muela and Eskom plus EDM (at Maseru intake) is transmitted through 132kV lines to Maputsoe and Mabote substations respectively.
The supply from Eskom (Clarence intake) enters Lesotho through an 88kV line at Khukhune substation in Butha-Buthe, while Qacha's Nek intake is through a 22kV line from Matatiele. Qacha's Nek and Mokhotlong districts are the only districts that are not connected to the main national grid.

The transmission network is managed from the National Control Centre at Mabote and consists of more than 1,100 km of power lines and 41 substations.
Network performance is generally considered good with an average system availability of 99.9% in 2016/17.
The transmission and distribution networks operates under the following voltage levels:

- 132 kV, used for energy generated locally and imported from South Africa;
- 88 kV, used for energy imported from South Africa;
- 66 kV, used for energy generated locally;
- 33 kV, used for distribution voltage used also for sub-transmission.

The transmission system in Lesotho was developed mainly along the western part of the country, including the Northern and South Western parts, where the geography of the terrain is less mountainous. The only areas covered by electricity, which are not linked to the main grid at this stage, are Qacha's Neck, Mokhotlong and Semonkong.

The two links from South Africa remain in operation and form an integral part of the main transmission grid.

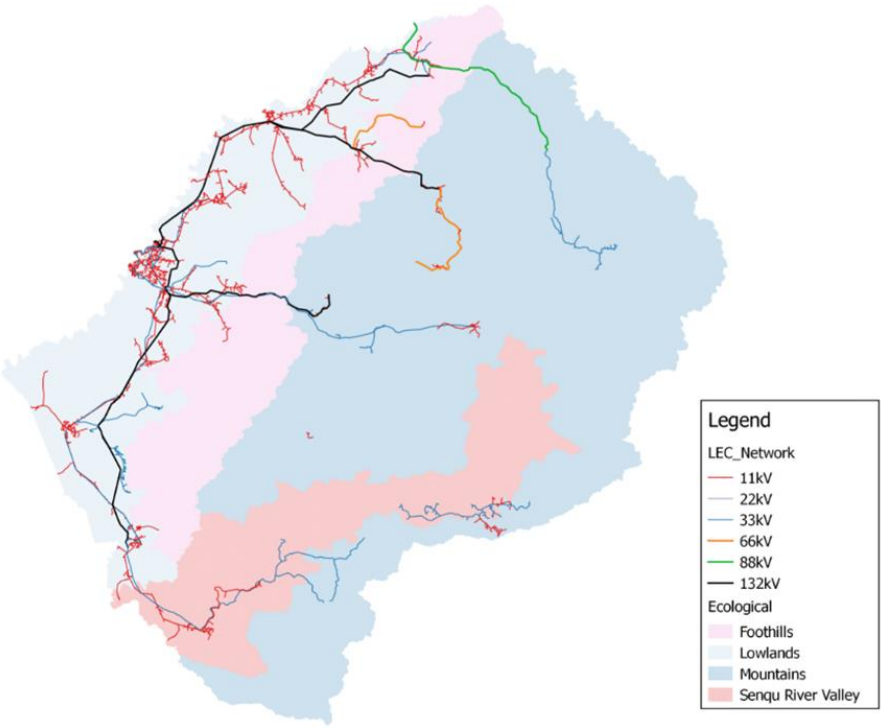

Figure 9 – Lesotho Existing Network: Transmission System

Rural Electrification

REU is the responsible entity for the Rural Electrification.
It was created at a time when the privatization of LEC was considered. In that sense it was established that REU would be responsible for energy supply outside the LEC covered perimeters (urban areas and zones more than 3.5km from the existing LEC distribution grid). At that time Government established as objective for the Country to make 15.000 households connections per year (8.000 LEC / 7.000 REU). REU started to promote pilot projects to evaluate which would be the best approach for each type of village. The following projects were implemented:

- **Diesel Minigrids Project** – One diesel Minigrid project was implemented. The cost of diesel and its transport to the village was too high and the solution was found unfeasible to roll out to other villages. This project was already phased out and the village was connected to the LEC Grid - 45km (33kV MV line) – a total of 1.500 households were connected since other Villages on the way were also electrified.
- **Hybrid Mini-hydro + Diesel power plant** – This was an existing mini-hydro LEC project that was converted into hybrid. Since operation of power plants is not the main mandate or core business of REU, it was transferred to LEC.
- **Cross border electrification** – Solution applicable to villages near the South Africa border and where neighborhood South African Villages are grid connected. In these cases, an agreement with ESCOM were negotiated in order to feed the Lesotho villages by extending ESCOM grid crossing the border to Lesotho.

- **LEC grid extension** – Villages (outside LEC range zones) to where the LEC grid was extended (by REU)
- **Solar stand-alone systems** – Equipment owned by the households bought at a subsidized price (funded by GEF/Private sector). The equipment value (at that time) was around 12.000 Maloti and it was subsidized in about 16%. The total amount to pay (84%*12.000Maloti) was still very high for the families to afford. It was then decided to roll out with a bigger subsidy provided by the Government with the target to equip 1.000 households per year. Unfortunately the rate of connections have been very below that number due to the lack of Government budget to subsidize. Many maintenance problems with these stand-alone systems were identified and REU is now convinced that to provide equipment to the households is not the better solution.

The current process for grid electrification involves the following steps:

1. REU receiving applications from schemes[23] and evaluating the following parameters:
    - number of customers in a scheme,
    - distance from the grid and
    - funds collected.
2. REU annually applies for government funding to electrify these schemes, and once funding has been approved, allocates this to the various schemes in priority order.
3. REU forwards the approved schemes to LEC for construction, in terms of an MOU between REU and LEC.
4. LEC procures contractors to build the networks, and REU monitors progress during the construction period.
5. Once completed, LEC takes over operation and maintenance of the schemes, including sale of electricity.

However, REU is not performing as it was expected due to lack of budget and team capacity constraints and will probably be transformed by the Government.
One of the interferences registered in this process has to do with the fact that some Communities are using funds provided by LHDA (dams land use compensation) to pay directly to LEC for the provision of the grid extension up to their villages. Four (4) Villages were already connected with solar stand-alone systems following this procedure (2,400 households) and 12 more Villages are in pipeline (6,000 households); the success and acceptability of these projects is currently under evaluation and the results should be known in 2019.

Regarding rural electrification, some initiatives have been undertaken in the recent years. A UNDP-GEF supported solar home system programme was implemented between 2007 and 2013, however this programme didn't give out the expected results and it resulted in a poor perception of the technology by the beneficiaries.

Also some challenges have been reported by LEC who is extending the grid to electrify villages that currently have no road access. Contractors are building temporary roads for erecting poles and conductor stringing. These temporary roads don't ensure access to grid maintenance which becomes a problem whenever a failure occurs.

[23] a group of customers in the same area that wish to be connected to the grid and have started collecting connection fees

A new approach to off-grid electrification is needed, with recommendation by the SEforALL-TAF initiative to establish a dedicated agency for this purpose.

Microgrids are often considered in areas where grid extension is not viable or cost prohibitive. In Lesotho, both Government and Non-Governmental Organizations (NGO) have already implemented several micro-grid projects providing access to electricity in rural areas.
Some mini-diesel and mini-hydro pilot projects were implemented by the Government of Lesotho as part of the World Bank Utilities Sector Reform Project (2007). Also, several NGOs have installed mini-grids to serve rural public buildings such as hospitals and schools.
The United Nations Development Programme (UNDP) and European Union Delegation (EUD) have recently allocated funding for micro-grid pilot projects in rural villages around the country.
The UNDP is currently conducting pre-feasibility studies in 20 pre-identified villages to determine the appropriate micro-grid technology for implementation.
Also EU is preparing a pilot project for two mini-grid projects in rural areas with substantial economic growth potential.
There are also private sector initiatives for developing small hybrid PV microgrids to serve rural populations outside of the LEC service areas.

Electricity Generation

The Table 13 presents the electricity generated in Lesotho from 'Muela, Semonkong and Mantsonyane in Megawatt hours (MWh) for the financial year 2016/2017.

Months	Muela	Semonkong	Mantsonyane	Total
April – 2016	42.988,07	68,00	-	43.056,07
May	48.996,47	71,61	-	49.068,08
June	48.720,24	71,22	96,11	48.887,57
July	51.494,89	63,87	6,53	51.565,29
August	50.987,35	76,01	375,41	51.438,77
September	44.191,77	63,25	37,58	44.292,61
October	45.373,15	51,82	-	45.424,97
November	41.153,55	60,96	1.044,26	42.258,76
December	34.353,56	63,57	59,50	34.375,64
January – 2017	33.488,70	62,03	472,24	34.022,97
February	34.757,52	58,06	753,72	35.569,30
March	38.484,11	63,49	158,66	38.706,26
TOTAL	**514.888,11**	**773,89**	**3.004,01**	**518.666,27**

Table 13 – Electricity Generated from Muela, Semonkong and Mantsonyane in MWh for the financial year 2016/2017

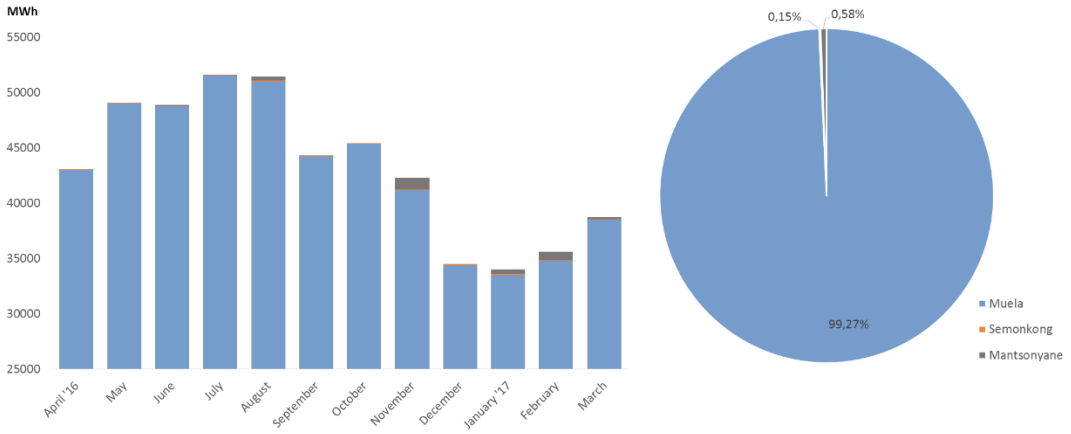

Figure 10 – Electricity Generated from Muela, Semonkong and Mantsonyane in MWh for the financial year 2016/2017

The total amount of electricity generated by Muela contribute almost 99,3% of the total on grid electricity produced in the country.

Initially LEC had four small mini hydro-power stations in the mountainous areas of Semonkong, Mantšonyane, Tlokoeng (Mokhotlong) and Tsoelike (Qacha's Nek). Tsoelike and Tlokoeng power plants have been decommissioned because of both technical and operational problems[24]. Currently LEC owns and operates two small-hydro power plants in Semonkong and Mantšonyane. The role of these small hydro power plants is to reduce the dependence on diesel generators in the remote areas and to supply rural areas with electricity in isolated networks from the National Grid.

Electricity Market

Lesotho produces 73,4% of its own energy demand[25] and imports the difference from ESKOM (South Africa) and EDM (Mozambique) at peak load hours whenever needed — roughly 55 percent of imports are used to meet peak demand.
The import rate has been relatively constant over the recent years as shown in Figure 11 and with a seasonal behaviour as shown in Figure 12 (31% of annual electricity imports occur in the rainy season between January and March).

[24] Source: 2016 Energy Report of the Lesotho Bureau of Statistics
[25] Based on 2016 statistical data : Generation : 507,7GWh / Demand : 691,4GWh

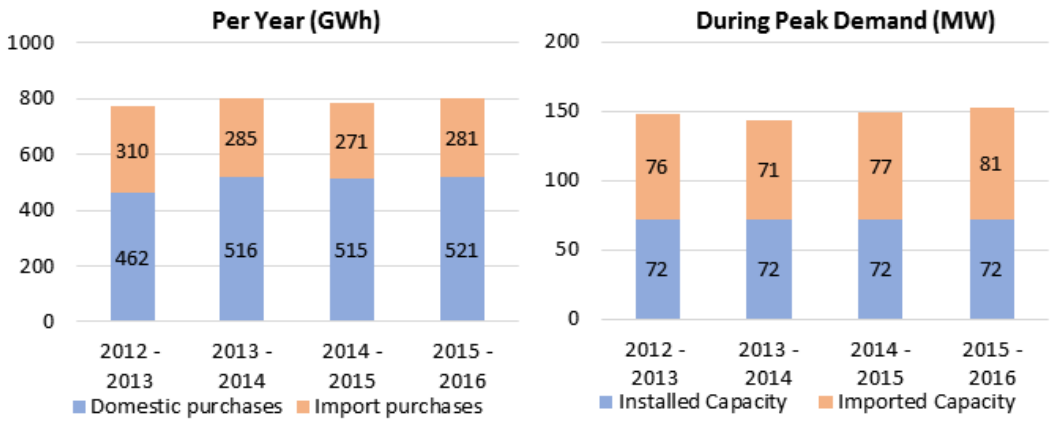

Figure 11 – LEC Purchases, 2012 – 2016 (Source: SREP Final Report)

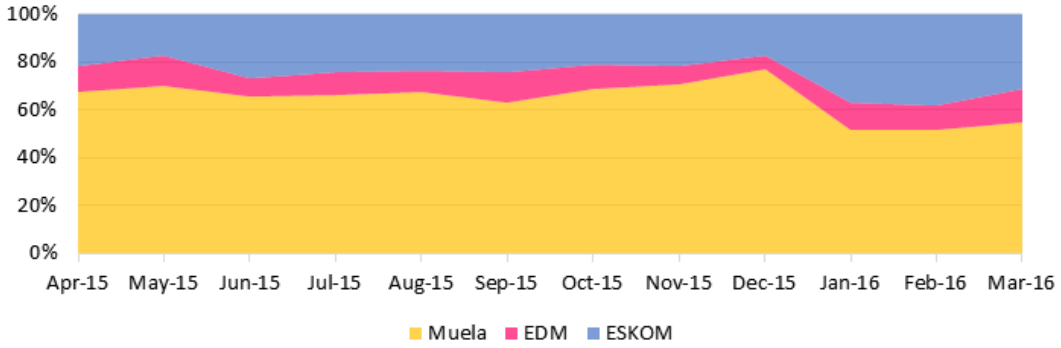

Figure 12 – LEC Bulk Purchases by Intake Point (GWh), April 2015 to March 2016 (Source: SREP Final Report)

On off-peak hours Lesotho exports Muela Hydropower station excess of production to ESKOM. The annual balance of electricity imports/exports between 2012 and 2016 is presented in Table 14.

Year	Total Imports (GWh)	Total Exports (GWh)
2012	284,2	21,0
2013	280,8	2,2
2014	335,5	2,8
2015	260,6	4,4
2016	372,6	2,6

Table 14 – Total Electricity Imports and Exports for Period 2012 to 2016 (source: Lesotho Highlands Development Authority)

Figure 13 describes electricity offtake in Gigawatt hours from 'Muela, Eskom and EDM by LEC for the period 2012/2013 to 2016/2017 and the percentage of electricity imports in which the financial year of 2016/2017 registered a high imports increase that can be justified by a slight decrease in Muela Hydro power plant generation together with a consumption increase during 2016/2017.

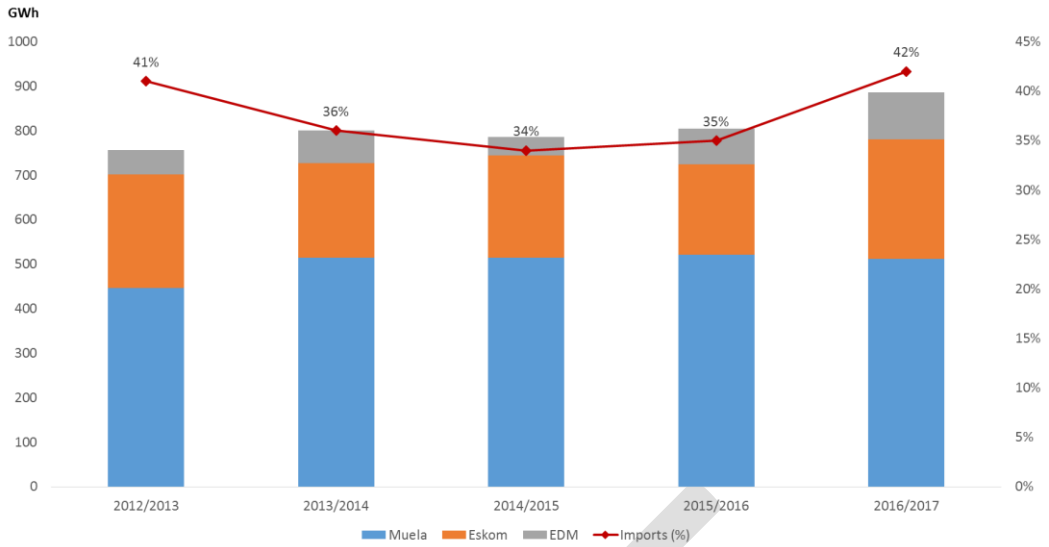

Figure 13 – Electricity offtake in GWh from Muela, Eskom and EDM by LEC for the period 2012/13 to 2016/17 (Source: Lesotho Energy Company)

Electricity Consumption

The Energy Sector has had a continuous growth over the years. This trend is particularly visible if we look at the evolution of the number of electricity customers that increased from around 22,000 to over 200,000, with most of the more densely populated areas now having access to grid electricity.

As presented in Figure 14, below, except for a slight decrease in 2016, energy demand has been growing in a very fast pace since 2004.

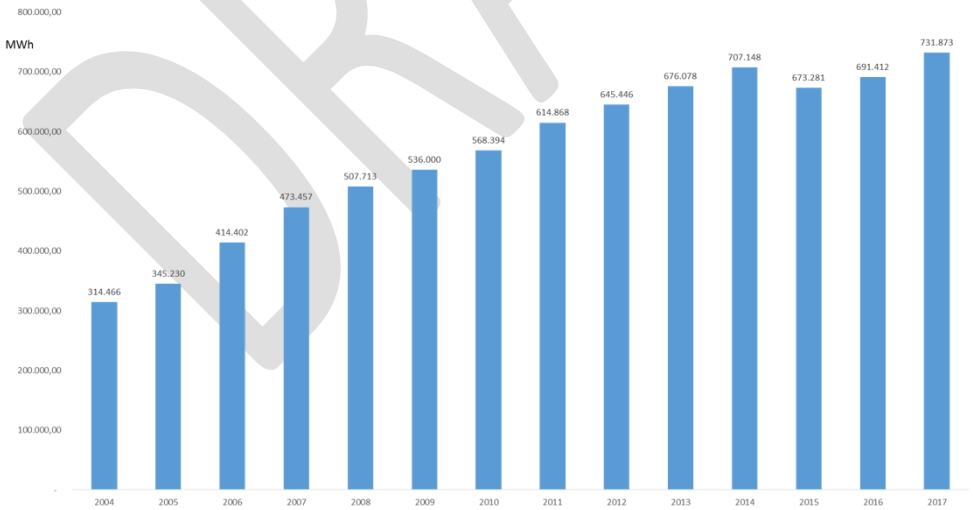

Figure 14 – Evolution of Electricity Demand in Lesotho (2004 – 2017) (source: LEC)

The recent efforts by the Government of Lesotho to further extend the National Grid has resulted in a steady increase of the number of customers in recent years. It can be perceived from the analysis of the existing data presented in Figure 15 that the number of LEC clients has been growing steadily over the years, however, as the number of clients grow, the average level of domestic consumption per client goes down, meaning that new customers are mainly rural/low-income population, bringing less revenue for LEC, resulting

in a reduction of the return on invests in grid extension, and meaning as well that some of the most recently connected domestic customers represent an investment that will take some time to payback.

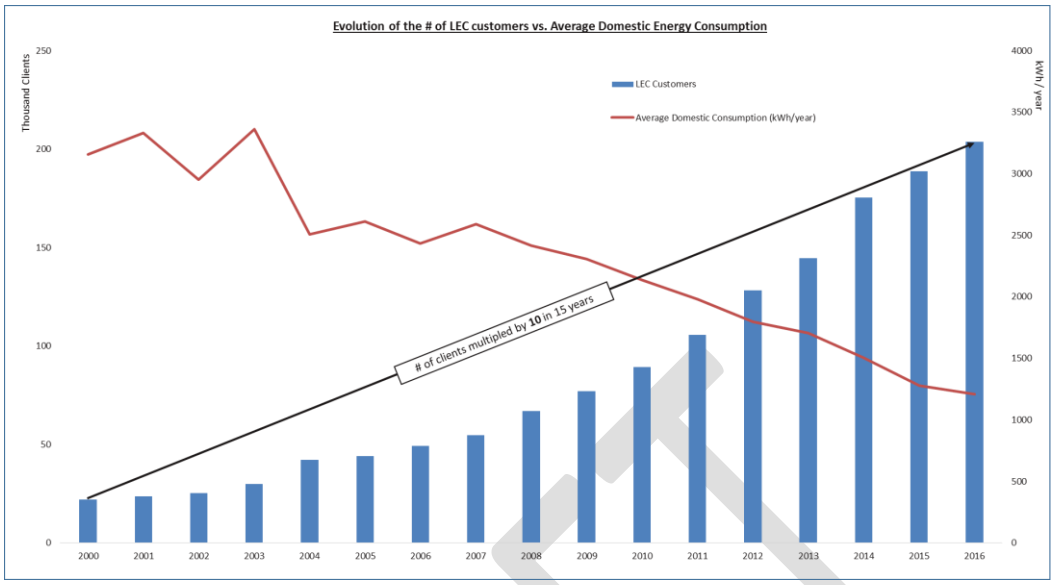

Figure 15 – Evolution of the Number of LEC Customers vs. Average Domestic Energy Consumption

Electrical grid losses

Electrical losses can be divided in Non-Technical losses (thefts, fraud and commercial losses) and Technical losses (due to energy dissipated in the conductors, equipment used for transmission line, transformer, sub-transmission line and distribution line and magnetic losses in transformers).

Figure 16 presents the Distribution Losses for the period 2012/2013 to 2016/2017.
It should be noted that Lesotho is considered one of the African Countries with the lowest total losses rate (currently 12,87% from which approximately 3% estimated to be due to non-technical losses).

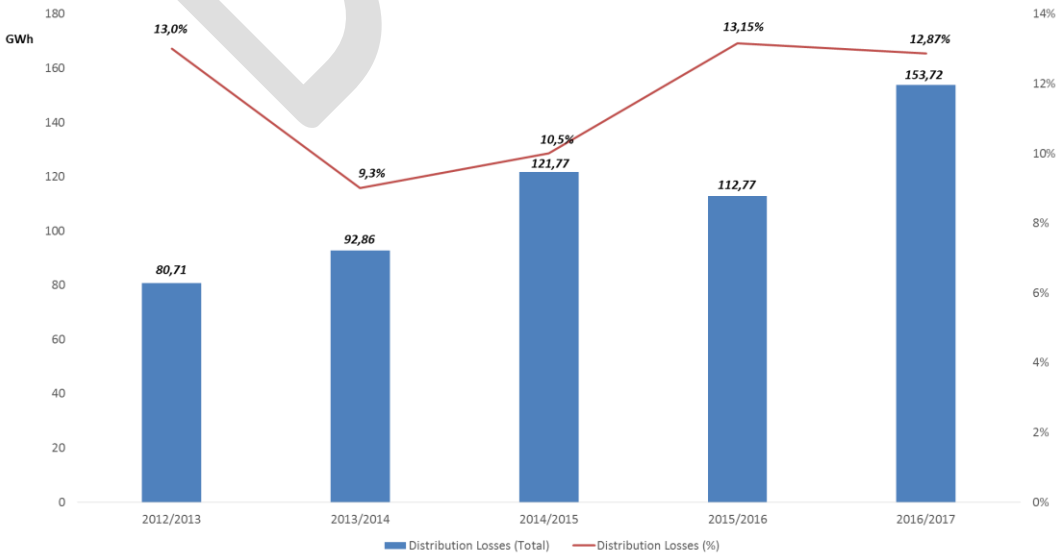

Figure 16 – Distribution Losses for period 2012/2013 to 2016/2017 (source: Lesotho Electricity Company)

2.1.2 EXISTING PLANS/STRATEGIES AND GAPS

Regarding energy access, several projects and studies have been recently undertaken in order to address the major key gaps identified in the "SEforAll Rapid Assessment and Gap Analysis" report.
Relevant conclusions and important steps have been taken and obtained from these projects in order to create the conditions to reach the energy access established targets.

The most relevant recent projects are:

- **Electrification Master Plan (2018)**

The electrification master plan (EMP) covers a 20-year time horizon, and caters for both grid and off-grid electrification. It is meant to enable systematic, predictable and equitable grid expansion and off-grid electricity roll-out, with a view to enhance quality of life, provide income-generating opportunities and alleviate poverty. This document also offers the possibility of unlocking targeted interventions that may be supported by development partners, also the EMP makes recommendations in this regard, in addition to proposing a prioritised schedule of electrification projects and an action plan for implementation.

The EMP comprised of the following components: Socio-Economic Analysis Report; Demand Analysis Report; Prioritisation Algorithm; Financial Model; Grid Development Plan Report, including a prioritised schedule of grid projects and an annual roll-out plan in accordance with the available budget; Off-Grid Master Plan Report, including a prioritised schedule of off-grid projects and an annual roll-out plan in accordance with the available budget; Action & Investment Plan Report.

- **Households Energy Survey Report (2017)**

Presented in April 2018, this document deals with electrification status of households, specifically looking at access to electricity and the type of supply that households have. The document also deals with energy consumption and use, as it discusses the energy sources that households generally use and then details the main energy sources for lighting, cooking and heating. Finally the document also has a section on the use of renewable energy and energy efficient technologies by households. It also discusses awareness of clean modern technologies and households preferences. In a nutshell, the document presents relevant statistical information the helps understand the energy sector of Lesotho and the main challenges it faces.

- **Cornerstone Public Policies and Institutional Capacities to Accelerate Sustainable Energy for All (SEforAll) Project (2018)**

The aim of this project is to catalyse investments in renewable energy-based mini-grids and Energy Centres to reduce GHG emissions and contribute to the achievement of Lesotho's Vision 2020 and SEforAll goals. The main focus of this project is to support the government of Lesotho, which is increasingly focused on distributed generation schemes and support for village-based energization models and mini-grids. The project aimed to analyse and test the best solutions for Lesotho and resulted in the electrification of 60 villages based on stand-alone (off-grid) mini-grids.

- **Constitution of the Universal Access Fund (2011)**

The Universal Access Fund (Legal Notice No. 83 of 2011 and is pursuant to section 34 and 35 of the Lesotho Electricity Authority Act of 2002) was constituted for purposes of subsidizing the capital costs of electricity service infrastructure in rural areas identified by Government. Renewable electricity generation projects are also eligible.
This Fund is to be replenished by the electrification levy collected by the public utility the Lesotho Electricity Company (LEC). The Universal Access Fund is now managed by Rural Electrification Unit

- **EU Energy Support Reform Program (2017)**

The EU Energy Support Reform Program focused on the DoE strengthening and mandate revision. The main recommendations were: 1. Ensure DoE has the skills needed to act as co-ordinator of the Energy Sector; 2. Restructure the Organization to improve functionality; 3. Transform the DoE into an Energy Commission); 4. Revise the model of the Energy Policy 2015-2025 and develop sectoral consensus; 5. Implement the legislative changes required to establish mandates as defined by the new energy sector model; 6. LEC is solely responsible for national grid management and extension; 7. Divide the current Rural Electrification Unit activities: grid extension projects to be the responsibility of LEC and off grid projects being promoted by a new Organization (possibly the transformed REU); 8. Create an Agency-like Entity that shall take care of energy solutions in off-grid areas: 9. Create a Financing Facility for Rural Energy Access)

- **National Strategic Development Plan 2012/13 – 2016/17**

This Plan presented three strategic goals: Increasing clean energy production capacity to attain self-sufficiency and export; Expanding electricity access to industry, commercial centres, households and other institutions; and Increasing energy conservation, security and distribution efficiency of alternative sources

Notwithstanding the REU and LEC efforts and despite the lack of regulation for Rural Electrification concessions, also Private Sector is investing in Rural electrification projects. OnePower Lesotho PTY LTD is preparing a Mini-grid pilot project (Solar PV tracking system supported by LPG backup generator and batteries). This Pilot Project will be installed in Ha Makebe supplying electricity for the Community facilities (Church, School, etc.) and 4 households, billing the costumers with a pre-negotiated cost-reflective tariff using smart meters centrally controlled. After evaluating the pilot phase results and securing funds, OnePower plans to extend the project and cover all the village (200 households). This project is being promoted with the aim to obtain a concessional area(s). In a second phase, 25 more villages are foreseen to be electrified by OnePower.

Regarding Energy Access, the following gaps are identified and should be addressed in order to ensure the success of the GoL strategy for increasing the energy access in Lesotho:

Recommendations acceptance, commitment and effective implementation
Several important recommendations and policies have been developed in recent years, in order to transform and up-grade the energy sector in Lesotho. However some of them

have proved to be hard to be implemented by Lesotho authorities. There is the need to ensure that the newly developed EMP is widely accepted so that its implementation become effective.

Lack of a proper Legal and Regulatory framework for Rural Electrification Concessions regimen

Creation of a proper legal and regulatory framework for the rural electrification concessions in order to ensure the mobilization of Private Sector to the Lesotho rural electrification effort.

Generation capacity gap

The latest Electrification Master Plan for Lesotho constitutes nowadays the roadmap and strategy for the Country electrification. However, it is focused on the Grid Development Analysis and in the Off-Grid Strategy, not addressing the potential need for investments to be undertaken in the generation assets. With an installed capacity of only 72MW and having to import around 50% of the total capacity required (68MW), the EMP developed in 2018 does not take into consideration generation requirements. Continuing with the *status quo* will leave Lesotho largely dependent on the import of electricity in order to meet its demand requirements. Since demand for electricity has been steadily growing, and it will be expected to continue growing in the future as new electrification projects are undertaken, the need for more energy imports will tend to grow even more. These facts turns the investment in generation capacity into an urgent and critical matter for Lesotho.

EMP implementation financing risk

The EMP 2018 assumes that a sustained annual electrification budget of M150 million will be available for a time span of 20 years, resulting in a total financing need of M 2,84 billion. There is no financing strategy provided in the EMP and although the estimated annual budget was calculated based on historical government spending on electrification projects, the number of years with such investments is far from being 20, meaning that other sources of financing, might be needed to ensure the full implementation of the proposed Electrification Master Plan.

2.1.3 ACTIONS NEEDED TO ACHIEVE THE OVERARCHING OBJECTIVE IN THE FIELD OF ENERGY ACCESS

2.1.3.1 Grid infrastructure and supply efficiency

A grid development plan focused in achieving the proposed targets has been recently produced under the Lesotho Electrification Master Plan (EMP) project.
This plan includes an investments schedule identifying all projects needed to achieve the proposed goals during the next years and will serve as a roadmap for grid infrastructure upgrade and extension projects.

Currently only 38% of the Lesotho Population is grid connected which is mainly concentrated in urban areas. The Figure 17 presents the current Lesotho's electrical grid area coverage

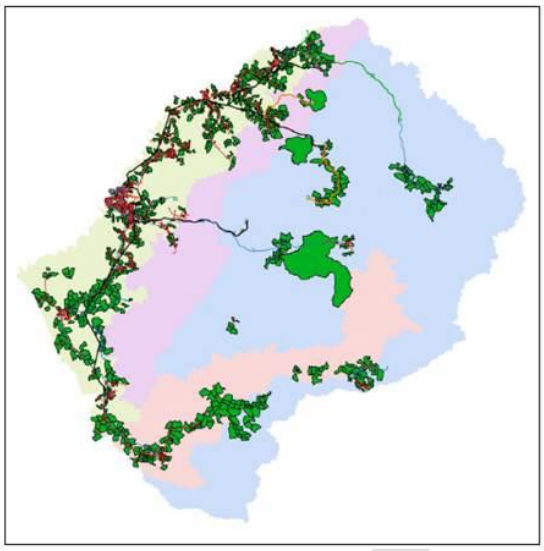

Figure 17 – Lesotho's electrical grid area coverage - Electrified EA's[26] (EMP 2018)

The EMP, produced in 2018 is based on the assumption that a sustained annual electrification budget of M150 million will be available, based on the current level of government budget allocation for this purpose. The Ministry of Energy and Meteorology (MEM) decided that 20% of this government budget – M30 million per year – shall be allocated to off-grid electrification for the time being, with the balance – M120 million per year – going towards grid electrification.

	Grid
Annual Electrification Budget	M 120 million
Average Annual Connections	7.756
Total Investment over 20 years	M 2.33 billion
Total Connections over 20 years	155.157
Average cost per connection	15.000
Number of EAs[27] electrified	1.399

Table 15 – Electrification Master Plan – Grid extension Investment Plan

The EMP Action & Investment Plan also points out that the roll-out of the electrification programme requires careful planning and points several barriers and challenges that should be overcome to its effective implementation.

Figure 18 presents the incremental Lesotho's electrical grid area coverage expected progression based on the EMP foreseen grid extension program (Year 5, 10, 15 and 20).

[26] EA=Enumerator Area (an area defined under the Census conducted by the Lesotho Bureau of Statistics as an Enumerator) used as a proxy for villages, since village-level data is not available

[27] EA=Enumerator Area (an area defined under the Census conducted by the Lesotho Bureau of Statistics as an Enumerator) used as a proxy for villages, since village-level data is not available

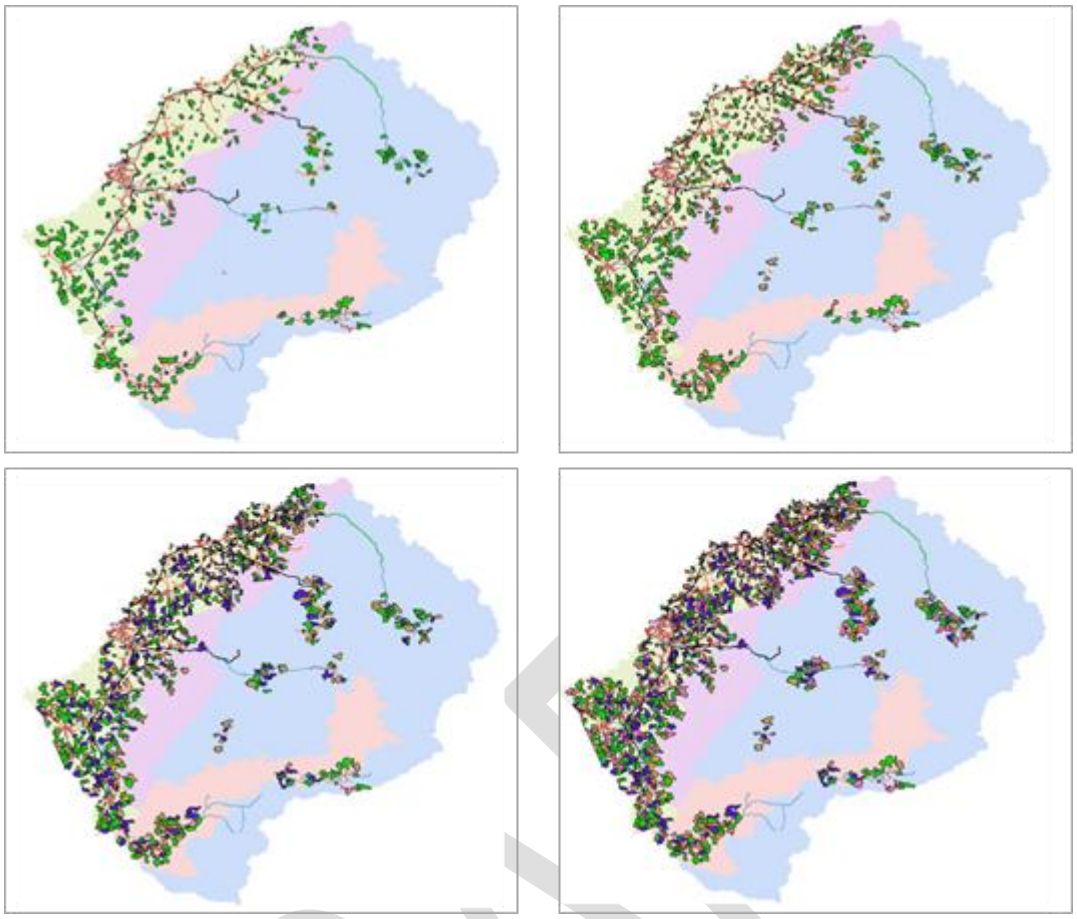

Figure 18 – EMP foreseen grid extension 20 years plan (Year 5, 10, 15 and 20)

Detailed Action & Investment Plan and related time schedule can be consulted in the EMP Final Report.

2.1.3.2 Distributed electricity solutions

Access to electricity stood at 38% in 2017, leaving approximately 330,000 households with no access to electricity
The mountainous terrain and low population density in the Senqu River Valley, Foothills and Highlands render grid extension largely unfeasible, which justifies electrification by off-grid means.

An Off-Grid Development Plan focused in achieving the proposed targets has been recently produced under the Lesotho Electrification Master Plan (EMP) project with the purpose to enhance quality of life, provide income-generating opportunities and alleviate poverty in Lesotho.
This plan includes an investments schedule 2018-2037 focus on all those areas of Lesotho that will not (initially) be reached by the national power grid, identifying all projects needed to achieve the proposed goals during the years to come.
The EMP proposes an annual investment of M30 million, in order to provide an average of 10.663 households with modern off-grid energy solutions every year, for a time period of

20 years. An average of 100 EAs[28] would be supplied with off-grid systems on an annual basis totalling 2,006 EAs over 20 years.

	Off-Grid
Annual Electrification Budget	M 30 million
Average Annual Connections	10.665
Total Investment over 20 years	M 509 million
Total Connections over 20 years	213,303
Average cost per connection	M 2,388
Number of EAs electrified	2,006

Table 16 – Electrification Master Plan – Off-Grid extension Investment Plan

Off-grid electrification will be made using different types of off-grid technologies, namely:

- Solar Lanterns
- Solar Kits
- Solar Home Systems
- Mini-grids

Table 17 presents the foreseen off-grid connections to be implemented during the EMP 20 years period by system type.

System ID	System Type	#Units of Connections/year (approx.)	#Units of Connections (Total 20 years)
OGS 1	Solar Lantern	2,461	49,227
OGS 2	Small Solar Kit	3,769	75,385
OGS 3	Large Solar Kit	3,466	69,329
OGS 4	Small SHS (150 Wp)	447	8,952
OGS 5	Large SHS (300 Wp)	141	2,830
OGS 6	Mini-grid (15 kWp)	379	7,580
Total		**10.663**	**213,303**

Table 17 – Foreseen off-grid connection by system type

According to the EMP Action & Investment Plan, 68% of the new connections will be done through Solar Kits, while only 4% will be done using mini-grids.

[28] EA=Enumerator Area (an area defined under the Census conducted by the Lesotho Bureau of Statistics as an Enumerator) used as a proxy for villages, since village-level data is not available

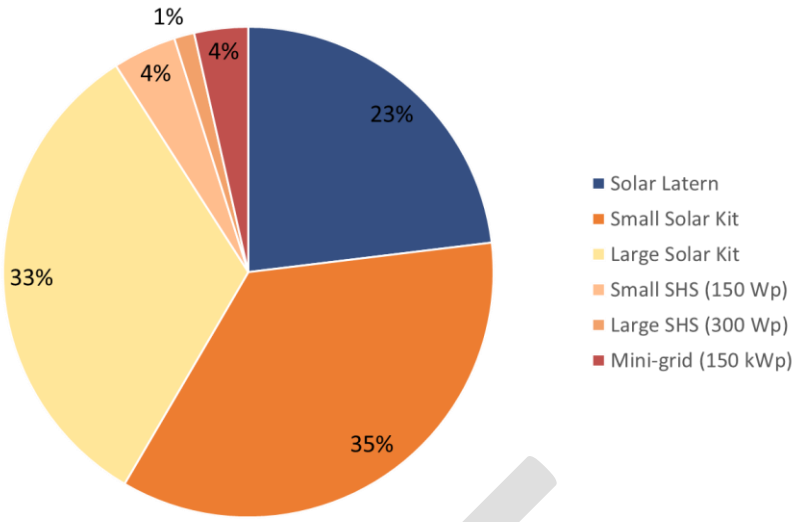

Figure 19 – EMP foreseen percentage of new connections by Off-grid technology type

In total, there are 30 foreseen Minigrids to be built over the 20 years period supplying approximately 7.500 households. The foreseen mini-grid project sites are presented in Figure 20 and listed in Table 18, below.

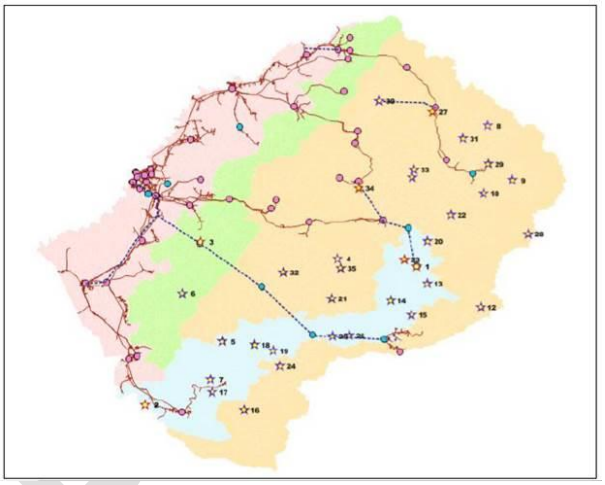

Figure 20 – EMP foreseen mini-grids to be implemented in Lesotho territory

#	Village	District	Project that identified the mini-grid	Closest Substation	Distance to Grid
1	Bafali	Mokhotlong	2001 Access-to-Electricity Study	Tlokoeng (33kV)	21.5
2	Daliwe	Quthing	2016 SEforALL-UNDP Project Doc	Leloaleng (33/11kV)	31.7
3	Ha Seng	Maseru	2001 Access-to-Electricity Study & 2007 NEMP	Mantsonyane (11kV)	29.0
4	Ketane Ha Nohana	Mohale's Hoek	All 3 projects	Leloaleng (33/11kV)	41.3
5	Kubung	Quthing	2016 SEforALL-UNDP Project Doc	Leloaleng (33/11kV)	50.5
6	Kuebunyane	Mohale's Hoek	2016 SEforALL-UNDP Project Doc	Ha Mpiti (11/33kV)	34.6
7	Lebakeng	Qacha's Nek	2016 SEforALL-UNDP Project Doc	Ha Mpiti (11/33kV)	20.1
8	Lesobeng	Thaba-Tseka	2007 NEMP	Mantsonyane (11kV)	28.8
9	Linakaneng	Thaba-Tseka	All 3 projects	Tlokoeng (33kV)	28.2
10	Makhoaba	Mohale's Hoek	2001 Access-to-Electricity Study	Tlokoeng (33kV)	17.4

#	Village	District	Project that identified the mini-grid	Closest Substation	Distance to Grid
11	Malingoaneng	Mokhotlong	All 3 projects	Tlokoeng (33kV)	19.8
12	Mashai	Thaba-Tseka	2016 SEforALL-UNDP Project Doc	Thaba Tseka (33/11kV)	25.4
13	Mateanong	Mokhotlong	2016 SEforALL-UNDP Project Doc	Tlokoeng (33kV)	35.4
14	Matebeng	Qacha's Nek	2016 SEforALL-UNDP Project Doc	Ha Mpiti (11/33kV)	35.7
15	Matsoaing	Mokhotlong	2016 SEforALL-UNDP Project Doc	Tlokoeng (33kV)	25.5
16	Molikaliko	Mokhotlong	2001 Access-to-Electricity Study & 2007 NEMP	Tlokoeng (33kV)	13.9
17	Motete	Butha-Buthe	2001 Access-to-Electricity Study & 2007 NEMP	Hlotse Adit (66/11kV)	18.8
18	Mphaki	Quthing	2001 Access-to-Electricity Study & 2007 NEMP	Leloaleng (33/11kV)	55.4
19	Phamong Moreneng	Mohale's Hoek	2016 SEforALL-UNDP Project Doc	Leloaleng (33/11kV)	21.9
20	Qhoali	Quthing	2016 SEforALL-UNDP Project Doc	Leloaleng (33/11kV)	56.1
21	Ribaneng	Mohale's Hoek	2016 SEforALL-UNDP Project Doc	Morija (11kV)	33.7
22	Sani Pass	Thaba-Tseka	2001 Access-to-Electricity Study & 2007 NEMP	Tlokoeng (33kV)	56.4
23	Sebapala Ha Sempe	Quthing	2016 SEforALL-UNDP Project Doc	Leloaleng (33/11kV)	18.5
24	Sehlabathebe	Qacha's Nek	All 3 projects	Qacha's Nek (22/11kV)	47.4
25	Sekake	Thaba-Tseka	2001 Access-to-Electricity Study	Ha Mpiti (11/33kV)	27.4
26	Tebellong	Qacha's Neck	2001 Access-to-Electricity Study	Ha Mpiti (11/33kV)	18.7
27	Thueleng Melikane	Qacha's Nek	2016 SEforALL-UNDP Project Doc	Ha Mpiti (11/33kV)	18.5
28	Tlhanyaku	Mokhotlong	2016 SEforALL-UNDP Project Doc	Tlokoeng (33kV)	27.5
29	Ha Nkau	Thaba-Tseka	2001 Access-to-Electricity Study & 2007 NEMP	Leloaleng 33/11kV	19.4
30	Ha Letsika	Thaba-Tseka	2001 Access-to-Electricity Study & 2007 NEMP	Matsonyane 33kV	23.4

Table 18 – Potential Mini-Grids and Project that identified them

Besides the implementation of the EMP Action and Investment Plan, some other relevant actions must need to be held in order to ensure the achievement of the overarching objectives and proposed targets in the field of electricity access:

- Promotion of quality standards for off-grid systems, equipment and appliances with emphasis on after-sales service, warranties, certification and labelling for systems, equipment and appliances
- Enabling access to affordable financing for end users
- Establish capacity and a mandate for dealing with the off-grid electrification program

2.1.3.3 Modern cooking appliances and fuels

Currently there is no specific strategy for modern cooking appliances and fuels in Lesotho. However, GoL is committed to promote universal access through increased supply and distribution of clean, modern and renewable energy sources and technologies to reach the proposed targets and to support and stimulate demand for and adoption of cleaner and more efficient cookstoves and fuels, as well as to develop a robust pipeline of enterprises that can meet growing consumer demand and supply products of high quality that customers value, at prices the population can afford.

Additionally, the GoL is willing to promote sustainable use and conservation of biomass resources and strengthen research in biofuels and associated technologies

2.1.4 RELEVANT HIGH-IMPACT OPPORTUNITIES

The following actions are considered relevant steps with high-impact on energy access in Lesotho:

- Commitment and effective implementation of EMP (including EMP Action & Investment plan funds mobilization);
- Creation of a proper legal and regulatory framework for the rural electrification concessions in order to ensure the mobilization of Private Sector to the Lesotho rural electrification effort;
- Creation of the Energy Centres in rural areas. UNDP/GEF within the scope of ongoing program "Cornerstone Public Policies and Institutional Capacities to Accelerate SEforAll Project" is willing to support private sector to develop mini-grids and Energy Centers on rural areas (1,2MUSD from GEF available). There are four companies funded by EU (three million euros) to develop energy hubs. The possibility to use a commercial bank as Management Agent is being evaluated;
- Creation of demonstration mini-grids pilot projects. World Bank is exploring the possibility to create an electrification fund to support mini-grids development: Pilot/demonstration Projects (Grant) and Roll out (Loan).

2.2 RENEWABLE ENERGY

2.2.1 CURRENT STATUS AND TRAJECTORY

Renewable energy resources are abundant in Lesotho territory, including Biomass[29] (wood fuel), Solar, Wind and Hydro. However, the total installed capacity of new and renewable (solar, wind and mini-hydro) energy sources is currently insignificant compared to the installed hydro capacity.

Solar energy is used extensively in small scale applications such as water pumping telecommunications industry, in health sector, in schools, in rural public institutions and households.
Initiatives that have been carried out include, the "Advisory Project for Household and Building Energy Issues" (APHABEI), the "Lesotho Electricity Supply Project" (LESP), the "Lesotho Renewable Energy Based Rural Electrification" (LREBRE[30]), the "Africa Adaptation Programme" (AAP), those projects implemented by the GoL.
More recently some relevant Projects were developed such as the "Scaling-up Renewables Energy Program" (SREP) and the "Mapping of Renewable Energy Potencial in Lesotho".

The Government of Lesotho has set targets to increase RE generation as part of efforts mitigate the effects of climate change and solve Lesotho's energy sector challenges. In its Energy Policy, the Government of Lesotho has committed to improving access to RE specifically to increase Lesotho's energy security and Basotho access to modern energy sources, and reduce the carbon intensity of the energy sector.

An assessment of technical potential for various RE technologies that can be used in Lesotho was recently carried out to support the preparation of the SREP Investment Plan. The results of the resource assessment are shown in Table 19.

Technology	Resource	Generation Capacity (MW)	Annual Generation (GWh)
Utility-Scale Solar PV[31]	Solar	118	372
Utility-Scale Wind	Wind	2077	5,157
Small-Scale Hydro (<10 MW)	Water	36	193
Waste-to-Energy	City Waste	10	62
Solar Microgrids	Solar Battery	31	85
Floating Micro-Hydro Microgrids	Water	0.50	1.75
Solar Home Systems	Solar Battery	1.2	3
Micro-Solar Technologies	Solar	38	92
	Total	**2,311.70**	**5,965.75**

Table 19 – Summary of Renewable Energy Technical Potential (SREP Investment Plan)

[29] The lack of a solid environmental planning by the Government of Lesotho has resulted in a declining biomass stock
[30] 84% of LREBRE funding is from Government(is this true RE)
[31] PV refers to photovoltaic

The technical potential for RE in Lesotho is high, but its development is slow mainly due to the following project development barriers[32]:

- **Regulatory and institutional barriers** such as an incomplete legal and regulatory framework, overlapping institutional mandates[33] of various energy sector entities, and the lack of technical standards on RE installations and appliances that creates an uncertain investment climate for RE investors and development;
- **Technical and capacity barriers** such as lack of a proper RE resource mapping[34], incomplete renewable energy resource and energy baseline studies and limited knowledge, experience and capacity from the institutional to the end-user level which hinders RE uptake;
- **Environmental barriers** such as declining biomass stock, increasingly variable rainfall and periods of drought, and limited availability of suitable land, with limited environmental impacts, for RE development resulting in the increase of the cost of RE deployment;
- **Financial barriers** such as limited access to financing and underdeveloped delivery mechanisms for households and private sector, and the high cost of distributing RE technologies to dispersed and remote communities in Lesotho limits the scaling-up of RE deployment; and
- **Social barriers**, in particular the lack of awareness among Basotho about the health and cost saving benefits of RE technologies limits RE uptake.

As presented before, Lesotho does not have sufficient domestic generation capacity to meet peak demand and relies on imports to bridge the supply gap.
The electricity supply gap is likely to increase as government electrifies the population and exploits new diamond mines, further weakening Lesotho's security of supply.
Renewable Energies could play an important role reinforcing the generation capacity of Lesotho.

2.2.1.1 Grid connected Solar photovoltaic (PV)

There is substantial potential for Utility scale solar photovoltaic in Lesotho.
As presented in Table 20, currently there are two operational small scale solar PV projects, both in Maseru district, with a total installed capacity of just 0.305 MW:

- A 281 kW small solar installation at the Moshoeshoe I International Airport is used primarily to serve the airport's electricity demand during the day. The system does not have storage capability and excess power generated flows back to the national grid[35].

[32] SREP
[33] (eg: currently promoters should negotiate directly with LEC the PPA and related tariffs, however it should be approved by LEWA who is not involved in the process)
[34] Resource Map being currently developed with Italian Government support "Mapping of Renewable Energy Potential in Lesotho"
[35] Based on the collected information this excess of energy delivered to the Grid is not being remunerated (no PPA signed with LEC)

- A 2.4 kW small solar installation is in Roma at the National University of Lesotho and is used for research and educational purposes.

Project Name	District	Resource	Project Status	Capacity (MW)
Moshoeshoe I	Maseru	Small Solar	Operational	0.281
Roma	Maseru	Small Solar	Operational	0.024
			Total	**0.305**

Table 20 – Existing grid connected small scale Solar PV Projects

The Scaling-up Renewable Energy Project (SREP) report presents a technical assessment of the solar potential in each district of Lesotho, which is summarized in Table 21 below.

District	Land (km^2)	Capacity (MW)	Capacity Factor (%)	Annual Generation (GWh)
Berea	221	32	35.3%	99
Leribe	290	41	35.0%	126
Maseru	314	45	34.7%	137
Mokhotlong	35	5	36.3%	16
Quthing	33	5	35.2%	15
Butha-Buthe	46	7	35.2%	22
Mafeteng	497	71	35.1%	218
Mohale's Hoek	200	29	34.8%	88
Thaba-Tseka	36	5	36.0%	16
Total	**1,672**	**239**		**737**

Table 21 – Solar Parks Technical Potential by District[36]

Despite the fact that there is no Utility scale Solar project in Lesotho, there has been substantial interest from the Private Sector and the GoL in developing larger scale solar PV projects in recent years and there are some under development Projects such as Tibia-Sinoma (Mafeteng) 70MW Solar PV Project and OnePower Mafeteng 20MW which is already at PPA negotiation phase[37] with LEC.

2.2.1.2 Utility scale Wind power

There are currently no wind farms operating in Lesotho. However, attempts have been made by some Private Sector Project Developers to undertake wind measurements and conduct feasibility studies at potential sites in Letseng, Semonkong, and Oxbow.

There are substantial environmental risks associated with wind farms in Lesotho territory such as the impact on local bird and bat populations. Environmental issues and road accesses have been also key obstacles to the Wind farm development in Lesotho, obstacles

[36] Source: SREP - Scaling-up Renewable Energy Projects

[37] Feed-in-tariff PPA with take-or-pay clause and weekly revisable commitment of energy generation (negative deviations payed by Promoter at ESCOM energy import rate)

that become more problematic as we get closer to the top of the mountains where the technical potential of wind energy is higher.

The table below shows the buildable capacity of wind farms by capacity factor.

Capacity Factor Range	Area (sq. km)	MW	Average Net Capacity Factor	Buildable MW*	Percentage of Buildable Capacity
25% – 27.5%	718	1795	26.3%	898	43%
27.5% – 30%	638	1594	28.6%	797	38%
30% – 35%	259	648	31.6%	324	16%
35% - 45%	46	115	36.9%	58	3%
Total	**1,661**	**4,152**	**28.3%**	**2,077**	**100%**

Table 22 – Buildable Capacity of Wind Farms by Capacity Factor (Source: SREP Option Study)

2.2.1.3 Small hydropower (<10MW)[38]

Lesotho territory has a substantial potential for small hydropower development however only two mini-hydro power plants are currently operational in Lesotho - please refer to Table 7 – Generation Assets in Lesotho in Chapter (Page 18).

The "Lesotho Power Generation Master Plan Final Milestones Report" proposes 11 small hydropower plants (SHPP) with a total combined capacity of nearly 88 MW (Table 24).

2.2.1.4 Bioenergy

There are currently no existing utility-scale biomass or biogas power generation facilities in Lesotho, but there is some interest among Government and Private Sector stakeholders in developing future projects of improved urban waste management and domestic fuel (liquid and gas) production.

Table 23, below present the summary of potential waste-to-energy facilities to be implemented in Lesotho.

Site	Maximum Potential (kW)
Maseru	9,988
Butha-Buthe	1,786
Leribe	1,358
Mafeteng	3,574
Total	**16,706**

[38] SREP only included generation under 10 MW of capacity because large-scale hydropower projects are currently being considered under phase II of the LHWP.

Table 23 – Summary of Potential Waste-to-Energy Facilities[39]

2.2.2 EXISTING PLANS/STRATEGIES AND GAPS

Within the scope of SREP, an investment plan was developed to support investments in the RE technologies that were identified through a previously developed prioritization exercise.

The increase in demand has not been matched by corresponding investment in generation and transmission infrastructure leading to widening supply deficit mostly due to industrial development and increase in number of customers connected to the grid.
To cover this supply deficit, the Scaling-up Renewable Energy Project (SREP), expected to contribute to the development of a RE commercial market in Lesotho, proposes a Renewable Energy Project pipeline based on different technologies as listed below:

SREP Proposed Small Hydro	Name of River	Installed Capacity (MW)	Annual Generation (GWh)
Hlotse HPP	Hlotse	6.5	39.7
Phuthiantsana HPP	Phuthiantsana	5.4	18.87
Khubelu HPP	Khubelu	14.6	64.26
Polihalie HPP	Mokhotlong	19.3	83.89
Tsoelike HPP	Tsoelike	17.7	69.86
Makhaleng 1 HPP	Makhaleng	2	15
Makhaleng 2 HPP	Makhaleng	1.4	6.15
Makhaleng 3 HPP	Makhaleng	8.9	39.4
Makhaleng 4 HPP	Makhaleng	9.1	58.3
Quthing 1 HPP	Quthing	0.63	2.31
Quthing 2 HPP	Quthing	2.4	9.61
	Total	**87.93**	**407.35**

Table 24 – SREP 2017 Proposed Small Hydro Projects

SREP Proposed Wind Farm	Administrative Division	Resource	Project Status	Capacity (MW)
Wind Park at Letseng	Mokhotlong	Wind	Planned	35.7
Wind Park at Semonkong	Maseru	Wind	Proposed	15.0
Wind Park at Oxbow	Butha-Buthe	Wind	Proposed	TBD

Table 25 – SREP 2017 Proposed Wind Farm Projects

SREP Proposed Solar PV Project	District	Proposed Capacity (MW)	Estimated Capacity Factor (%)	Annual Production (GWh)
Tsupane Gate	Mafeteng	10	35.0	30.7
Mafetang – 2	Mafeteng	10	35.6	31.2
Makhalinyane	Maseru	15	34.8	45.7
Lithabaneng	Maseru	10	34.7	30.4
Matbang	Berea	10	35.8	31.4

[39] Source: Prime Enviro Energy, "Waste-to-Energy in the Kingdom of Lesotho: Project Outline/Executive Summary", 2013.

Maputsoe – 2	Leribe	10	35.0	30.7
	Total	**65**		**200.0**

Table 26 – SREP 2017 Proposed Solar PV Projects

SREP Proposed floating micro-hydro	River	Capacity (MW)	Annual Generation (GWh)
Malibamatso	Malibamatso	0.1	0.35
Makhaleng	Makhaleng	0.1	0.35
Senqu 1	Senqu	0.1	0.35
Senqu 2	Senqu	0.1	0.35
Senqunyane	Senqunyane	0.1	0.35
	Total	**0.5**	**1.75**

Table 27 – SREP 2017 Proposed Floating Micro-hydro Projects

Some of these Projects are already being developed by Private Sector investors and LHDA. Table 28 presents the currently under development RE power generation projects in Lesotho.

Project	Capacity (MW)	Promoter	Technology
Mokhotlong Phase II Hydro project[40]	40 to 110MW[41]	LHDA	Hydro (multipurpose)
Katse Mini-Hydro	1MW	LHDA	Mini-Hydro
Muela Mini-Hydro	1MW	LHDA	Mini-Hydro
Semonkong Wind Farm[42]	15MW	MOSCET(LS) + POWER + MATLA(ZA SEPCO(CN)	Wind
Netgroup Wind Farm (location?)	35MW	NETGROUP	Wind
LHPP[43] **Wind Farm**[44]	1,150MW (Phase I) 2,400MW (Phase II)	BREEZE POWER	Wind
Mafeteng OnePower Solar Farm[45]	20MW	ONEPOWER	Solar PV
Mafeteng Tibia-Sinoma Solar Farm[46]	70MW	TIBIA (ZA) + SINOMA (CN)	Solar PV
Maseru Waste to Power Project	47MW	???	MSW[47]

Table 28 – Under development Power Generation Projects in Lesotho

[40] Expected commissioning date: 2026
[41] Depending on the feasibility studies currently under development
[42] Feasibility studies funded by a Grant (2013). Land secured. Ongoing EIA. PPA in preliminary stage of negotiation with LEC. Not yet financed.
[43] Lesotho Highlands Power Project
[44] Early stage of development. Project was conceptualized during the South Africa power shortage period. Grid stabilities studies were held and delivered to LEC to demonstrate the grid integration capacity. Promoter is in conversations with a Chinese technology provider. Project not yet financed. Current development constraints: 1) project feasibility is depending on the South Africa will to offtake the produced energy. Industry PPA offtake scenario is being considered as alternative: 2) No environmental clearance due to existing endogenous species; 3)Logistic challenges (challenging routes and weights to get to project site)
[45] Funded by Nordfund, AfDB and Lesotho Pension Fund among other institutions. Land procurement finalized (almost 50 land owners involved). PAA with LEC currently at final negotiation stage.
[46] Two Phase project (30MW+40MW) funded by Asian Development Bank. Facility will be built and transferred to LEC after a knowledge transfer period.
[47] Municipal Solid Waste

Regarding Renewable Energy, the following gaps are identified and should be addressed in order to ensure the success of the GoL strategy for increasing the Renewable Energy installed capacity in Lesotho:

Need to establish a coherent and solid Legal, Regulatory and Administrative (LRA) Framework

Currently, Lesotho possesses an incomplete legal and regulatory framework regarding Renewable Energy development. Also the current overlapping/undefined responsibility boundaries[48] of existing institutional mandates of some energy sector entities, and the lack of technical standards on RE installations and appliances creates an uncertain and unattractive investment climate for RE Private Sector investors . Furthermore, Lesotho lacks a clear LRA towards the procurement of RE installed capacity[49], an issue that should be addressed in order to ensure a clear and transparent process for the Private Sector investors to follow.

Institutional lack of capacity and experience

The current lack of institutional capacity and non-existing experience in implementing and managing Utility scale RE Projects creates an apprehensive environment for Private Sector to come to Lesotho.

Existing Environmental constraints

The lack of a solid environmental planning by the Government of Lesotho has resulted in a declining biomass stock. Lesotho is also heavily suffering from global climate change with increasingly variable rainfall and periods of drought. Both these environment issues as well as a limited availability of suitable land for RE development, results in the increase of the costs of RE deployment; a further assessment of the situation would be very important to understand the severity of the situation and to propose strategies that could enable renewable energy investments.

Financial barriers

Limited access to financing and underdeveloped delivery mechanisms for households and private sector, and the high cost of distributing RE technologies to dispersed and remote communities in Lesotho limits RE the scaling-up of RE deployment.

Need to create a shift in public awareness

Limited awareness among Basotho regarding health and cost saving benefits of RE technologies.

2.2.3 ACTIONS NEEDED TO ACHIEVE THE OVERARCHING OBJECTIVE IN THE FIELD RENEWABLE ENERGY

2.2.3.1 Renewable power generation

Lesotho has a peculiar situation regarding Renewable since all electricity generated in the Country is 100% based on renewables (mainly hydro).

[48] (eg: currently promoters should negotiate directly with LEC the PPA and related tariffs, however it should be approved by LEWA who is not involved in the process)

[49] Prepared by LEWA ("Application for licensing rules", 2012 – available at http://www.lewa.org.ls/licensing/) but still not approved by the Ministry of Energy and Meteorology

In that sense, the way forward to increase the use of renewable electricity is to increase the generation capacity promoting new renewable energy projects in Lesotho to progressively become autonomous/self-sufficient and stop importing non-renewable based electricity from abroad.

As described above, Lesotho does not have sufficient domestic generation capacity to meet peak demand and relies on imports to bridge the supply gap. The electricity supply gap is likely to increase as government electrifies the population and exploits new diamond mines, further weakening Lesotho's security of supply.
As per the Sustainable Energy Strategy Action Plan, to achieve the proposed targets the following actions should be considered:

To build more on-grid electricity generation capacity:

- Install and commission LHDA Hydro phase 2 (~80MW)
- Construct and commission 40MW Hydro
- Install and commission a 60 MW Solar PV
- Install and commission 35MW Wind

To perform feasibility studies for the following Projects:

- 70 MW solar PV study
- Develop multi-purpose dams' feasibility studies in collaboration with LWSC: Hlotse 10MW, Makhaleng 40MW

2.2.3.2 Grid infrastructure and supply efficiency

To accommodate and manage high penetration of renewables in Lesotho, two storage Projects were studied in the past[50]:

- Kobong Pumped Storage 1,200 MW – Project promoted by LHDA, te be constructed along the upper Kobong River
- LHPP Pumped Storage 4,000 MW - Project studied in 2011 by Breeze Power along with the construction of a 6,000MW wind capacity

It should be highlighted that these kind of investments would only be economically feasible if a high quantity of new intermittent renewable energy projects are implemented in the territory and Lesotho is not able to negotiate cross-border offtake contracts for the energy excess.

2.2.4 RELEVANT HIGH-IMPACT OPPORTUNITIES

[50] During South Africa power shortage period

The following actions are considered relevant steps with high-impact on energy access in Lesotho:

- Support the current ongoing private sector Projects (the solar and wind projects currently under development are the first private PPA initiatives in Lesotho. The success of these pioneer Projects is required if Lesotho wants to attract other promoters to invest in Lesotho)
- Create an enabling and attractive environment for private sector to invest in RE in Lesotho addressing the gaps and key success factors identified in the previous sub-chapter.

2.3 ENERGY EFFICIENCY:

2.3.1 CURRENT STATUS AND TRAJECTORY

Currently, no historical data on energy efficiency and related improvements achieved is available in Lesotho. The efforts and initiatives in this field are developed by different energy stakeholders, such as LEC, LEWA and the DoE. Currently no specific Agency or Department, to cater for Energy Efficiency issues exists within the Ministry of Energy and Meteorology, with a defined strategic plan and mandate regarding energy efficiency.

In the past, LEC has promoted a CFL lightning benefits awareness campaign and recently have implemented a reactive energy tariff for industrial consumers leading to the installation of capacitor banks promoting the distribution grid efficiency (reduction of reactive power flow)
Currently LEC is willing to promote a project for the installation of smart metering systems in its costumers with special focus on urban areas.

Sporadic energy efficiency initiatives are applied as a good practice by the Government of Lesotho' departments without clear specific objectives and planning.
Energy efficiency has primarily been driven from the angle of DSM and costumer education with LEC being the main promoter. With the increase in new household connections, the domestic sector is now a significant contributor to electricity consumption compared to other sectors as illustrated in Chapter 1.1. LEC has focused on this sector with awareness campaigns on energy saving tips. Regarding the industrial sector, nothing is being made.

Lesotho is a partner State of SADC Regional Centre for Renewable Energy and Energy Efficiency (SACREEE) based in Namibia that contributes towards increased access to modern energy services and improved energy security across the SADC Region through the promotion of market based uptake of renewable energy (RE) and energy efficient (EE) technologies and energy services by:

- Supporting the achievements of the sustainable development objectives of SADC Member States by promoting the use of RE&EE technologies and energy services.
- Supporting the Region's sustainable development objectives through: resource mobilization, policy, quality assurance, capacity building and knowledge management, communication, promoting investments in RE&EE projects and programmes.

2.3.2 EXISTING PLANS/STRATEGIES AND GAPS

The Lesotho Energy Policy (2015-2025) identifies the following strategies for the Energy Efficiency in Electricity:

a) Implement demand side management programmes and projects.
b) Introduce a metering system and tariff structure that will support energy efficiency and demand side management.
c) Discourage the use of intensive energy use devices and promote the use of energy efficient technologies.
d) Carry-out dissemination campaigns on wise use of energy.
e) Promote the adoption of renewable energy technologies that reduce total end-use electricity consumption.
f) Implement energy efficiency programmes in buildings.
g) Introduce incentives to support energy efficiency programmes and activities.
h) Support applied research and development in energy efficiency programmes and activities.
i) Develop specific principles for the policy statement.

These strategies/actions need to be supported by enabling policy and regulations for them to take effect.

The recently adopted SADC Roadmap for "Leapfrogging to Efficient Lighting, Appliances and Equipment in SADC" is expected to result in substantial energy savings, in 2030, by adopting energy efficient refrigerators, air conditioners and distribution transformers. A strategy to adopt and deploy these energy efficient technologies in Lesotho would need to be developed and the cost there-of determined.

Regarding Energy Efficiency, the following gaps are identified and should be addressed:

- No institutional framework in place to support energy efficiency save for DSM work conducted by LEC
- No standards and a labelling framework for energy efficiency devices and technologies
- No incentives for undertaking energy efficiency or disincentives to the contrary
- No Programme to address energy efficiency holistically[51] in all sectors of the economy including agriculture, transport, buildings, etc.

2.3.3 ACTIONS NEEDED TO ACHIEVE THE OVERARCHING OBJECTIVE IN THE FIELD ENERGY EFFICIENCY

The actions considered relevant to ensure that the overarching objective of energy efficiency is attained are:

[51] The focus of energy efficiency awareness is on lighting, power factor correction, and load management for large electricity consumers.

- Intensive and extensive public awareness and education on the benefits of energy efficiency;
- Development of policy and regulatory framework for energy efficiency;
- Improved institutional capacity building and effective coordination for monitoring and enforcement of relevant regulations;
- Creation of a National Agency for Energy Efficiency responsible for energy efficiency issues, and, among other responsibilities would adopt adequate tools to implement a measurement and verification (M&V) framework to quantify the savings from the implemented energy efficiency improvement initiatives;
- Supporting the establishment of a Construction Industry Council and the establishment of the Lesotho Standards Authority in order to develop and implement ethical standards, practices and procedures that promote energy efficiency in the built environment;
- Supporting energy management practices in large power users.
- Fiscal and financial incentives to encourage the use of energy efficient appliances and technology by households, commercial and industrial sectors;
- Innovative financing schemes for energy efficiency and conservation programmes;
- Addressing gaps in statistical data for periodically evaluating the level of energy efficiency and conservation nationwide, covering domestic, industrial, commercial and agricultural users as well as public services (e.g. health and education);
- Implementing free distribution of efficient lamps (CFL/LED technology) or at subsidized cost to carefully selected communities
- Promoting energy-efficient appliances (such as refrigerators, air conditioners and distribution transformers);
- Promoting installation of efficient lighting in all new social housing projects of government;
- Developing national energy efficiency policy and action plan;
- Developing and implementing a policy on energy efficiency rating and standards for appliances and equipment; and
- Encouraging industry to embrace ISO 50001, the energy management standard.

The following, are also important priorities that could be relevant to Lesotho in a medium/long-term:

- Reducing distribution losses and improving reliability;
- Promoting energy management practices and systems ; variable-speed motors; conversion of waste to energy; improved process and system design; co-generation systems (combined heat and power); energy-efficient irrigation pumps; and energy-smart agriculture;
- Use of alternative fuel vehicles, including flex-fuel, hybrid, and electric vehicles (EVs); use of renewable fuels; fuel efficiency and fuel quality standards; overall

transportation demand reduction; eco-driving programmes, expanded and more efficient public transport; electrification of rail systems;

- Public / residential / commercial buildings, cool roofs, building integrated solar PV, and small-scale renewables such as rooftop solar and solar hot water; sectoral efficiency labels and performance standards; well enforced building codes; and
- DSM programmes and advanced technologies to enable energy-saving behavior and shift demand across time; advanced lighting, space cooling and heating, and refrigerators; and wider adoption and enforcement of regional minimum efficiency standards and comparable test procedures by industry and local governments.

2.3.4 RELEVANT HIGH-IMPACT OPPORTUNITIES

The following actions are considered relevant steps with high-impact for the energy efficiency improvement in Lesotho:

Creation of a National Energy Efficiency Agency
Designation of an entity to be responsible for energy efficiency issues, promotion of energy efficiency initiatives and to implement a measurement and verification (M&V) framework to quantify the savings from the initiatives implemented in the Country.

Study the feasibility of implementing hourly based industrial and domestic tariffs: Feasibility study for the creation of hourly based energy consumption tariff. Time-based tariffs creates economic incentives for consumers to manage efficiently the time of consumption contributing for a more efficient grid management (reduction of peak hours consumption) and energy importation cost reduction.

Develop and implement a Regulatory framework for the labelling of Energy Efficiency Appliances: Create a certification, labelling and enforcement mechanism to promote energy efficient appliances reducing the household's electricity consumption that nowadays uses energy inefficient appliances available on the local market.

Develop and implement a Legal and Regulatory framework for the certification of Energy Efficient Buildings: Development of energy efficiency policies, legislation and secondary regulations to be adopted in order to strengthen the regulatory framework in order to implement the energy certification for buildings to promote and incentive energy efficiency measures to be taken in both new and existing buildings.

Improve the Energy Efficiency of Public Buildings: To perform a set of energy consumption audits to the major public institutional buildings and implement of energy saving measures and solutions according to the building's electric and climate needs.

Reducing Network Energy Losses: To study and evaluate the current technical losses of the transport and distribution grid focused on the identification of the origin of the electricity network losses which represent approximately 10% of the total delivered energy. A set of HV and MV network upgrades should be identified and implemented ijnn order to improve the transmission and distribution efficiency.

Introduce LED technology in the Public lightning assets: To progressively change the existing public lightning system to energy efficient technologies (LED). This is a very cost-effective investment which can decrease the public lightning operation costs dramatically.

Focus on non-technical Losses reduction: To quantify the non-technical losses in the distribution grid and to assess processes, competences and potential investments to reduce commercial energy losses leading towards their total elimination. The non-technical energy losses refer to electricity effectively delivered by LEC but not paid by the users, resulting in direct financial losses for LEC.

2.4 ENABLING ACTION AREAS:

2.4.1 ENERGY PLANNING AND POLICIES

Regarding Energy Planning and Policies there are several relevant gaps, most of them already highlighted in the previous chapters, that should be addressed in order to create an enabling environment in Lesotho Energy Sector, namely:

- Government and Public Institutions current lack of capacity to support private sector initiatives and projects is a general and disseminated feeling among the Private Sector stakeholders;
- Energy Access/ Rural Electrification:
  - Lack of a proper legal and regulatory framework for rural electrification concessions regimen that encourages private sector to support Lesotho Government bringing off-grid solutions and energy related services to the remote rural populations;
  - Need to create an Enabling Environment for Off-Grid, improving Private Sector engagement for the rural electrification effort in the areas where LEC grid extension is not feasible, creating awareness, promoting quality standards for off-grid systems and equipment, and enabling access to affordable financing for end users;
  - Need to revise the present tariff structure in order to consider the LEC increasing investment and operational costs related to grid extension effort for rural electrification.
  - Lack of a National strategy to promote the use of modern cooking appliances and fuels
- Renewable Energy/Utility scale Projects
  - Lack of a coherent and solid Legal, Regulatory and Administrative Framework, namely regarding the procurement of RE projects in order to ensure a clear and transparent process for the Private Sector developers[52];

[52] Already prepared by LEWA ("Application for licensing rules", 2012 – available at http://www.lewa.org.ls/licensing/) but still not approved by the Ministry of Energy and Meteorology.

- Institutional lack of capacity and experience managing Utility scale RE Projects promoted by Private Sector and need to clarify overlapping institutional mandates[53];

- Energy Efficiency
  - Need to develop a policy, action plan and regulatory framework for energy efficiency;
  - Lack of Public awareness and education on the benefits of energy efficiency matters;
  - No standards and a labelling framework for energy efficiency devices and technologies;
  - No incentives for undertaking energy efficiency or disincentives to the contrary;
  - No Programme to address energy efficiency holistically in all sectors of the economy including agriculture, transport, buildings, etc.;

2.4.2 BUSINESS MODEL AND TECHNOLOGY INNOVATION

Regarding Business models and Technology innovation there are some opportunities for Lesotho that may have substantial impact. Besides the Concessional Rural electrification based on renewable/hybrid systems business model which the GoL is already planning to put in place, the following opportunities should be evaluated:

- Low-cost grid extension solutions - To evaluate the adequacy of the current grid standards used by LEC when applied to low-load rural areas sparsely populated mostly by poorer communities. Alternative low-cost connection solutions (Single-wire earth return (SWER), load-limited supplies, etc.) for these particular cases should be studied and appraised in order to allow a bigger LEC grid coverage at feasible cost.
- On-grid household renewable generation systems – To develop a legal and regulatory framework to establish an adequate regimen for on-grid household renewable generation systems (Solar PV or small scale wind turbines) with a suitable tariff for exceeded energy selling).

2.4.3 FINANCE AND RISK MANAGEMENT

Regarding finance and risk management there are some actions that are considered to have a relevant potential impact, enabling and boosting the renewable energy and energy efficiency sector development:

[53] (eg: currently promoters should negotiate directly with LEC the PPA and related tariffs, however it should be approved by LEWA who is not involved in the process)

- To reduce/exempt taxes on imported components of RE systems and improved energy efficiency appliances
  - Renewable Energy - There is the political will "**To reduce levies and taxes on imported components of renewable energy systems** such as solar panels, hydro/wind turbines and solar collectors as much as possible to do so" (as per "Energy Policy 2015"). However this reduction was not implemented yet. Coordination with Ministry of Finance is still needed.
  - Also to consider to **reduce the levies and taxes for top efficient appliances** according to the certification and labelling system to be implemented in Lesotho (please refer to subchapter 2.3.4).
- To de-risk private sector investments
  - To support private sector project development by evaluating the possibility to concede **Sovereign Guaranties** to private investments on Renewable Energy utility scale Projects in order to ensure that the Projects can be financed and implemented as planned[54];
  - To create "***Renewable Energy Land Zoning Development***" for Lesotho territory identifying Renewable Energy development sites and establishing a "right to reserve" and allocating the land use to be exclusive for renewable project development purposes (Zone of Renewable Energy Development – ZREDs) where:
    - Nothing else can be built there other than projects for the use of renewable energies
    - The RE projects developed within these ZRED's are exempted from licensing and permitting (environmental licensing, electricity production licensing, grid connection, etc.)

    This initiative could also be complemented with renewable resources measurement campaigns. The purpose is to mitigate risk from the Projects, creating special conditions "almost ready-to-build" for the Private Sector to develop, turning Lesotho a very interesting territory for renewable energy developers.
- To create enabling financing schemes
  - For energy efficiency measures promoting the use of efficient technologies and appliances as well as for energy conservation (buildings for instance);
  - For scaling-up market penetration of clean efficient cook stoves

2.4.4 CAPACITY BUILDING AND KNOWLEDGE SHARING

Regarding capacity building and knowledge sharing there are several relevant gaps, most of them already highlighted in the previous chapters, that should be addressed in order to create an enabling environment in Lesotho Energy Sector, namely:

[54] The use Sovereign Guaranties would be evaluated in a case by case basis and only be used for those projects considered to have strategic benefits for the Country and which would not be bankable otherwise

- Need to create a “Monitoring Unit” under the DoE Energy Planning Division” to ensure, among other responsibilities:
  - Timely collection and organization of relevant energy sector statistical data;
  - Periodically analysis and evaluation of energy sector indicators;
  - Work as “knowledge hub” for the energy sector ensuring communication between all energy sector stakeholders to access and exchange coherent and official energy data and information.
- Improvement of Institutional capacity regarding Renewable Energy and Energy efficiency matters such as:
  - Utility Scale RE Projects PPA negotiation
  - Renewable Energy tariffs calculation
  - Energy efficiency benefits and technologies awareness
  - XXX
- Need to create National awareness regarding Energy Efficiency benefits and technologies through the younger generations:
  - Creation of Renewable Energy Laboratory for the National University of Lesotho and technical schools
  - Creation of modules in the curricula from primary and secondary level
  - Promotion of Renewable and Energy efficiency conferences involving universities and other stakeholders
  - Participation in international and regional conferences, exhibitions and seminars

PART 3: COORDINATION AND FOLLOW-UP

3.1 NATIONAL SEFORALL COORDINATION STRUCTURE

There are four key factors to ensure the success of the Country Action Agenda implementation:

1. The involvement of the SEforAll National Coordinator throughout the CAA development process;
2. A champion at the highest level to drive the process;
3. Good stakeholder engagement;
4. The identification of bankable projects in the process as input for the Investment Prospectus.

An effective coordination capacity and structure at national level is needed so as to sustain momentum over the SEFORALL implementation span and mainstream the initiative's core objectives in political and business decisions.

Given the inclusive nature of SEFORALL, the coordination structure must be broad-based to include government, business sector, civic society and development partners.
In coordinating SEFORALL at national level, key coordinating functions, include strategic planning; facilitating multi-stakeholder dialogue; coordinating country action and high-impact opportunities; supporting policy analysis, knowledge management, technical advisory services, and communications; monitoring, reporting and accountability; and mobilising partnerships and resources.

Effective implementation of the Lesotho SEforAll Country Action Agenda requires governance arrangements that reflect cross-sectoral cooperation and inter-ministerial coordination. This will ensure that, at the policy level, acceleration of sustainable access to energy has an imperative for sustainable growth, employment and poverty reduction remains a major plank of national strategies for shared growth.

Currently, no Institutional arrangement has been made in Lesotho in order to ensure SEforAll coordination and follow-up.
Lesotho should put in place the following Institutional framework in order to ensure the Government of Lesotho ownership of this Country Action Agenda, as well as ensure the creation of a structure that can take responsibility for coordinating SEforAll initiatives.

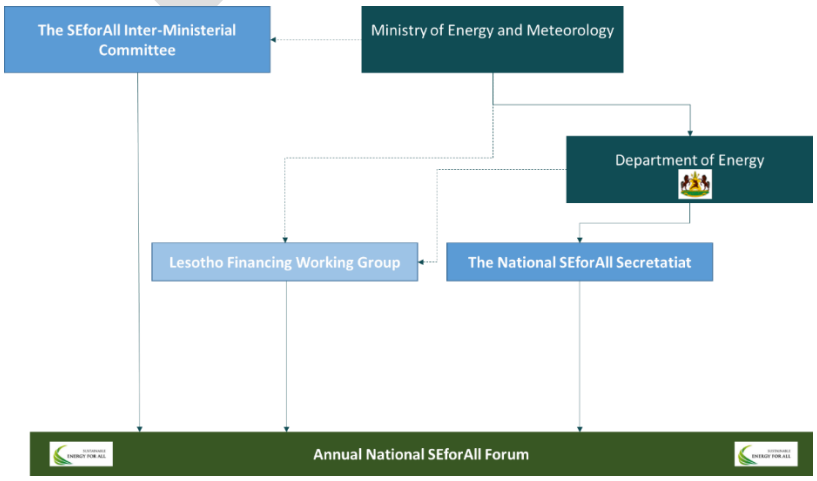

Figure 21 – Proposed Institutional Arrangement for SEforALL Coordination

Inter-Ministerial Committee

To create an Inter-Ministerial Committee, to be chaired by the Ministry of Energy and Meteorology in order to provide the required oversight, leadership and guidance on the implementation of Lesotho's SEforALL Action Plan as well as to coordinate the SEforALL interventions of the ministries and provide a high-level forum for setting priorities and strategies for engaging with the private sector and development partners.
The committee should include the following members:

- Ministry of Energy and Meteorology;
- Ministry of Development Planning;
- Ministry of Finance;
- Ministry of Forestry, Range and Soil Conservation;
- Ministry of Health;
- Ministry of Public Works and Transport;
- Ministry of Tourism, Environment and Culture;
- Ministry of Trade and Industry;
- Ministry of Water Affairs;
- Ministry of Social Development;
- Ministry of Communication, Science and Technology.

This committee will establish three sub-committees on: off-grid renewable energy electrification; productive uses of energy; and clean cooking solutions.
To provide technical support to the implementation of SEforALL specific activities representatives of civil society, research community, development partners and the private sector, especially business associations and financial institutions, would be co-opted as members.
This inter-ministerial committee should be constituted as soon as possible and would meet bi-annually while the sub-committees would meet as often as required.

There is also the need to constitute the SEforALL Lesotho Financing Working Group with the aim of supporting the SEforALL Secretariat and the project sub-committee to identify and develop bankable project proposals, and facilitate access to available financing. The Financing Working Group should be made up of representatives from the:

- Ministry of Energy and Meteorology,
- Department of Energy,
- SEforALL National Secretariat,
- Ministry of Finance,
- African Development Bank,
- Delegation of the EU,
- UNDP and
- World Bank.

This ad-hoc group would meet as and when needed.

The Secretariat

A National SEforALL Secretariat should be established at the Department of Energy. The main purpose of the Secretariat will be to coordinate the implementation of the SEforALL activities by responsible institutions, monitor and report on implementation progress against set targets. Due to the limited technical and financial capacity of the SEforALL secretariat, it would focus on high impact opportunity projects relating to electricity access for off-grid communities using decentralized renewable energy technologies, productive use of electricity and clean cooking solutions. The Secretariat will therefore work closely with the policy planning monitoring and evaluation (PPME) units in the relevant ministries and report on implementation progress. The Secretariat would also identify funding opportunities for public-private, public-public or private-private partnerships to drive SEforALL project implementation.

Annual National SEforALL Forum

A National Sustainable Energy for All Forum should be held every year by the Ministry of Energy and Meteorology to review progress on the implementation of the Lesotho SEforALL Country Action Plan. The main objective for this Annual Forum will be to serve as the SEforALL "annual general meeting" of all stakeholders (government, the private sector, civil society, research community and end-user representatives) and a forum for holding those responsible for implementing the Country Action Plan to account. Presentation of the overall "*Monitoring and Performance Assessment Report*" will be the centre piece of the national forum, enabling stakeholders to review progress against the targets set. This Annual Forum should also serve as the principal forum for private sector partnership and investment promotion. Hence, it would be adequate to hold a mid-year review prior to the annual forum to discuss progress being made in the implementation of SEforALL and the Secretariat will be the convener under the auspices of the Ministry.

3.2 MONITORING, EVALUATION AND REPORTING

It is important to establish a flexible but robust monitoring and evaluation framework for the national SEforAll Action Agenda to monitor implementation, support lessons learning, and make necessary adjustments over time (including provisions for regular review/update of the Action Agenda, which should be seen as a living document) enhancing the effectiveness of the actions.

To continuously build support for the SEforAll Action Agenda and foster ownership and accountability, a mechanism should be put in place to track National progress toward the tree SEforAll objectives and report progress on the achievement of expected outcomes under the SEforAll initiative. This process should ensure:

- Measure National progress made against the proposed targets;
- Link to the Government's own monitoring and evaluation instruments and where relevant build on existing monitoring exercises by the different partners;
- Facilitate the collaborative participation of stakeholders in monitoring;
- Make the monitoring information accessible to the public;

- Highlighting lessons learned from implemented projects , programs and initiatives;
- Reviewing annually the Action Agenda implementation, underlining the achievements and gaps;
- Provide for regular reporting on Country Action Agenda implementation to the GFT and SEforAll Regional Hub.

Currently energy indicator's monitoring activities falls under the DoE Energy Planning Division, however there is no monitoring framework in place.
Presently only electricity statistical data is collected (provided by LEC) and there is no available data or analysis regarding the clean cooking, energy efficiency nor renewables.
A creation of a "*Monitoring Unit*" with properly skilled resources should be considered in order to ensure the needed monitoring, evaluation and reporting activities

Monitoring

The monitoring exercise in Lesotho would be linked to the SEforAll Global Tracking Framework (GTF) that has concrete indicators for measuring and tracking global progress towards meeting the three objectives.
Lesotho should use the GTF to measures and track progress in energy access, renewable energy, and energy efficiency at national level.
The GTF is also evolving to bring forward indicators that reflect relevant and practical attributes for access, energy efficiency, renewable energy and the nexus. The SEforAll Secretariat will need to plan the collection and tracking of key indicators for the priority actions.

Evaluation

The evaluation should consist of annual reviews of the progress made through the activities conducted and performance achieved towards the targets that are set under the Action Agenda.
The evaluation should ensure a broad and representative perspective on the achievements and challenges in the implementation of priority actions, and should allow the adequacy of the adopted strategies to be assessed to meet the targets as planned and take any corrective measures if needed. The evaluation should include the provision of recommendations for future monitoring periods and it is also intended to inform the stakeholders participating in the implementation of the Action Agenda of follow-up actions required to further strengthen its performance and strategic activities.

The purpose of the evaluation activities is:

- To contribute to improving program effectiveness and delivery towards Lesotho's SEforAll goals by 2030 by using knowledge and lessons learnt from its implementation back into the country initiative;
- To contribute to overall alignment of strategic activities of the Action Agenda and ensure that it remains relevant to addressing country level objectives whilst also aligned to the global SEforAll initiative.

During the annual SEforAll evaluation, the SEforAll Focal Point should review:

- The results achieved in the current monitoring period in comparison to the baseline and the previous year; and
- Progress on actions and targets met as planned in Lesotho's Action Agenda using the selected indicators.

Reporting

The Department of Energy, as the National SEforAll Coordinator shall report on an annual basis on the progress and performance towards the implementation of the SEFORALL Action Agenda. A Performance Assessment report should be prepared annually using the monitoring and evaluation results and shared with stakeholders for awareness, socialization and proper contributions on their part. The report should clearly show the baseline scenario and the progress made against the targets set.

Regular updates should be made to the SEforAll Secretariat and to the SEforAll Africa Hub[55].

3.3 INVESTMENT PROSPECTUS

The Action Agenda provides a set of actions, national energy plans and programmes of action that help unlock private investment flow. It is important, therefore, that the Action Agenda is closely linked to the Investment Prospectus. Attainment of the SEFORALL target is only made possible with the right and adequate investments.

The "Lesotho SEforAll Investment Prospectus" provides an approach to operationalizing the Country Action Agenda by identifying and developing a set of implementable programs and projects, including their investment requirements, that can be presented to potential private and public investors.

[55] Partnership between the African Development Bank, the African Union Commission, the NEPAD Planning and Coordination Agency and UNDP

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