



SUSTAINABLE  
ENERGY FOR ALL

# **Rapid Assessment and Gap Analysis for Lesotho**

**Sustainable Energy for All (SE4All)**

By Dr Peter P. Zhou assisted by Tichakunda Simbini  
EECG Consultants Pty Ltd  
Box 402339 Gaborone, Botswana  
EMAIL [pzhou@eecg.co.bw](mailto:pzhou@eecg.co.bw); [pzhou@global.bw](mailto:pzhou@global.bw)  
Tel +267-3910127  
Fax +267-3910127  
Mobile +267-71693104 or SA cell +27788438380

On assignment from UNDP

# Rapid Assessment and Gap Analysis

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## Abbreviations and Acronyms

AAP	Africa Adaptation Programme
AIDS	Acquired Immune Deficiency Syndrome
APHABEI	Advisory Project for Household and Building Energy Issues
ATS	Appropriate Technology Services
EE	Energy Efficiency
CFL	compact fluorescent lamp
°C	degree centigrade
DOE	Department of Energy
DSM	Demand Side Management
EDM	Electricidade de Mocambique
EEP-SEA	Energy Environment Partnership for East and Southern Africa
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GEF	Global Environment Fund
GoL	Government of Lesotho
GTZ	German Technical Cooperation (Deutsche Gesellschaft für Technische Zusammenarbeit)
GWh	gigawatt hour
HIV	Human Immunodeficiency Virus
kWh	kilowatt hour
LEA	Lesotho Electricity Authority
LEC	Lesotho Electricity Company
LEGA	Lesotho Electricity Generation Authority
LESES	Lesotho Solar Energy Society
LESP	Lesotho Electricity Supply Project
LESOC	Lesotho State Oil Company
LEU	Lesotho Electrification Unit
LHDA	Lesotho Highlands Development Authority
LHPP	Lesotho Highlands Power Project
LPG	Liquid Petroleum Product
LREBRE	Lesotho Renewable Energy Based Rural Electrification
mm	millimetre
MHP	Muela Hydropower Station Plant
MJ	megajoule
MNR	Ministry of Natural Resources
MW	megawatt
MWh	megawatt hour
NEMP	National Electrification Master Plan
NGOs	Non-Governmental Organisations
NREF	National Rural Electrification Fund
NUL	National University of Lesotho
PF	Petroleum Fund
ProBEC	Programme for Basic Energy and Conservation
PRS	Poverty Reduction Strategy Paper
PV	photovoltaics
RE	Renewable Energy
REFIT	Renewable Feed In Tariff
RERA	Regional Electricity Regulators Association
RES	Renewable Energy Source
RETs	Renewable Energy Technologies
SADC	Southern African Development Community
SAPP	Southern African Power Pool

SACU	Southern Africa Custom Union
SE4ALL	Sustainable Energy for All
UNEP	United Nations Environment Program
UNDP	United Nations Development Program
US\$	United States Dollar
VAT	Value Added Tax



## OBJECTIVE

The purpose of Rapid Assessment and Gap Analysis is to provide:

- A quick brief look of the energy situation in the country (Section 1) within the context of its economic and social development and poverty eradication
- A good review of where the country is in terms of the three SE4ALL goals (Section 2), and
- A good estimate of the main challenges and opportunities vis-à-vis the three goals of SE4ALL where the major investments, policies and enabling environments will be required (Section 3)
- A sound basis and background for an Action Plan that may follow as part of the SE4ALL activities in the country

## EXECUTIVE SUMMARY

Lesotho is a landlocked country, which has a population of 1.7million, with three-quarters living in rural areas. Lesotho's population growth rate has been severely affected by changes in fertility, mortality, migration and HIV/AIDS. The country's weather is characterised by hot summers and cold winters.

Lesotho's 2010 GDP was US\$1500 million and the average growth rate since 2001 was 3.7%, with above average growth rates being registered in the past 5years except for 2009 due to the global recession. The service sector, which includes Wholesale and Retail Trade, Hotel, Transport and Communication, Financial Intermediation, Real estate activities and Public Administration contributed 53% to the GDP in 2010. The contribution of other goods producing industries which include mining, electricity, water, and construction averaged 15% over the last 20 years.

Lesotho's energy sector is guided by the Energy Policy of 2003 with support from other sector documents. There are however no strategies that operationalize the draft energy policy. Development plans in the country prioritises 'clean energy and green technologies' with investment in hydro, wind and solar to meet Lesotho's energy demand. There is recognition of the importance to enhance Lesotho's electricity generation capacity so as to cater for the energy needs of the productive sector, specifically for the mines that are currently not connected to the national grid.

Government has plans to develop an electrification policy and power generation policy which are expected to be instrumental in implementation of strategies for the sustainable development of the energy sector such as regulating and eliminate VAT on LPG, banning paraffin flame stoves and promoting safe and less polluting stoves.

Over 95% of rural households in Lesotho predominantly use energy fuels that include such as paraffin, candles, fuelwood, dung and coal for lighting, cooking, lighting and space heating. There is a strong bias on the energy access between urban and rural households, with more urban households having access to cleaner forms of energy and significantly more rural households using less cleaner forms of energy. Electricity is envisaged to be used by 100% of the households connected to the grid for lighting

Electrification rate in Lesotho is of 2012 at 26 % with 65% urban households and 6% of rural households connected to the national grid. The high number of connections in urban areas is attributed to well-developed transmission and distribution infrastructure. The country has been experiencing growth in electricity demand due to industrial development and an increase in number of customers connecting to the grid and now supply outstrips demand. The shortfall is being met from imports from other SADC countries mainly South Africa and Mozambique. To address supply deficits in the long term, Lesotho is planning to implement a number of energy projects. Lesotho is also considering increasing electricity tariffs to attract investment in electricity infrastructure and also open up the sector to the private sector.

Despite not having a comprehensive energy efficiency strategy and program, the Government of Lesotho recognises the importance of energy efficiency (EE) and conservation. The aim is to develop strategies for demand-related areas in households, industry and commerce, government and transport. Energy efficiency programs in the country include information dissemination on EE for residential and transport sectors,

development of EE guidelines for industry, commercial and residential sectors, power factor correction and dissemination of residential and energy efficiency stoves

Electricity consumed in Lesotho is hydro based and despite this, utilisation of other forms of renewable energy is very low in the country. There are planned projects, which when completed will increase renewable energy contribution to the country's energy mix through deployment of wind and solar projects. It is important to point out that the success of all the planned electricity projects depends largely on the availability of a regional market for the bulk electricity excess.

The major economic sectors that include industrial and commercial sectors are well serviced with modern energy services particularly in form of electricity. The attribution of modern energy services to small scale productive uses are not documented, although the level is still considered inadequate at the moment.

Lesotho has no comprehensive targets in relation to the SE4All goals. The only stipulated targets are in relation to electrification rates. In that regard, the country has a target to electrify 35 % of the total households by 2015 and 40 % by 2020.

**There are a number of key gaps, barriers and additional requirements to achieve SE4All goals and these are provided below.**

General

- Weak Policy and Legal framework as evidenced by the absence of an approved policy and strategy for energy, renewable energy and energy efficiency promotion
- Fragmented institutional and legal framework resulting in inadequate multi-sectoral approach in the country
- Lack of incentives for retentions of skills in key energy organizations

Energy access

- Lack of baseline data for proper analysis of the access to modern 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.
- Short term initiatives by donors and NGOs that need to be sustained
- Electricity supply is a limitation to meet the growing demand both in households and industry
- Rural connections limited by restrictive grid extension/maintenance,

Energy efficiency

- Lack of energy efficiency strategy and programmes in the country
- 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 community
- Low application of demand-side management (DSM) and energy efficiency measures for modern energy in the productive sectors:

Renewable energy

- High capital costs of Renewable Energy
- Low awareness about RETs and access to information on RETs
- 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),
- Certain RETs based services have limited applications e.g. for thermal applications and productive uses.
- Uncertainty on resource potential of hydro potential in the country and required assessment of wind, solar and biomass potential.

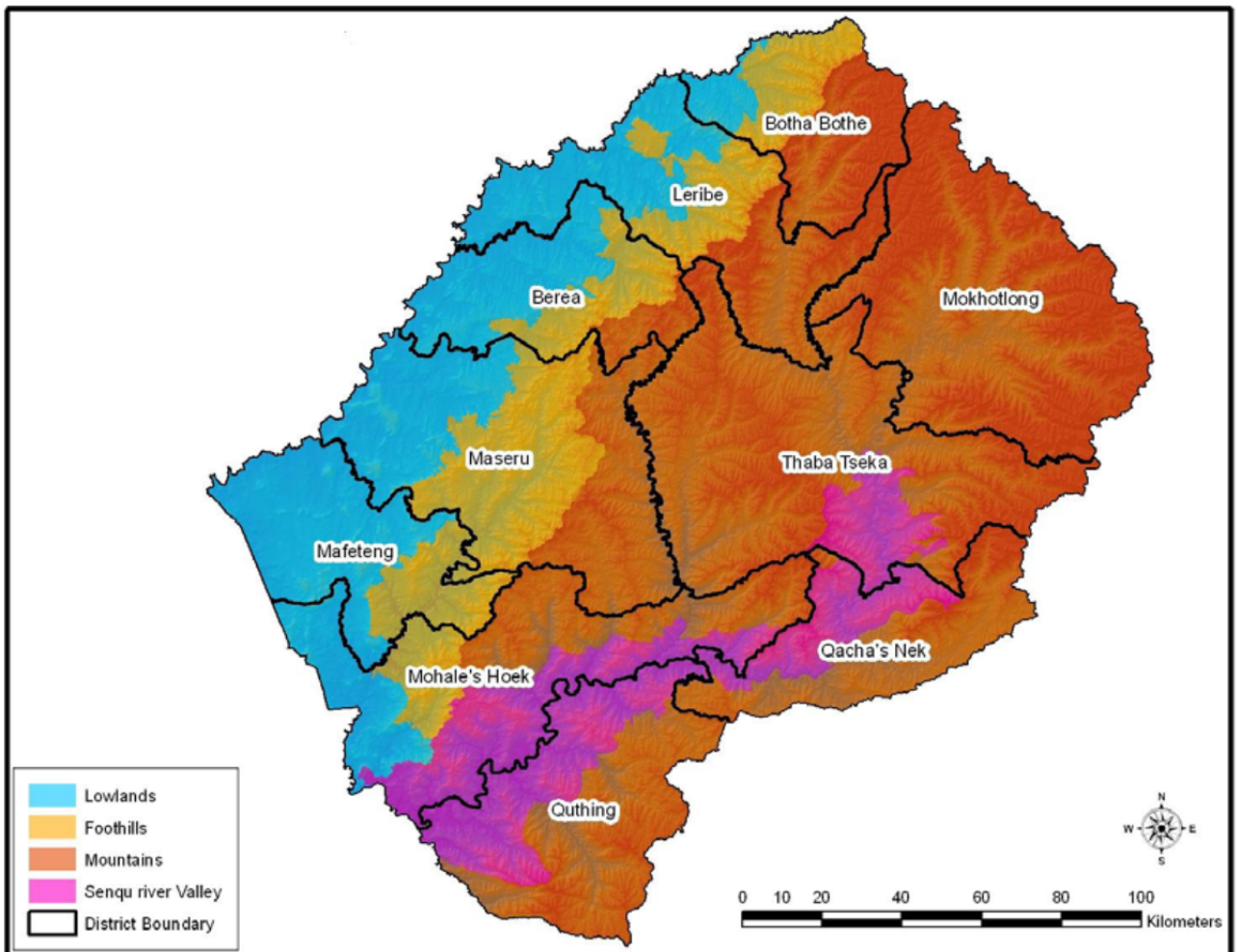
The gaps, barriers and requirements will form the basis for the development of the SE4All Action Plan for Lesotho.



## SECTION I: INTRODUCTION

### 1.1 Country Overview

Lesotho is a mountainous country with a land area of 30,355sqm completely surrounded by Republic South Africa. Due to its high altitude the country has a temperate climate with hot summers and severe cold winters with temperatures reaching 30°C in summer and winter temperatures as low as -7°C in the lowlands and -18°C in the highlands. The mean summer and winter temperatures are 25°C and 15°C respectively. The annual rainfall ranges between 600mm in the lowlands and 1200mm in the northern and eastern parts of the country. The figure below shows the map of Lesotho and the major geographic regions.



Source: Lesotho Bureau of Statistics (2010)

**Figure 1: Map of Lesotho**

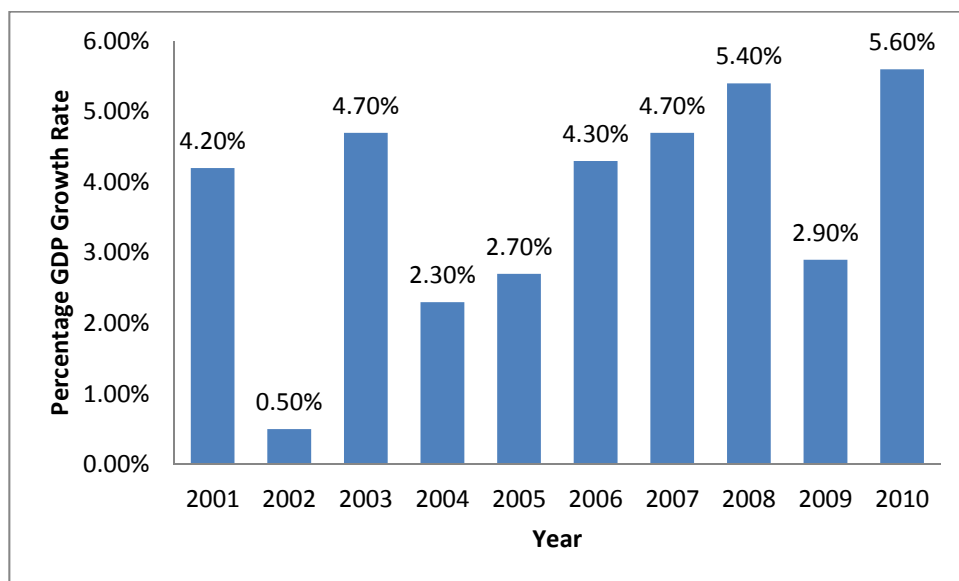
According to the 2006 census, the population of Lesotho was 1,89 4194 million. More than three-quarters of the population live in rural areas, with an average household size of 6 people and are mostly engaged in agriculture and informal activities. Lesotho's population growth rate has declined from 2.8% in the 1980s to 0.1% from 1996 to 2006, due to changes in fertility, mortality, migration and HIV/AIDS (Table 1) .

**Table 1: Historical Population statistics for Lesotho**

Group	1875	1891	1904	1911	1921	1936	1946	1956	1966	1976	1986	1996	2006
Population in thousands													
De jure	---	---	---	426	543	661	689	794	970	1 217	1 605	1 862	1 877
De facto	128	219	349	405	499	562	564	642	852	1 064	1 448	1 598	1 741
Intercensal growth, % per year													
De jure		---	---		2.5	2.0	0.4	1.4	2.0	2.3	2.8	1.5	0.1
De facto		3.4	3.6	2.1	2.1	0.8	0.0	1.3	2.9	2.2	3.1	1.0	0.9

Source: Bureau of Statistics

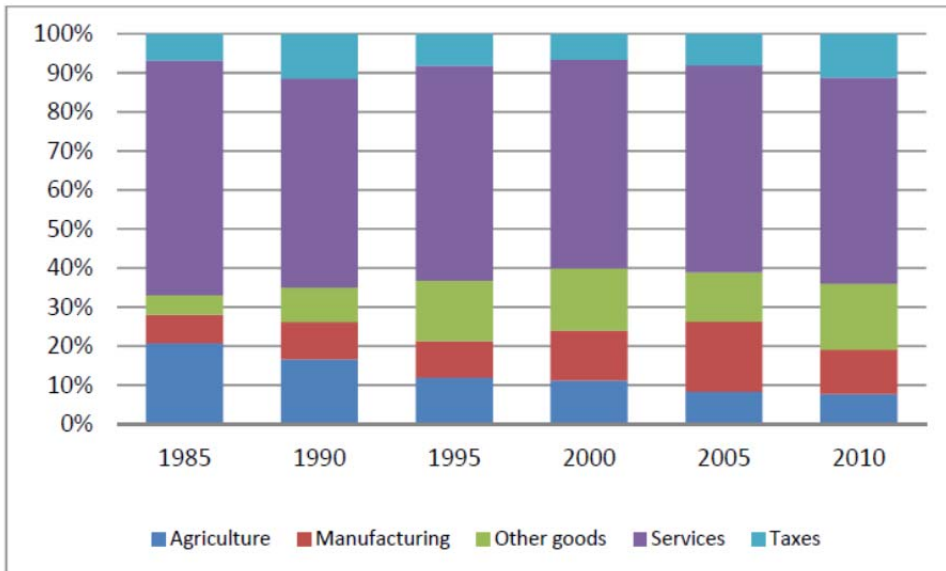
Lesotho’s GDP for the year 2010 was 10 242 million Maloti (USD 1500 million) at 2000 constant prices. Figure 2 shows that the GDP has grown at an average rate of 3.7% since 2001, with above average growth rates being registered in the past five years part from the lower growth rate in 2009 that is being attributed to the effects of the global economic crisis.



Source: Lesotho Bureau of Statistics, 2010

**Figure 2: Lesotho Percentage GDP growth rate**

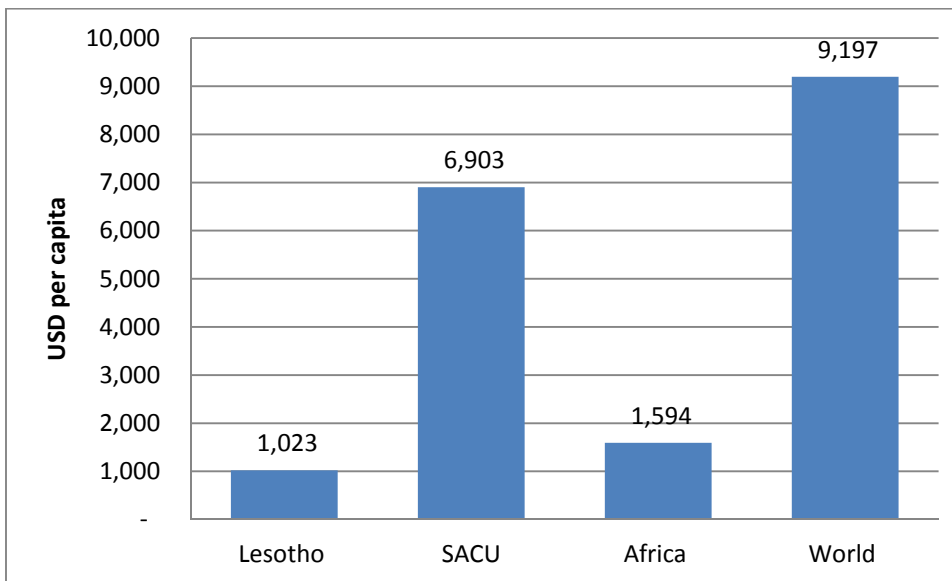
The contribution to the GDP shown in figure 3 is dominated by the *service industries* which include wholesale and retail trade, hotel, transport and communication, financial intermediation, real estate activities and public administration. The services industries contributed 53% to the GDP in 2010 but show a decline from over 60% in 1985. The contribution of *other goods* producing industries which include mining, electricity and water, and construction have shown a steady growth since 1985 from below 5% to 15% in 2010. The contribution of *agriculture* to the GDP steadily declined since 1985 from 20% to below 10% in 2010. The manufacturing sector is also on the increase hovering between 7% and 15% between 1985 and 2010.



Source: Lesotho Bureau of Statistics 2010

**Figure 3: Lesotho Sectoral contribution to the GDP.**

The GDP per capita of Lesotho shown in figure 4 of USD 1,023 is far much lower compared to Southern Africa Custom Union (SACU) average of USD 6903 but comparable to that of the rest of Africa. This implies that Lesotho has a huge potential for development and has currently lagged behind its SACU counterparts.



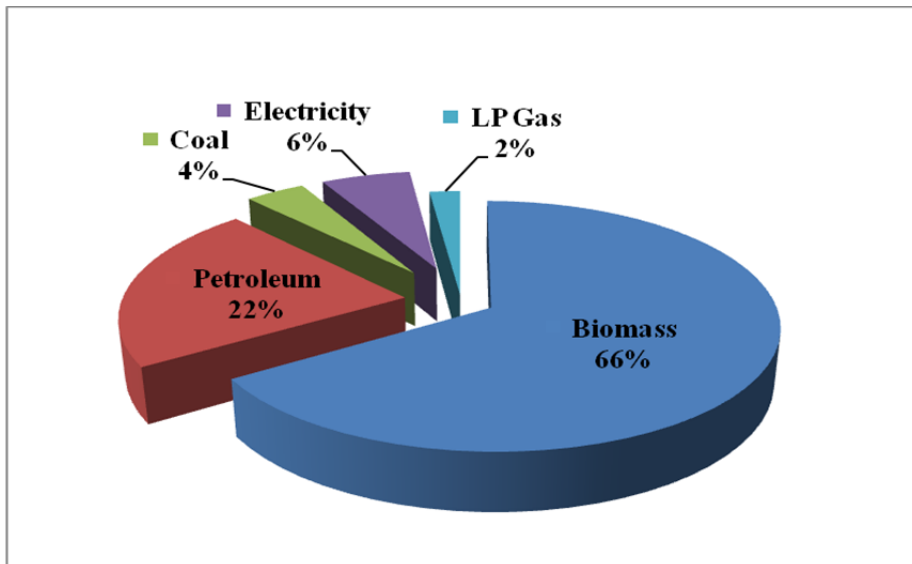
Source: IREN, 2011

**Figure 4: GDP Per Capita for 2010 for Lesotho relative to SACU, Africa and the rest of the World**

## 1.2 ENERGY SITUATION

### 1.2.1 Energy supply

Lesotho's energy balance is dominated by biomass energy, which contributes 66% to the energy mix. The remaining 34% is made up of petroleum products, hydroelectricity, coal and LPG in order of decreasing magnitude (Figure 5).



Source: B.M. Taele et al<sup>1</sup>

**Figure 5: Lesotho's Energy Mix**

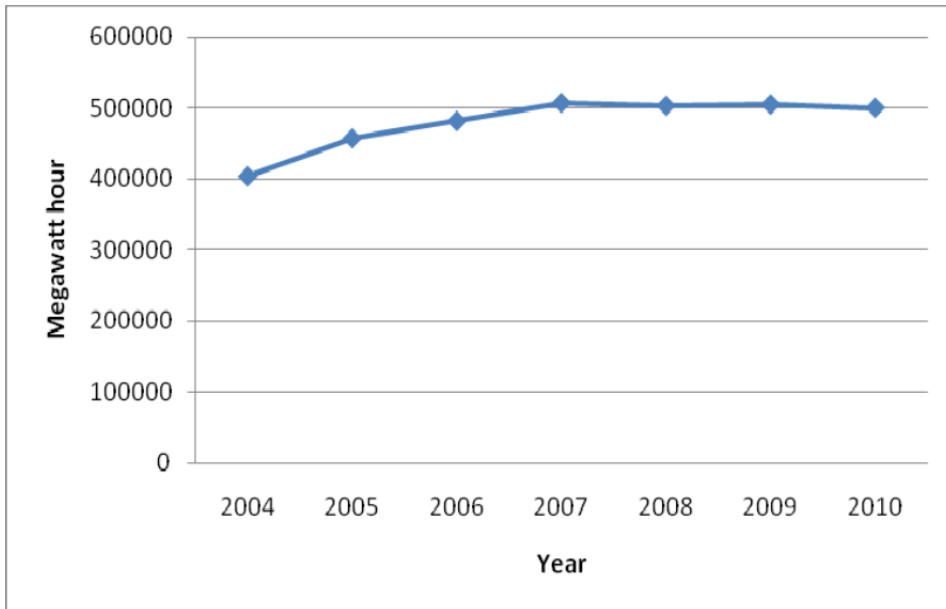
#### **Electricity Supply**

All the electricity generated locally is hydro based and Muela the main operating Plant has an installed capacity of 72MW. There are also four mini-hydro plants with a combined installed capacity of 3.25MW, Semonkong mini hydro plant is in operation while the Mantsonyane is under rehabilitation. The other two are not operating due to poor maintenance, siltation and flooding. The total installed capacity is less than the maximum demand of 145MW mostly in winter (2011)

The electricity deficit is offset by electricity imports from Electricidade de Mocambique (EDM) in Mozambique and ESKOM in South Africa within the Southern African Power Pool (SAPP).

The figure 6 shows that Lesotho's electricity generation increased from 403,858MWh in 2004 to 507,346MWh in 2007 and a steady 0.93% decline has been observed since 2007 to 2010.

<sup>1</sup>Renewable and Sustainable Energy Reviews 16 (2012)973 – 980



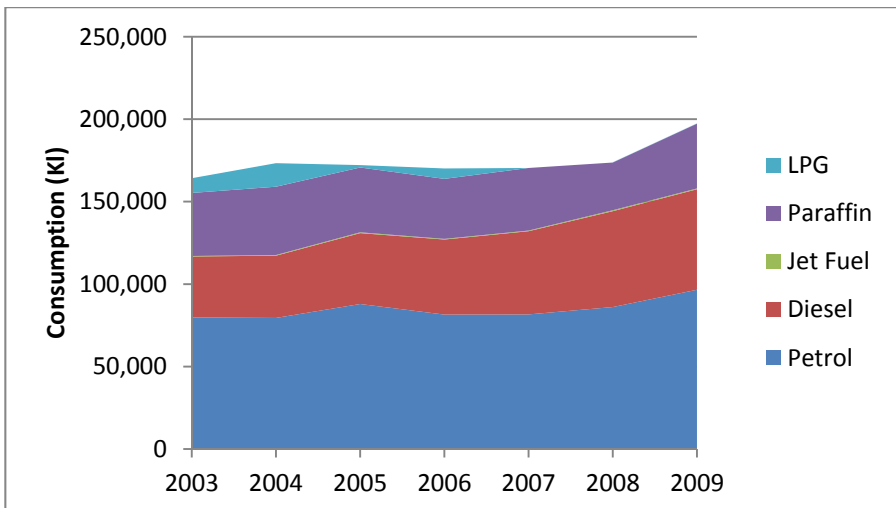
Source: Lesotho Bureau of Statistics

**Figure 6: Lesotho Electricity Generation History.**

### ***Petroleum Fuels***

Lesotho imports all its refined petroleum fuel requirements from South Africa as it is landlocked and has no refineries and proven oil reserves. There are three multinational companies operating in Lesotho, which import and store petroleum products in bulk storage facilities before redistribution in the country. Lesotho is planning to establish a 60- days strategic fuel reserves in the country.

The graph in figure 7 shows Lesotho’s overall requirements of transport fuels. The graph shows that Lesotho consumed close to 200million litres of petroleum fuels in 2009 and these are dominated by petrol, diesel and paraffin. The contribution of LPG is insignificant compare to the aforementioned fuels and that of jet-fuel is minuscule. Paraffin and LPG are mostly used in for cooking purposes in the household sector.



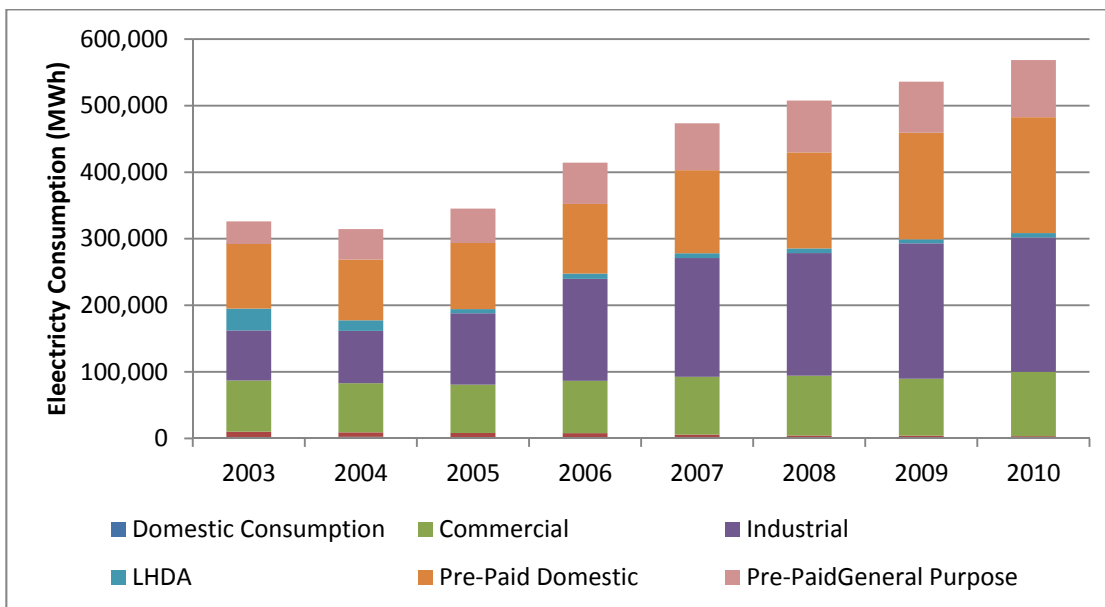
Source: Lesotho Bureau of Statistics

**Figure 7: Lesotho Petroleum Fuel Mix.**

## 1.2.2 Energy demand

### Electricity Consumption

The electricity consumption of Lesotho has grown on average by 6% between 2003 and 2010 from 325GWh to 568GWh as shown in figure 8. The peak demand for electricity is 145MW (2011) compared to an available capacity of 72MW. The industrial Sector<sup>2</sup> is the dominant electricity consumer followed by the pre-paid domestic sector.



Source: Lesotho Bureau of Statistics

**Figure 8: Lesotho's growth in electricity consumption.**

Increased mining is responsible for the rise in the country's peak demand which has been rising at 2.7 MW per annum.

### Biomass Consumption

The majority of households in the country, especially in the rural areas are dependent on biomass as the main source of energy and this has placed tremendous pressure on indigenous trees and shrubs (State of the Environment Report, 2002). The picture in figure 9 shows the kind of biomass used in Lesotho, which include wood, shrubs and dung.

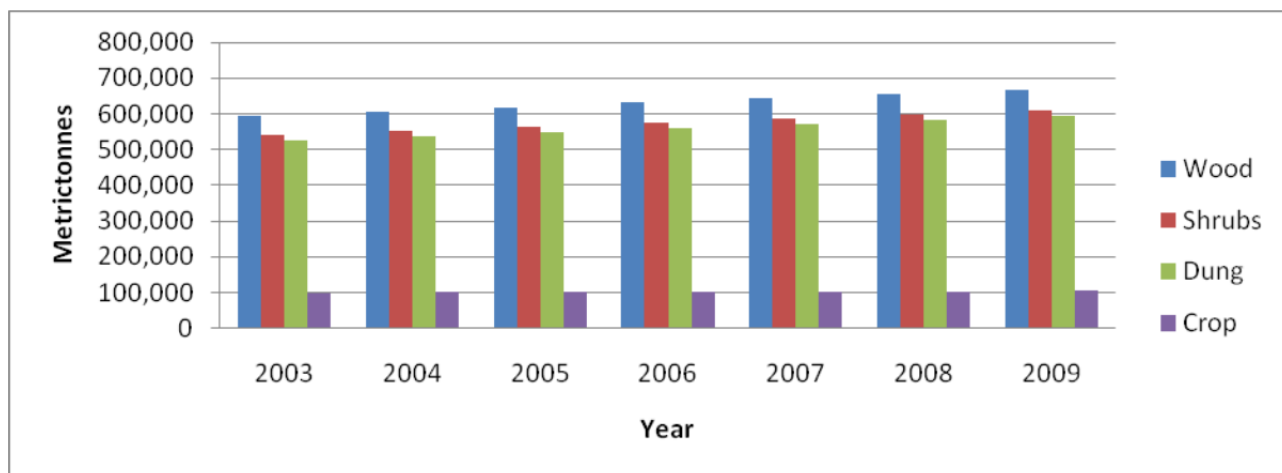


Source: GTZ 2007

**Figure 9: Types of biomass used in Lesotho**

<sup>2</sup>Accentuated since 2006.

The figure 10 shows the quantities of the types of biomass used in Lesotho and it is evident that the dominant biomass is fuelwood, shrubs and dung. The amount of biomass used in Lesotho has also been on the increase slowly, averaging at least 600000 metric tonnes by the year 2009 for each of the major biomass types used in the country.



Source: Lesotho Bureau of Statistics

**Figure 10: Lesotho's growth in biomass demand.**

### 1.2.3 Energy and economic development

In terms of public spending on the energy sector, the table 2 below shows the source of budgeted finance and the share allocated to the Ministry responsible for energy affairs for the 2011/2012 financial year. The table shows that though the ministry got 24% of the budgeted amount, energy projects got 7% of the total budget and 29% of the ministry budget, with the bulk of the money coming from international loans.

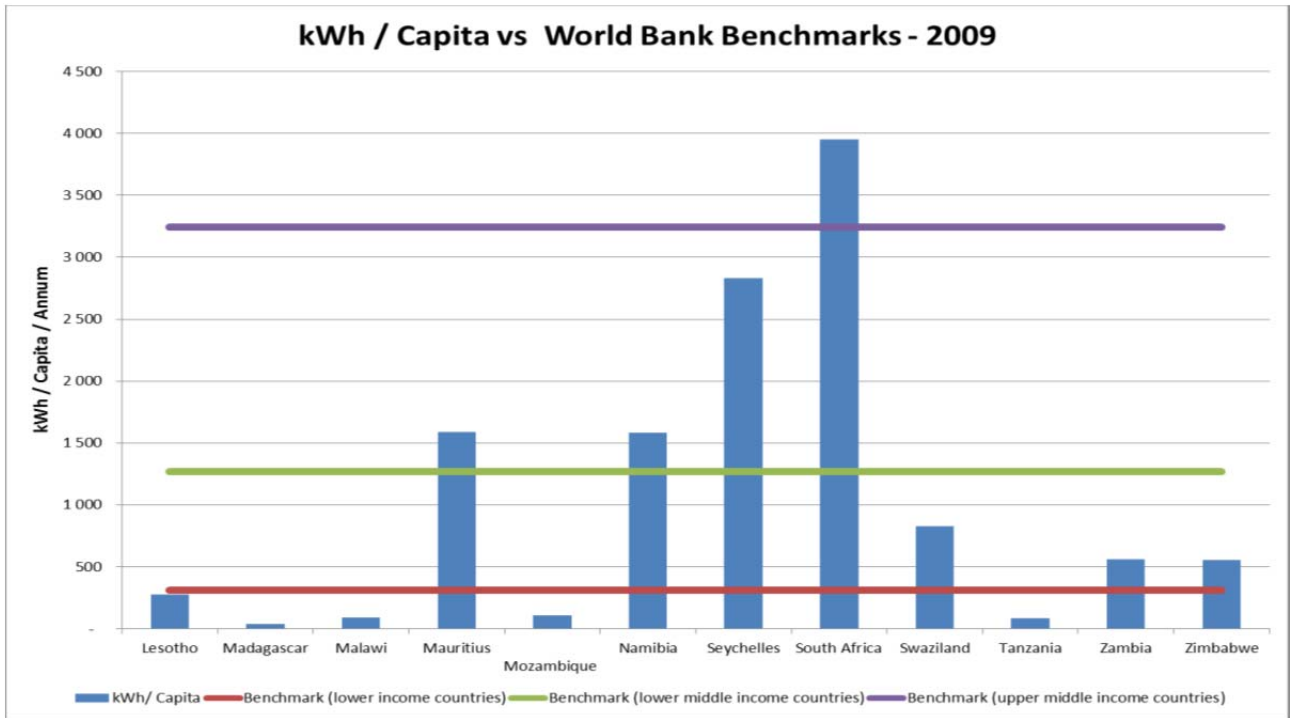
**Table 2: Percentage Budget Allocation for Energy by Government**

Source of Budget Finance	% Contribution to the development budget	% allocated to Ministry of Natural Resources	% Allocated for Energy Projects
GOL	41%		1%
Donor Grants	43%		0.27%
Donor Loans	16%		44%
Total	100%	24%	7%

Source: Ministry of Finance and Development Planning

For the financial year 2011/12 the energy sector was allocated 11% of the ministry budget but the share is projected to get down to 5% and 0.4% for the subsequent two financial years. However it should be noted that in addition to the normal budget allocations, there is a capital budget from government to LEC and other regulators every year. There is also donor participation an example being the decentralized renewable energy and environment project and also Energy Environment Partnership program for East and Southern Africa (EEP-SEA).

The indicator of annual per capita consumption of electricity reflects the level and potential of the country's economic development (RERA, 2009). The per capita electricity consumption of Lesotho of 309 kWh/person/year is below the World Bank benchmark for the low income countries signifying the high energy requirements needed to realize further development by Lesotho (Figure 11).



Source: RERA<sup>3</sup>

**Figure 11 Energy per capita of Lesotho**

#### 1.2.4 Energy strategy and relevant targets

##### **Energy Policy and Strategy**

The draft Energy Policy of 2003 is the document providing the strategic direction for energy in Lesotho and includes all planned policies. Actions plans will be incorporated in strategies that are to be developed from it. Investment in the electricity sector is guided by the draft National Electrification Master Plan (NEMP) of 2007 and more recently the draft Generation Master Plan 2010-2011A. There is also a draft Renewable Energy Policy (2011), which seeks to promote the development of solar, wind, hydro, biomass and biogas in terms of resource potential, technologies and capacity.

In addition to these energy sector documents, are other key documents which include the MNR Strategic Plan (2009), the draft National Strategic Development Plan (2012-2017), the National Vision 2020 (2000), the Millennium Development Goals, the National Forest Policy (2008) for guidance on biomass issues, the National Environment Policy (1998) and the Environment Act (2008) that are relevant for implementation of energy capital projects. Apart from the national documents, are the regional documents that have a direct bearing on the energy sector that include the SADC Renewable Energy Strategy and Action Plan (2012), the SADC Energy Access Strategy and Action Plan (2010) and the SADC Regional Infrastructure Development Master Plan (2012). The draft National Strategic Development Plan (2012-2017) prioritises ‘clean energy and green technologies’ with investment in hydro, wind and solar for meeting Lesotho’s energy demand.

##### **Targets**

The Energy Policy does not set specific targets for access, capacity, generation and energy security. However the Vision 2020 has a target of increasing electricity access to 35% by 2015 and 40% by 2020 and to reduce the fuelwood usage in the national energy consumption. With regards to energy security the Government of Lesotho is planning to establish a National Oil Company, which will construct a 60 day

<sup>3</sup> Technical Report: RERA Publication on Electricity Tariffs & Selected Performance Indicators for the SADC Region, 2009



strategic oil reserves. Currently the strategic oil reserves are in the hands of the private sector and have capacity for only 3 days.

Additional plans include the Lesotho Electricity Supply Project (LESP), in which the government through the Department of Energy plans to rehabilitate the 2MW Mants'onyane Mini-power Plant by 2013. Planned power generation projects include a 6000MW<sup>4</sup> Lesotho Highlands Power Project by 2025 by a private developer, 10MW Concentrated Solar Power Plant in Ha-Ramarothole, Mafeteng (2012), a 1200MW Kobong Pumped Storage (2017); 1000MW Monontsa Pumped Storage Scheme pre-feasibility study (2015), 35MW wind farm (2014) and 47MW waste-to-power plant (2014). Through the Government of Japan, a solar generation with capacity of 280kW will be funded at the airport by 2014. Beyond these targets, the government has plans to develop an electrification policy and power generation policy.

Explicit legislation is required for the sustainable development of the energy sector such as regulating use of traditional biomass, creating incentives e.g. removing VAT on LPG, banning paraffin flame stoves and promoting safe and less polluting stoves.

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<sup>4</sup> The 6000MW potential is constrained by environmental aspects and may not be fully realised.

## SECTION 2: CURRENT SITUATION WITH REGARD TO SE4ALL GOALS

The three SE4All goals as stipulated by the UN Secretary General are as follows:

1. Universal access to modern energy services by 2030
2. Doubling the global rate of improvement in energy efficiency by 2030
3. Doubling the share of renewable energy in the global energy mix by 2030

It is also important to realize that the three goals are interlinked e.g. energy access to modern energy services can be achieved by doubling renewable energy and or energy efficiency.

Below is an assessment of state of these goals in Lesotho.

### 2.1 Energy access vis-à-vis goal of SE4ALL

#### 2.1.1 Overview Assessment

The access to modern energy services for Lesotho is presented in the Lesotho Bureau of Statistics. Some of the statistics however do not reflect the current situation as the last comprehensive national baseline study was done more than a decade ago. The consultations with the energy stakeholders during preparation of this SE4All report have assisted in providing the more representative situation in the country at the moment.

#### 2.1.2 Modern Energy Services for Thermal Applications

##### *Access Levels*

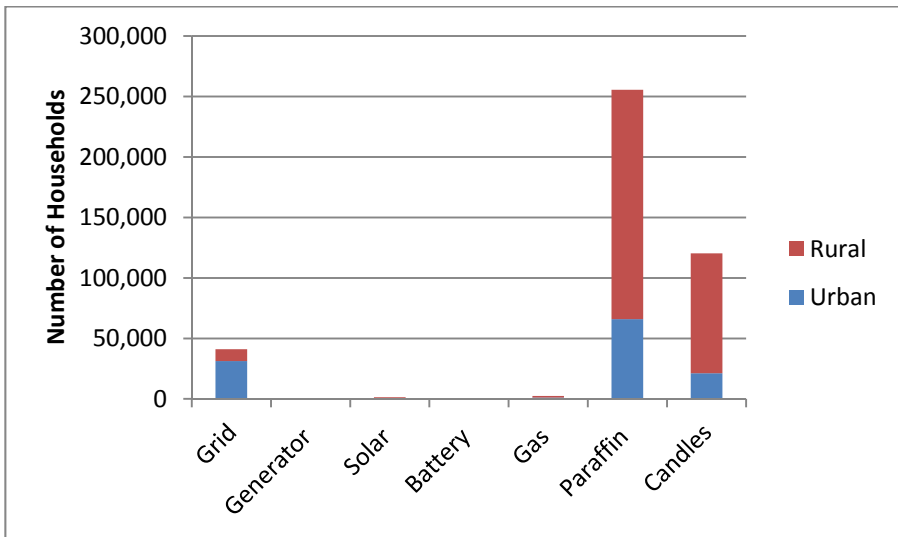
##### **Household Energy Use**

Households in Lesotho require energy mainly for lighting, cooking, and space heating. Data show that there is a difference in level of energy access and hence use between urban and rural households in Lesotho, with a higher proportion of urban households having access to more modern forms of energy compared to rural households. However there is generally low access to modern forms of energy in Lesotho.

Households use a combination of traditional fuels (i.e. fuelwood, agricultural residues and dung), intermediate fuels (i.e. coal and kerosene) 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. In 2008, traditional fuels contributed 95% to the rural energy consumption for cooking, with fuelwood and shrubs contributing over 73% (i.e. 40% and 33% respectively). Paraffin is mainly used for cooking, space heating and lighting. The use of solar energy such as solar photovoltaics (PV) for lighting is growing as there should be over 2700 solar systems that will be in operation by end of 2012.

##### **Lighting**

According to the 2010 energy statistics, 61% and 29% of households in Lesotho use paraffin and candles respectively for lighting (refer to Figure 13). All households connected to the national grid (65% urban and 6% rural households) use electricity for lighting. The use of solar energy and gas for this application is negligible averaging less than 0.3%.

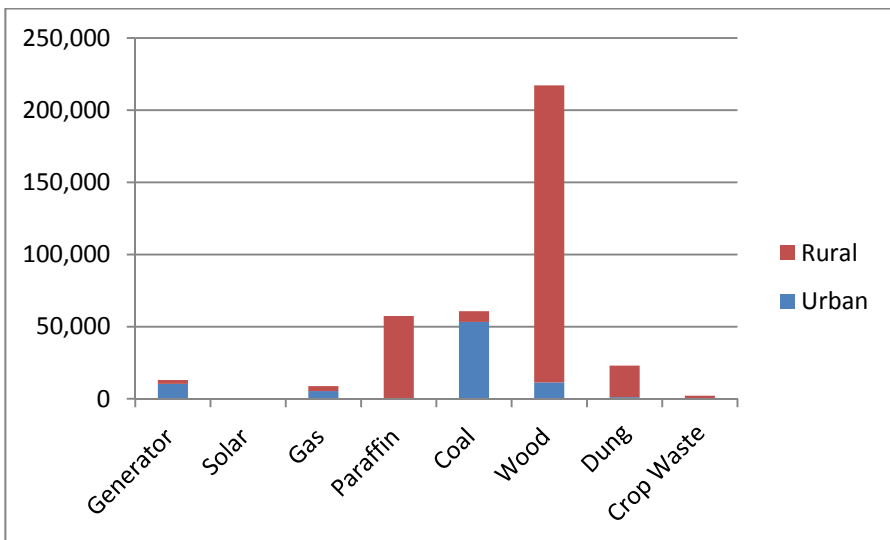


Source: Lesotho Bureau of Statistics 2010

**Figure 12: Lesotho’s household energy use for lighting**

**Space Heating**

The vast majority of households in Lesotho (over 95%) use less modern forms of energy for space heating such as fuelwood, dung, coal and gas (refer to figure 14). Fuelwood and dung are used by rural households while coal and gas are mainly used in urban households. The energy stakeholders corrected that electric generators and paraffin are not known to be used for space heating in the country contrary to what the Bureau of Statistics indicate.



Source: Lesotho Bureau of Statistics 2010

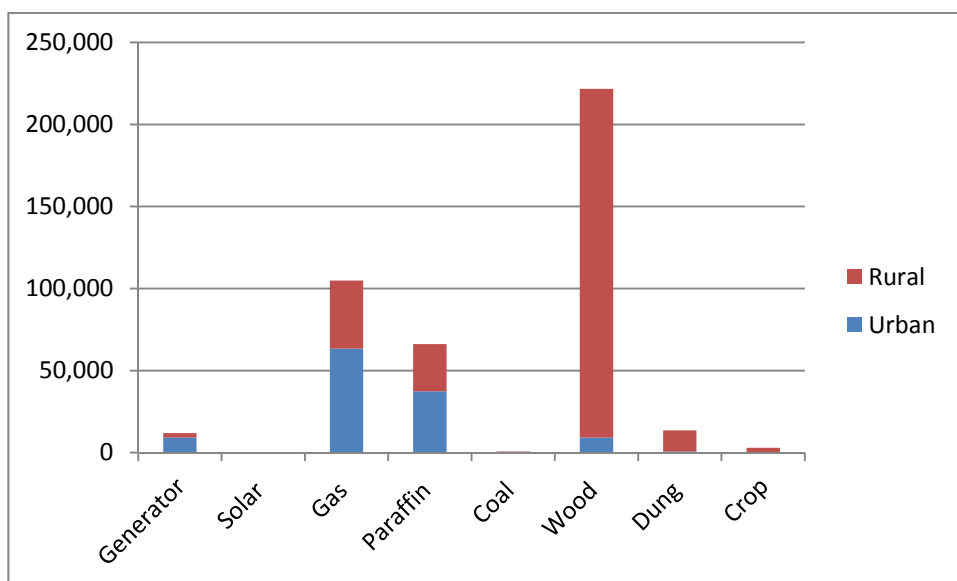
**Figure 13: Lesotho’s household energy use for space heating**

**Cooking**

The fuels used for cooking in Lesotho in 2010 as shown in Figure 15, are fuelwood, LPG and paraffin that are used by 53%, 25% and 16% of the households respectively. Urban households used LPG (i.e. 53%) and paraffin (i.e. 31%) for cooking. For rural households, the vast majority (70%) used fuelwood for cooking and the rest use LPG (14%), paraffin (10%) and dung (4%) as their main fuel for cooking. Though the data from the bureau of statistics does not show it, electricity is also used for cooking by households connected to the grid although the share is expected to be small <10%<sup>5</sup>. Bio-gas is also

<sup>5</sup> Fuelwood, LPG and paraffin are used by over 90% of households

known to be used for cooking and 500 biogas plants for cooking are estimated to be in operation countrywide.



Source: Lesotho Bureau of Statistics 2010

**Figure 14: Lesotho's household energy use for space heating**

### *Availability*

Electricity supply to the household sector is done by Lesotho Electricity Company and the Lesotho Electrification Unit (LEU) 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.

Fuelwood is scarce in Lesotho and the country imports fuelwood and charcoal mostly for consumption by small businesses in urban areas. Table 3 below shows the cost of the fuelwood and coal imported into the country.

**Table 3: Fuelwood and Coal Imports for Lesotho (Maloti)**

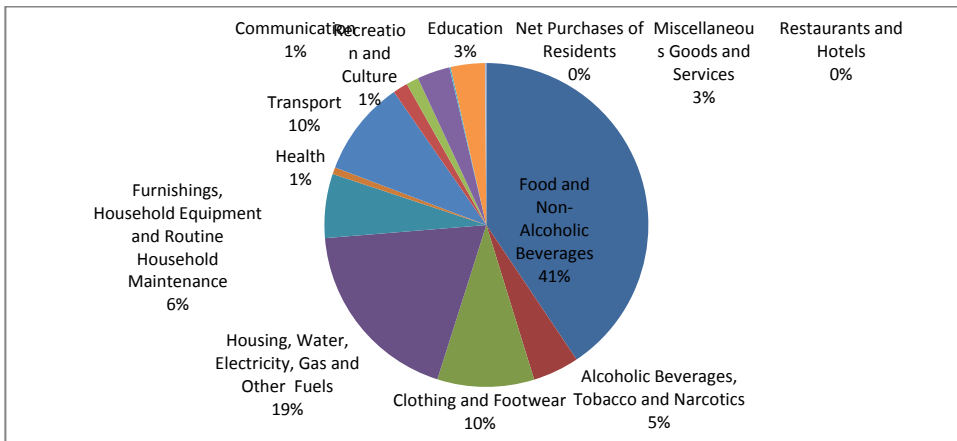
Type of Fuel Year	2004	2005	2006	2007	2008
Fuel wood	2,314,481	2,084,404	9,745,304	8,806,471	4,872,552
Coal <sup>6</sup>	148,665	905,674	248,842	308,671	646,912

Source: Lesotho Bureau of Statistics

### *Affordability*

The chart in figure 16 shows that energy, combined with housing and water constitute about 19% of the household expenditure in Lesotho and is the second highest expenditure after food and non alcoholic beverages. The contribution of energy alone to household expenditure is not isolated hence the direct household energy expenditure burden cannot be provided from the available statistics.

<sup>6</sup> Reflected as charcoal in the National Energy statistics but energy stakeholders believe that should reflect coal that is imported.



Source: AfDB 2012

**Figure 15: Percentage Per Capita Nominal Expenditures of households in Lesotho**

Data on cost of using various energy sources were not available and such information will be important when developing strategies to improve access to various modern energy services for thermal applications.

### Sustainability

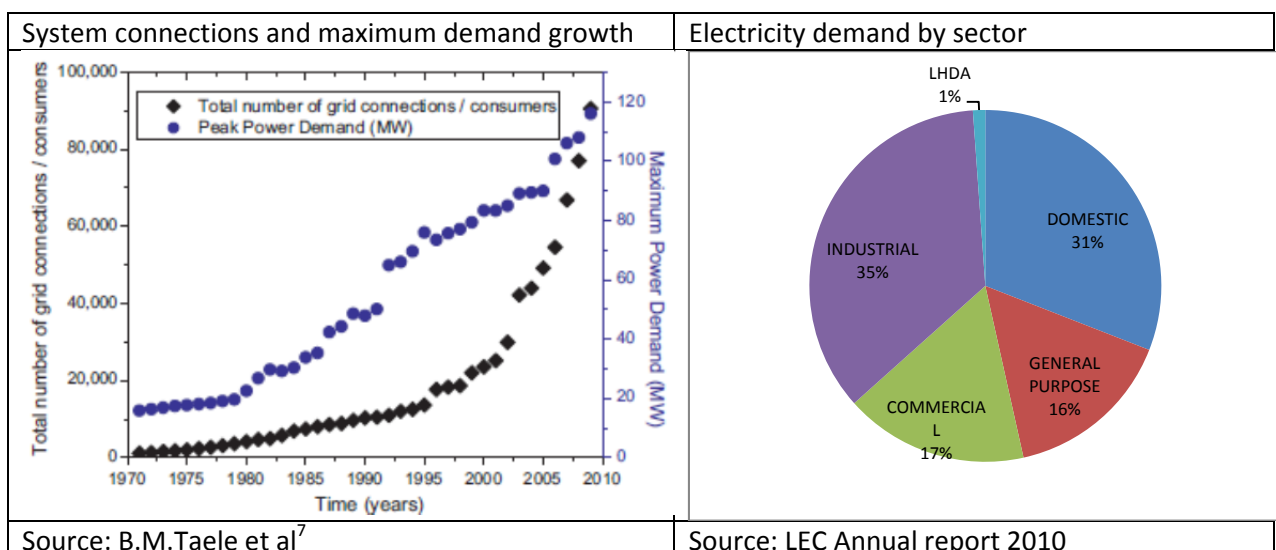
The overwhelming reliance of rural households on biomass fuels places tremendous pressure on this forest resource. The percentage of households in Lesotho with access to energy efficient stoves in Lesotho is growing and an estimated 2900 stoves are in operation in the country, however more effort is required so that continued reliance on biomass will be sustainable. Fuelwood scarcity is already evident through the Lesotho's reliance on imports for fuelwood and coal to complement its domestic supply.

The use of dung and crop residues as alternatives to fuelwood deprive agricultural lands of soil nutrients.

### 2.1.3 Access to Electricity

The household electricity access in Lesotho has already been indicated to be averaging 26% nationally divided into 65% for urban households and 6% for rural households.

Figure 17 shows an exponential growth in electricity access (total number of grid connections) and a steady growth in peak power demand (MW). The increase in maximum demand has been spurred on by development in the industry sector (mining and textile industries).



**Figure 16: Grid connection/maximum demand profile and demand by sector for Lesotho**

<sup>7</sup>Renewable and Sustainable Energy Reviews 16 (2012)973 – 980

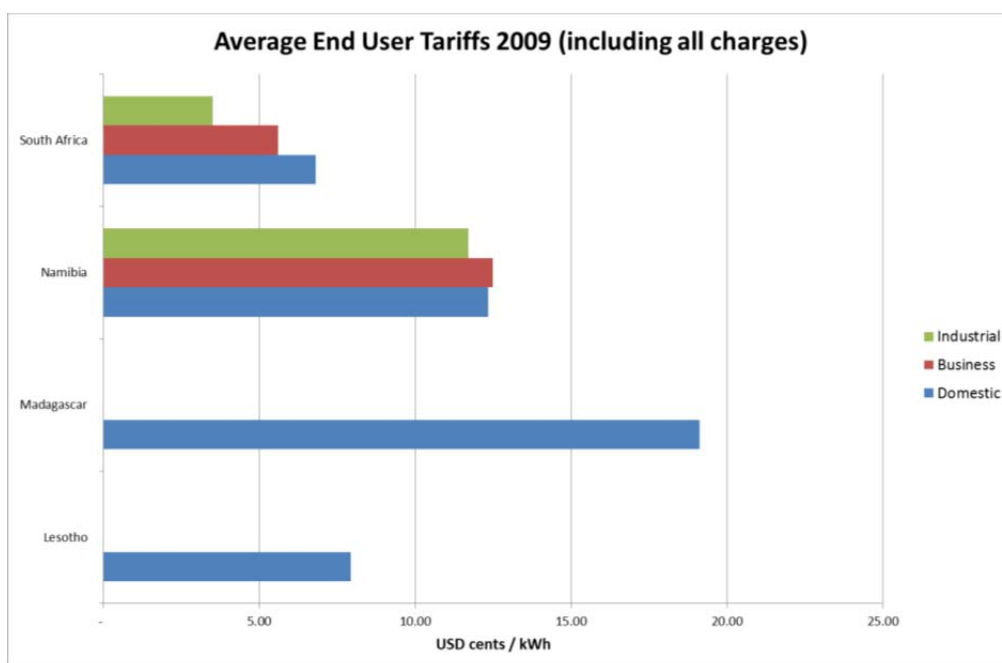
The figure shows that the industrial sector consumed 35% of the electricity demand in 2010 and this was followed by the domestic sector, which consumed 31% of the total electricity. The commercial sector (17%) and general purpose energy consumption (16%) are both about half of the industrial and household sector consumption respectively.

### Availability

Lesotho's electricity is generated 100% from hydroelectricity and the contribution of other RES is currently non-existent. However this is expected to change as there is large wind projects planned in the near future. Currently, Lesotho produces 86% of its peak demand domestically and imports the deficit from the Republic of South Africa and Mozambique mostly during winter.

### Affordability

Tariffs in most SADC countries are not cost reflective. The need for new generation capacity to meet demand has put pressure on governments (including Lesotho) and regulators alike to increase electricity tariffs to attract investment for electricity infrastructure and also to open up the sector to the private sector. Figure 18 shows that the domestic electricity tariff for Lesotho and other SADC countries in 2009 for comparison.



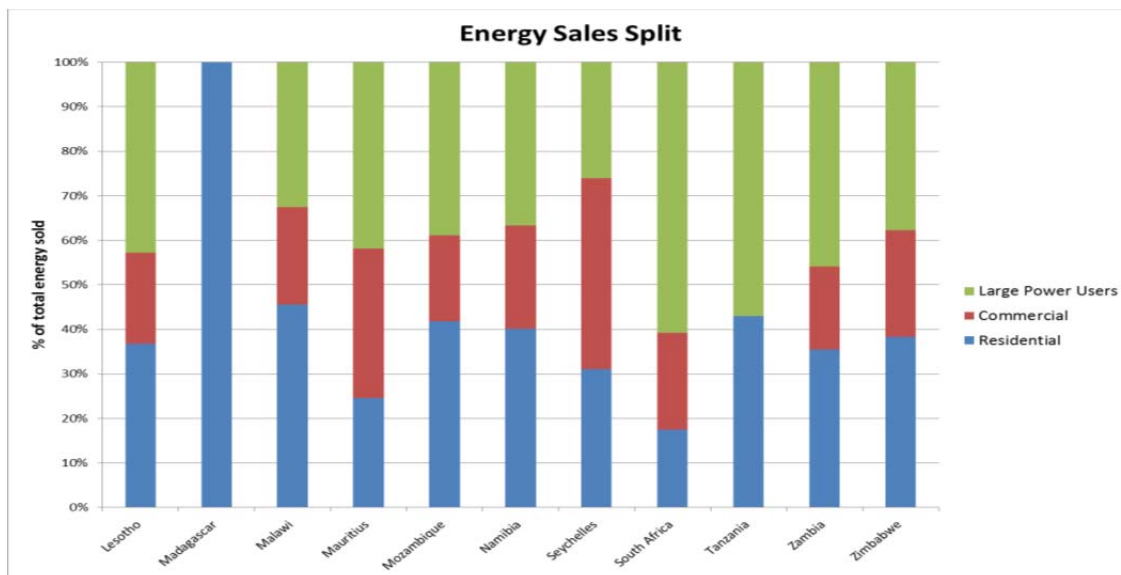
Source: RERA 2009

**Figure 17: Lesotho Electricity tariff relative to other SADC countries.**

### 2.1.4 Modern energy services for Productive use

Consideration of the provision of modern energy services to the productive sector in the context of the SE4All assessment encompasses both small and large scale applications e.g. in SME activities and large scale commercial and industrial activities. The nation's large scale economic sectors are well catered for in terms of supply of electricity and other modern energy sources such as petroleum and, coal and often national energy statistics provide the level of consumption of energy in the economic sectors.

The energy sales to the commercial and large users (productive sector) in Lesotho in 2009 constituted about 63% which was comparable to other SADC countries such as Namibia, Zambia and Zimbabwe (figure 19). The proportion to commercial and productive sectors in South Africa (83%), Mauritius (76%) and Seychelles (70%) were much higher than Lesotho in that year showing that the economies are much more industrialized/commercialized.



Source: RERA 2009

**Figure 18: Energy Sales by category and country**

The statistics on SME level productive applications in Lesotho are not documented and the situation is similar to the other countries that are preparing SE4All Gap Analysis reports.

## 2.2 Energy Efficiency vis-à-vis goal of SE4ALL

### 2.2.1 Overview Assessment

The Government of Lesotho recognises 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 thermally efficient buildings.
- Promote efficient use of energy.
- 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.

Some DSM programs implemented include power factor correction with Lesotho Electricity Company (LEC). The Lesotho Electricity Authority (LEA) also gives guidelines on energy efficiency for industry, commercial and residential sectors. Philips has set-up a compact fluorescent lamp (CFL) manufacturing plant in Lesotho with standards that have been endorsed by SAPP utilities.

To improve the efficient and sustainable utilisation of fuelwood, improved stoves are being promoted for institutional, private and domestic use and these are being promoted by various development agencies. To date about 6000 efficient cook stoves have been supplied in the country by various players. .

### 2.2.2 Energy Intensity of GDP

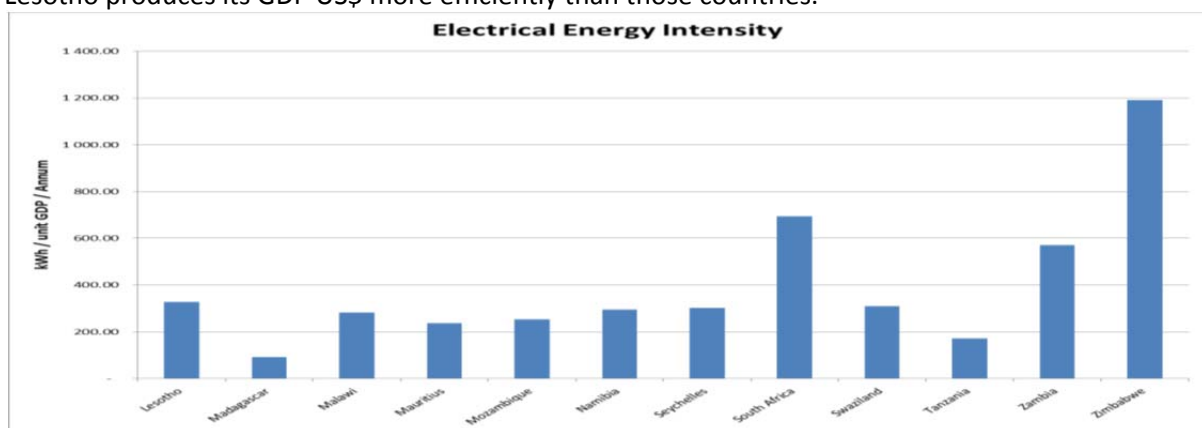
The electrical energy intensity (e.g. Gigajoules or kWh per unit GDP) gives another measure of industrialization and how efficient the economy is in generating its GDP. The lower the GJ or kWh/GDP the more efficient the economy is.

There are no national statistics developed on energy intensity of Gross Domestic Product (GDP) but an estimate calculated for 2010 based on total primary energy (TPES) and Gross Domestic Product (GDP) indicate an energy intensity of GDP of 0.10 below that of several SADC countries, suggesting that Lesotho is more energy efficient than even South Africa. The statistics may not be representative energy when considering total energy supply as some GDP may be generated where energy is not recorded e.g. in agriculture. It may be useful to isolate productive sectors and their contribution to GDP for a more reliable assessment of energy intensity of GDP. Global statistics have however used TPES/GDP.

**Table 4. Energy Intensity of GDP for selected SADC countries**

Country	TPES (Mtoe)	TPES/cap (Mtoe)	TPES/GDP (Toe/thousand 2000US\$)
Botswana <sup>8</sup>	1.658	0.80	0.43
Lesotho	0.154	0.09	0.10
Namibia	1.71	0.79	0.29
South Africa	160.4	2.9	0.79
Zimbabwe	9.51	0.76	2.05

Figure 12 shows Lesotho’s energy intensity in kWh/GDP compared to some SADC countries. It is interesting to note that even for electricity that tends to be used for commercial and industrial purposes, Lesotho energy intensity of GDP is lower than those for South Africa, Zambia and Zimbabwe, suggesting that Lesotho produces its GDP US\$ more efficiently than those countries.



Source: RERA<sup>9</sup>

**Figure 19 Energy per capita of Lesotho**

In spite of this result, it will be prudent to keep appropriate data (both energy and GDP figures) that will provide more reliable efficiency levels on this indicator of energy intensity of GDP.

### 2.2.3 Energy Efficiency Measures

Energy efficiency measures being promoted focus mainly on efficient operations , efficient equipment and efficient building design.

Implementation of efficient buildings measures in rural and peri-urban areas has been hampered by the existence of an informal property market where there are no regulations governing building plans and construction, lack of enforcement of building regulations in urban areas, extra costs that are associated

<sup>8</sup> 2008 figures

<sup>9</sup> ibid



with some energy conservation measures, and the absence of established property developers (Lesotho National Communication, 2000).

Also for the household sector, research by ATS indicated that fuel savings stood at 30% for the retained heat cooker, 60% for the stone paola, and 22% for the metal stove. However adaptation of these technologies has been low due to reasons, which include design and cultural problems, and failure to appreciate the need to save energy, particularly in rural areas where biomass is freely available (Lesotho National Communication, 2000).

## 2.3 Renewable Energy vis-à-vis goal of SE4ALL

### 2.3.1 Overview Assessment

Renewable energy resources of Lesotho include wood fuel (if used sustainably), solar energy, wind and hydro. The total installed capacity of new and renewable energy sources (wind, solar, modern biomass etc) is currently insignificant compared to hydro capacity. Solar energy is however used extensively in telecommunications industry, for water pumping, in the 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<sup>10</sup>), the Africa Adaptation Programme (AAP), those projects implemented by the Local Government, and in the agriculture and health sectors.

### 2.3.2 On-grid and off-grid renewable energy

Potential grid and off-grid renewable energy resources in Lesotho include hydro power, solar and wind energy. Biomass can also be considered where the material can be transformed to produce electricity either through direct combustion or via biogas.

#### **Hydro and pumped Storage**

Lesotho has a very high hydroelectricity potential which has been assessed at over 22 sites with an estimated total potential of over 14 000 MW. This potential is categorized as 4 large-hydro sites (313 MW, and over 1500 GWh/annum) and 18 small-hydro potential with a total of almost 13 900 MW. In addition, Lesotho also has pumped storage potential of over 4000 MW made up of 1000 MW at Monotsa on the Pitseng River and at least 1000 MW at four other sites, and 2400 MW at the LHWP Phase 2 at Katse Dam.

To date the 72 MW Muela Hydro Power Station which was commissioned in 1998 by the LHWP is the only commercial large-hydro power installation in Lesotho.

#### **Solar**

Lesotho has a high solar energy potential with some of the highest annual solar radiation globally. The mean annual daily solar radiation of Lesotho is estimated at 5.4 kWh (19.44 MJ) per square metre, showing great potential for solar water heating, solar photovoltaic and crop drying. The National University of Lesotho (NUL) is working on generating solar irradiation data for assessing key performance indices and characterizing solar PV systems for rural areas.

Solar PV contribution to the energy mix is currently less than 1% and there are no grid connected solar PV projects yet.

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<sup>10</sup> 84% of LREBRE funding is from government

## **Wind**

Lesotho is one of the top four Southern African countries with good wind potential. Although the total wind potential is still to be evaluated, wind speeds average 3.5m/s with maximums as much as 25m/s. Wind regimes have been characterized at 3 sites (Letseng-la-Terai, Sani and Masitise) at heights of 30 – 50 metres above ground. The objective is to erect wind farms at the sites for power generation. Wind profile studies to produce a national wind map are also being undertaken and the AAP and the Lesotho Highlands Power Project (LHPP)s will contribute to this effort.

### **2.3.3 Use of renewable energy sources (RES) for thermal applications**

Other than fuelwood, there is very low utilisation of other renewable energy resources for cooking and heating. Utilisation of other renewable energy sources for these applications currently is below 1% compared to fuelwood, which is used by over 95% of the households for space heating for by 53% of the households for cooking.

### **2.3.4 Use of RES for productive activities**

Besides hydro-electricity, there is very low utilisation of other forms of RES for productive use in Lesotho at small scale level apart from use in telecommunications and public institutions but data are not readily available.

## **2.4 Consolidated Summary: problem statements with regard to energy access, energy efficiency and renewable energy**

### **Energy Access**

There is old data to provide more up to date levels of access to modern energy services particularly for thermal applications and productive uses. There are discrepancies between the available statistics on electricity access and energy utilisation for domestic applications such as lighting, space heating and cooking, which point to low utilisation of electricity for such applications.

There are still low levels of electricity access by rural households at 6%. Over 95% of rural households in Lesotho predominantly use other less modern form of energy such as paraffin and candles for lighting, fuelwood, dung, coal and paraffin for space heating and fuelwood, LPG, paraffin and dung for cooking even though they would prefer to use modern forms of energy such as electricity.

Electricity is largely used for lighting and while all households connected to the grid are expected to use electricity for lighting, no data are available for those that use electricity for cooking.

There is a strong bias on the energy access between urban and rural households, with more urban households having access to cleaner form of energy and significantly more rural households using less cleaner forms of energy

The electricity supply-demand deficit also limits extent of use in the country's social and economic services and incurs an import bill.

### **Energy efficiency**

The energy intensity of GDP for Lesotho will require verification considering that the country seems to be producing its GDP more efficiently than other regional countries.

Although there is a realization of the benefit of energy efficiency, the country does not have an energy efficiency strategy and coordinated programme. The Government of Lesotho has no comprehensive Energy Efficiency and Conservation program, though it recognises its importance and is alluded to in the draft Energy Policy.

The opportunities for EE that are being pursued ( that include information dissemination on EE for the residential and transport sector by the Department of Energy; development of EE guidelines for industry, commercial and residential sectors by LEA, power factor correction by LEC, dissemination of residential and institutional energy) need to be adopted at policy and strategy level.

### **Renewable energy**

Though all the electricity consumed in Lesotho is hydro based, there is still very low (<1%) utilisation of other renewable forms of energy in Lesotho. Utilisation of solar PV is below 1% and there is virtually no wind energy utilisation at the present moment. The government of Lesotho however is implementing a GEF supported Renewable Energy-Based Rural Electrification (LREBRE) project, which will result in the installation of 5000 solar lighting systems in Lesotho. The country's wind potential is also very favourable and 3 wind sites have been characterised with the objective to set up a wind farm.

The large hydro potential estimated at 14000MW<sup>11</sup> remain largely untapped and only 72MW capacity is operational.

In spite of the low utilisation of other renewable energy forms, Lesotho has a number of planned projects, which may drastically increase the contribution of Renewable Energy in the energy mix if they are fully realised. However their success depends largely on the availability of a regional market for the produced electricity and to attract funding.

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## **2.5 SE4ALL Goals**

As part of this SE4All Gap Analysis countries are expected to indicate their targets towards the three SE4ALL goals of Universal Access to modern energy services, energy efficiency and renewable energy. Lesotho so far has explicit target to increase its access to electricity of 35% of total households in 2015 and 40% in 2020. Currently there are no specific targets for energy efficiency and renewable energy goals. In the case of renewable energy, the target is already met as Lesotho is 100% hydropower and planned projects will still be renewable energy. Explicit targets will be required for access to modern energy services for thermal applications and energy efficiency.

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<sup>11</sup>The estimated potential of 14000 MW should be investigated because Lesotho cannot have that kind of capacity (as a result of amount of water existing in the country. This figure requires further assessment.

## SECTION 3: CHALLENGES AND OPPORTUNITIES FOR ACHIEVING SE4ALL GOALS

### 3.1 Institutional and policy framework

#### 3.1.1 Overview Policy Framework

Lesotho has developed a Poverty Reduction Strategy (PRS): National Strategic Development Plan 2012/13–2016/17. The documents fully recognize energy as a key driver to poverty reduction and economic development. The documents highlight the need to revamp the electricity distribution network to increase its safety and reliability in order to expand services to household and key development sectors such as mines. The documents seeks to mobilize fund for the exploitation of hydro power pump storage, wind and solar. The Plan also seeks to step-up the promotion of energy conservation, use of bio-fuels and to develop a long term strategy for improving national energy security.

#### 3.1.2 Energy governance

The Ministry of Natural Resources through the Department of Energy is responsible for the overall administration and coordination of energy in Lesotho. Other institutions and facilities responsible for various aspects of energy in Lesotho through the overall coordination of the Department of Energy include the Petroleum Fund (PF), Lesotho Electricity Company (LEC), Lesotho Electricity Authority (LEA), Appropriate Technology Services (ATS), Lesotho Electrification Unit (LEU), National Rural Electrification Fund (NREF) to be established, Lesotho Electricity Generation Authority (LEGA), NGOs and associations such as the Lesotho Solar Energy Society (LESES). The responsibilities of the major institutions are summarized in Table 5:

**Table 5 Energy institutions and their roles for Lesotho**

Department of Energy:-	Policy, Plans, Strategy, Programs formulation, enforcement and information dissemination.
Petroleum Fund (PF):-	Funding viable energy projects and research and development in the petroleum sector.
Lesotho Electricity Authority (LEA):-	Electricity Sector Regulation
Lesotho Electricity Generation Authority (LEGA):	Development and management of electricity generation projects to supply Lesotho and the region with electricity
Lesotho Electricity Company (LEC):-	Electricity transmission, distribution and supply in urban and financially viable areas of the country.
Lesotho Electrification Unit (LEU),	Build operate and Transfer of electricity transmission, distribution and supply network and management of NREF
National Rural electrification Fund (NREF),	Rural electrification –NREF is still at concept level.
Ministry of Forestry and Land Reclamation	for Afforestation programmes
Appropriate Technology Services	Technology development

Other institutions directly related to energy include Forestry and Land Reclamation and the Appropriate Technology Services (ATS). There is however no institutional support for promoting alternative energy fuels such as LPG and the efficient use of biomass. This function has been left with the private sector and NGOs.

## Thermal energy for households:

- *Relevant targets, policies, strategies, plans*  
Besides these there are no national targets or plans for increasing the uptake of energy sources that can be used for thermal applications at household level such as LPG. In addition, there are also no national targets for the promotion of energy efficient biomass cooking devices at household level. . LPG and efficient cooking devices are expected to play a significant role in providing modern thermal energy services for households.
- *National institutions/capacities (mandate/capacities of relevant governmental institutions and market regulators, fuel tariffs, specifically for households)*  
Institutions responsible for household energy include DOE for policy formulation, Ministry of Forestry and Land Reclamation for Afforestation, Appropriate Technology Services (ATS) for technology development and Petroleum Fund for funding petroleum related energy and other energy forms. Electricity for households connected to the national grid is supplied by LEC and regulated by LEA. The LEA also sets electricity tariffs for the domestic sector. The Government of Lesotho also established the Lesotho Electrification Unit (LEU) within the Department of Energy as part of its directive to increase rural access to electricity and expand the use of PV in rural electrification. The LEU currently would require additional capacity to fully implement its mandate. Institutions such as LEA and LEU have inadequate capacity for them to fully implement their mandate.

The price of paraffin is set by the PF and the price of LPG is left to the private sector. Key challenges are the price regulation for commercial fuels as well as quality control on technology and imported fuels.

## Power sector:

- *Relevant targets, policies, strategies, plans*

The National Strategic Development Plan 2012/13 to 2016/17, and the Generation Master Plan 2010-2011 are the most comprehensive plans to date which outline the potential for the development for power generation in Lesotho. The plan mention Lesotho's established potential for 6,000 MW of wind power, 4,000 MW of pumped storage hydropower and 80 MW of conventional hydropower, which would require resource mobilisation for development.

A long term strategy for improving national energy security is to be developed under this National Strategic development Plan.

- *National Institutions/capacities (Ministry of Energy/Power, existence/capacity/mandate of market regulator for power sector, market structure in power sector, power tariffs)*

The national institutions responsible for the power sector in Lesotho are the Ministry responsible for energy affairs, Department of Energy, Lesotho Electricity Company (LEC), Lesotho Electricity Authority (LEA), Lesotho Electrification Unit (LEU), National Rural Electrification Fund (NREF) and Lesotho Electricity Generation Authority (LEGA). With regards to LEGA, an ACT of parliament is still to be passed, which will stipulate its mandate. The NREF is still a concept and has not yet been fully established.

The Lesotho Ministry of Natural Resources is responsible for providing the overall vision and political direction of the energy sector. The Department of Energy acts as the technical arm of the Government on energy matters that include policy and strategy formulation and coordination of energy sector activities.

The power sector is divided into institutions responsible for Power Generation, Transmission, Distribution, supply and Regulation. The Lesotho Electricity Authority (LEA) is responsible for regulating the sector by issuing licenses and setting the electricity tariffs. Electricity generation has

been mandated to the Lesotho Electricity Generation Authority (LEGA), and organization that was set up in 2011. The development of transmission, distribution and supply infrastructure is done by the Lesotho Electrification Unit (LEU), which also manages the National Rural Electrification Fund (NREF). The Lesotho Electricity Company (LEC) is responsible for the management of the transmission, distribution and supply infrastructure. Most of these institutions will require additional capacity to fully implement their mandate.

### Modern energy for productive sectors:

- *Relevant targets, policies, strategies, plans*

There is a general acknowledgement in the National Strategic Development Plan 2012/13–2016/17 of the importance of enhancing Lesotho’s electricity generation capacity so as to cater for the energy needs of the productive sector, specifically for the mines that are currently not connected to the national grid. The draft energy policy also highlights the important role played by energy in job creation and establishing Lesotho’s economic competitiveness.

- *Institutions/capacities*

Energy supply for the productive sector is mostly in the hands of private companies except for the electricity supply which is administered by institutions that have been mentioned in the preceding section. The petroleum sector is mostly run by multinational petroleum companies but is regulated by the Petroleum Fund, which set the wholesale and retail prices for petroleum products. The government is planning to set-up a state owned Oil Company, the Lesotho State Oil Company (LESOC), which will develop 60 day strategic fuel reserves.

### National monitoring framework for SE4ALL:

The proposed monitoring framework for SE4ALL in Lesotho is summarized below (Table 6)

**Table 6 Matrix of indicators for monitoring and evaluation**

Needs	Thermal Applications	Power	Productive Uses
<b>Energy Access</b>	No of efficient appliances in use at household and institutional level	National/urban, rural electricity access %	No of SMEs and agricultural enterprises having access to electricity, other fuels for productive uses
	Types and consumption per household/per capita and per institution	Grid connected, minigrid and off grid connections access %	Grid, minigrid and off-grid systems and types for productive uses
	Perception on convenience of energy services	Per capita consumption KWh/capita	Increase in productivity
<b>Energy Efficiency</b>	Fuel/energy savings due to use of efficient appliances e.g. fuelwood	Energy savings achieved %	Comparative energy savings with old/traditional systems
	Perceptions on quality of energy service	Energy/GDP	Energy/GDP by sector
<b>Renewable Energy</b>	Types and quantities of RE energy sources in use for thermal purpose e.g.	Capacity installed for electricity of solar, wind, biomass/biogas etc.	Systems and types in use for productive use
	Number of SWH installed for households	Number of PV systems disseminated for HH, institutions, businesses etc.	

## 3.2 Programs and Financing

This section provides an overview of on-going/planned programs, but further details such as project titles, financing and partners are provided in Annex 1. The section is divided into three sections, which focus on matters related to thermal energy, the power sector and the modern energy for productive use. Thermal energy issues discussed under this section relate to the programs and financing, demand side issues and the programs aimed at promoting environmental sustainability. Issues discussed under the power sector relate to physical access, availability (i.e. capacity), reliability and sustainability of investment in renewable energy, off-grid electrification and energy efficiency.

### 3.2.1 Thermal energy

Programs to encourage the manufacture of energy efficient wood stoves in Lesotho have been pioneered mostly by NGOs such as ProBEC, FAO and the DHL. ProBEC and FAO helped to construct institutional stoves in Lesotho and DHL intended to distribute 10000 ready-made household stoves by 2012.

ProBEC was one of the main projects that promoted energy efficient stoves in the region in the last decade but the continuance of the program objectives is now doubtful after the ProBEC program came to an end in 2010.

- *Demand: financial support schemes to improve affordability of modern energy for end-users, as well as build their knowledge and capacity*

The Government of Lesotho subsidizes paraffin to make it more affordable for the poor by removing VAT, levy and duty on the price of paraffin. To encourage adoption of renewable energy Government is also subsidising solar PV equipment through the Renewable Energy Based Rural Electrification program.

- *Sustainability: programs aimed at improving environmental sustainability of energy supply for cooking, such as forest plantation and sustainable charcoal production*

The sustainability of the stoves program is now doubtful after the pulling out of ProBEC from the region. Also the sustainability of other RE programs for the domestic sector e.g. solar cookers and biogas in Lesotho is doubtful since most programs are run by NGOs with donor support that is short term.

However the financial support for fuels such as paraffin is sustainable since this is financed by the petroleum fund and through tax exemptions although the consumption levels are still low compared to other petroleum fuels.

### 3.2.2 Power sector: programs and financing to improve access, efficiency and use of RES for power supply

#### *Physical access a(electrification)*

Lesotho has set a target of 40% electricity access by 2020 in its Vision 2020. The National Strategic Development Plan 2012/13 – 2016/17 layout three strategic goals of 1) Increasing clean energy production capacity to attain self-sufficiency and export, 2) Expanding electricity access to industry, commercial centres, households and other institutions and 3) Increasing energy conservation, security and distribution efficiency of alternative sources and specific objectives related to sustainable energy under each of these goals are to:-

- Evaluate renewable power generation options and negotiate financing arrangements to expand national generation capacity

- Develop small-scale electricity generation models that are viable for communities, where connection to the national power grid is not cost effective
- Maintain the existing power generation infrastructure.
- Extend transmission and distribution networks and increase connectivity rates through community initiatives and by reviewing the tariff policy and terms for connections
- Evaluate the rural electrification programme for technical and cost efficiency and implement recommendations
- Raise awareness and promote use of energy efficient technology
- Develop and disseminate guidelines for specific industries and types of firms to increase energy conservation/efficiency
- Promote appropriate technology for bio-fuel use
- Undertake research to assess market and distribution efficiency of other sources of energy
- Promote research in solar and other potential niche energy markets

Since 2007, Lesotho has been implementing a 5 year GEF supported Renewable Energy Based Rural Electrification project, which is scheduled for completion in the year 2012. The project sought to develop a market based renewable energy solution through the development of an enabling environment by removal institutional, information, know-how, policy and financial barriers inhibiting the wide-spread of renewable energy systems in rural areas.

The 2007 draft National Electrification Master Plan (NEMP) estimated that around US\$410 million is required to meet government's target of 40% electrification level by 2020. The Government cannot finance this from the national budget alone and has identified other sources of financing. LEA has established a fund whose main objective is to subsidize costs for electricity service connection for domestic consumers. The fund initial was called the Universal Access Fund but is now called Rural Electrification fund, which is funded through a levy to the customer of M0.015/kWh for large customers and M0.03/kWh for other consumers, in addition to the Government fiscus and donor support. LEA is also financed through a customer levy (@M0.0196/kWh).

### *Availability (new capacity)*

The gap between the peak demand and electricity supply has widened over the years resulting in supply deficit mostly due to industrial development and increase in number of customers connected to the grid. The increase in demand has not been matched by corresponding investment in generation and transmission infrastructure leading to widening supply deficit. To cover this supply deficit, Lesotho is planning the projects listed in Table 7 below, whose success is also dependent on the availability of a local and regional market to take up the excess electricity to be created by these projects.

**Table 7. Planned power generation projects in Lesotho**

PROJECT	YEAR OF IMPLEMENTATION
CSP in Ha-Ramarothole 2MW	2012
Mants'onyane Mini-power Plant Rehabilitation 2MW	2013
Netgroup Wind Farm 35 MW	2014
280kW Airport Project Solar PV	2014
Waste to Power 47MW	2014
LHPP Wind Farm Phase 1 150 MW	2015
LHPP Wind Farm Phase 2 400 MW	2017
Kobong Pumped Storage 1200MW <sup>12</sup>	2017
Kobong Transmission Line 400kV	2017
LHPP Pumped Storage 4000 MW	2025

<sup>12</sup>Project managed to be included in the South African Integrated Resource Plan



### **Reliability (grid maintenance/upgrade)**

Lesotho has set up the Lesotho Electrification Unit (LEU) whose mandate is to expand the national grid. There is also a strong realisation in the National Strategic Development Plan 2012/13–2016/17 for the need to improve the reliability of the national grid for it to be able to cope with new and existing customers. However this is dependent on the availability of finance to implement these programs.

### **Sustainability (investment in renewable energy, on-grid and off grid, and energy efficiency)**

Sustainability of investment on grid RE projects in Lesotho is heavily dependent on the availability of both a local and regional market for the produced electricity. For off grid solutions however, these are dependent on continued donor support and government subsidies, which two options are not sustainable.

In addition off-grid solar PV systems are based on the assumption that rural communities that are not connected to the national grid need alternative energy sources to displace fuelwood and that they are cleaner and more environmentally friendly. Unfortunately renewable energy cannot supply all the energy needs such as water heating, space heating, cooking and productive use. This therefore limits its contribution to sustainable livelihoods. Renewable energy therefore meets some basic household needs and creates a technology market without empowering the market to pay.

## **3.2.3 Modern energy for productive use**

Currently the renewable energy programs being implemented for households cannot meet the energy needs for productive

## **3.3 Private Investment and Enabling Business Environment**

### **3.3.1 Incentives**

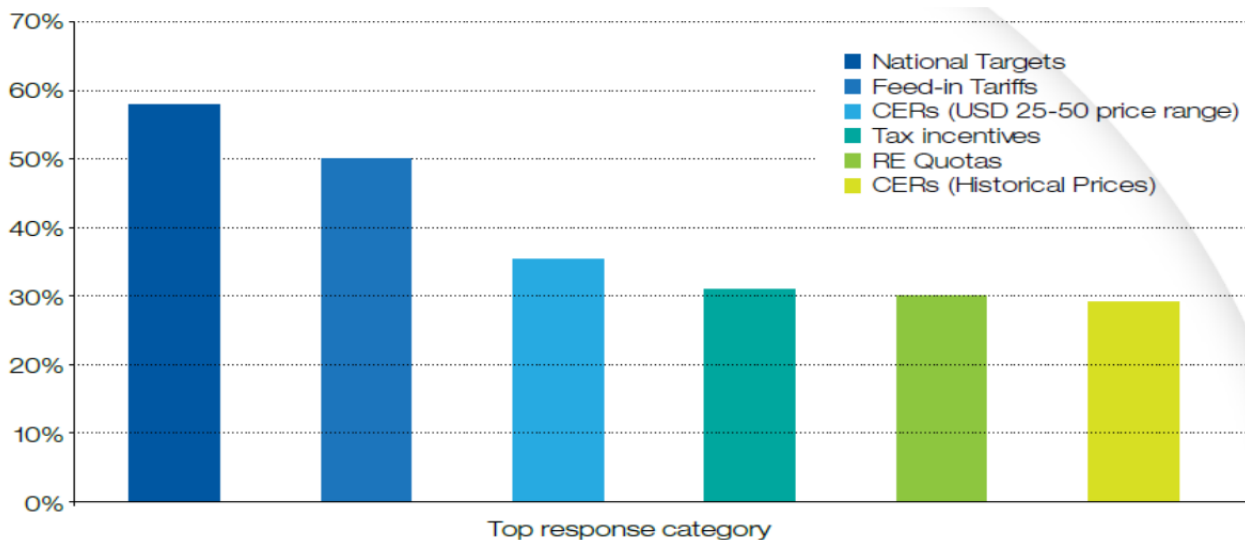
Lesotho has put in place incentives that are meant to attract investment and these include the following<sup>13</sup>:-

- 0% corporate tax on manufacturing profit generated from exporting manufactured goods outside of the Southern African Customs Union (SACU).
- A maximum manufacturing corporate tax rate of 10% on profits for intra-SACU trade.
- No withholding tax on dividends distributed by manufacturing firms to local or foreign shareholders.
- No advanced corporation taxes are paid by companies on the distribution of manufacturing profits.
- Training costs are allowable at 125% for tax purposes.
- Payments made in respect of external management skills and royalties related to manufacturing operations are subject to withholding tax of 10%.
- Easy repatriation of manufacturing profits.
- A VAT rate of 14% (ensuring harmonization with the RSA). Furthermore, the Lesotho Revenue Authority has introduced flexible VAT payment systems, to tax compliant firms, to ease cash flows.

For energy specific policies and incentives that are meant to promote investment in the energy sector, the graph in figure 20 shows that mechanism that private finance investors consider to be most important. According to the figure, two types of public intervention are considered to be “most powerful” in unlocking private investment and finance for renewable energy in developing countries: i.e. the establishment of clear national targets for renewable energy generation and the introduction of feed-in tariffs (UNEP, 2012).

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<sup>13</sup>Lesotho National Development Corporation



Source: UNEP, 2012<sup>14</sup>

**Figure 20: The most powerful incentive mechanisms for renewable energy deployment in developing countries, according to private finance practitioners**

Targets are considered key as they provide the backbone of any country's overall energy strategy and the framework within which incentive mechanisms, such as feed-in tariffs or quotas, are placed. Clear targets and a formulated government vision provide certainty to private sector actors and make subsequent public incentive instruments more reliable and trustworthy from the perspective of financiers (UNEP, 2012).

In spite of the aforementioned investment incentives that have been formulated by Lesotho, the country is still lagging behind on the key incentives essential for investment in energy i.e. clearly formulated policy targets and incentives such as the REFIT.

### 3.3.1 Barriers<sup>15</sup>

The main barriers that were identified to hamper the large-scale utilisation of RETs in Lesotho can be classified into four categories as follows:--

1. Institutional
  - Lack of an effective infrastructure for RET services on a sustainable basis
  - Fragmented institutional responsibilities and lack of integrated planning
2. Economic, commercial and market
  - Small potential market
  - Limited private sector capacity for supply, distribution, installation and maintenance of RETs
  - Limited business skills
  - Lack of suitable financing arrangements for renewable energy companies and end users
  - Low income levels of rural population to afford modern energy services
3. Technical and information
  - Poor workmanship in the installation, operation and maintenance of RETs
  - Limited skilled manpower for build, operate and maintain particularly RE facilities.
  - Inaccessibility of the rural population to service centres and towns
4. Education and training
  - Lack of access to necessary information
  - Lack of public awareness of the technologies
  - Low retention of trained manpower
  - Insufficient qualified personnel for maintenance for renewable energy systems

<sup>14</sup>Financing renewable energy in developing countries, Drivers and barriers for private finance in sub-Saharan Africa, UNEP. February 2012.

<sup>15</sup> Renewable Energy Technologies In Southern Africa, A Guide For Investors, September 1999

### 3.4 Gaps

The absence of an approved policy and strategy has been cited as the major problems for energy access, renewable energy and energy efficiency promotion. In addition, mechanisms for stakeholder consultations are not often used. For instance, stakeholders at university felt that they were not involved in policy formulation. As with other SADC countries, technical expertise and experienced personnel are not always available.

Data availability is also another significant barrier to the proper analysis of the energy sector. Though statistics on the quantities of petroleum products imported into Lesotho are available, data on the final energy and cost of energy imported into the country are missing. This is mainly because the importation of petroleum products has been left in the hands of the private sector.

In addition, Lesotho, like most SADC countries has set-up a strong institutional and legal framework for the electricity sector to the exclusion of other sectors.

The theft and vandalism of PV panels and equipment from rooftops is another barrier, which is impacting on the performance of the PV market. Theft of large installations discourages institutions from investing in solar and also distorts the market as the stolen panels end up on the market.

#### Summary: key gaps, barriers and additional requirements

The key barriers to sustainable energy for all in Lesotho are:-

##### General

- Weak Policy and Legal framework as evidenced by the absence of an approved policy and strategy for energy, renewable energy and energy efficiency promotion
- Fragmented institutional and legal framework resulting in inadequate multi-sectoral approach in the country
- Lack of incentives for retentions of skills in key energy organizations

##### Energy access

- Lack of baseline data for proper analysis of the access to modern 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.
- Short term initiatives by donors and NGOs that need to be sustained
- Electricity supply is a limitation to meet the growing demand both in households and industry
- Rural connections limited by restrictive grid extension/maintenance,

##### Energy efficiency

- Lack of energy efficiency strategy and programmes in the country
- 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 community
- Low application of demand-side management (DSM) and energy efficiency measures for modern energy in the productive sectors:

##### Renewable energy

- High capital costs of Renewable Energy
- Low awareness about RETs and access to information on RETs
- 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),
- Certain RETs based services have limited applications e.g. for thermal applications and productive uses.

- Uncertainty on resource potential of hydro potential in the country and required assessment of wind, solar and biomass potential.

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## Annex 1 –Matrix of existing programs and required financing for achievement of SE4ALL goals

### 1.1 On-going initiatives by the Government and development partners

Title	Lead Agency	Financier	Relevant SE4ALL Goal(s) (Access/Efficiency/Renewable Energy)	Brief description and time frame	Value, US\$
Lesotho Renewable Energy-Based Rural Electrification (LREBRE)		Global Environment Facility	Energy Access Renewable Energy	Project aims to reduce energy related CO <sub>2</sub> emissions by promoting renewable energy technologies .It is expected the project will result in the installation of 5000 solar lighting systems in Lesotho.  Time frame 2007- 2012	
Kobong Pumped Storage (1200 MW)			Renewable Energy	2017	
Netgroup Wind Farm (25 MW)			Renewable Energy	2013	
Waste to Power (47 MW)			Renewable Energy	2014	
Wind Farm (600 MW)			Renewable Energy	2016	
Poloko Multipurpose Dam (200-500 MW)			Renewable Energy	2019	
Ramarothole Solar Plant (10 MW)			Renewable Energy	2019	
LHPP Wind Farm (6000 MW)			Renewable Energy	2025	
LHPP Pumped Storage (4000 MW)			Renewable Energy	2025	
Renewable Energy Strategy	Department of Energy , Lesotho Meteorological	UNDP	Renewable Energy	2012	

	Services				
Kobong Transmission Line			Energy Access	2017	
Energy Efficiency Program				The program includes information dissemination on EE for residential and transport sectors, development of EE guidelines for industry, commercial and residential sectors, power factor correction and dissemination of residential and energy efficiency stoves	

Priority Area	Programmes	Activities	Progress	Challenges	Support needed	Time lines
1. Develop energy policy and regulation and implementation master plans/strategies.	1. Energy Policy	<ul style="list-style-type: none"> <li>Set up a Policy development teams/committees from stakeholders</li> </ul>	None	<ul style="list-style-type: none"> <li>Lack of an activity/project anchor for the sector</li> </ul>	<p><b>Finance:</b> To support procurement of development teams and international specialists</p>	By end of FY 2012/13
	2. Renewable Energy Policy		Attempt failed in 2011			By end of FY 2012/13
	3. Electrification Policy		None			By end of FY 2012/13
	4. Generation Policy	<ul style="list-style-type: none"> <li>Procure document development teams</li> </ul>	<u>Ongoing:</u> LEC	<ul style="list-style-type: none"> <li>Opportunity cost of not having a policy (forgone financing for projects, technical cooperation, and capacity building...)</li> </ul>		By end of FY 2013/14
	5. Petroleum Policy		None			By end of FY 2013/14
	6. Regulate LP Gas at wholesale level	<ul style="list-style-type: none"> <li>Procure international specialists to aid teams</li> <li>Develop documents</li> </ul>	None	<ul style="list-style-type: none"> <li>Welfare loss by energy end-users</li> </ul>		By end of FY 2012/13
	7. Phase out Lead Replacement Petrol (LRP)		None			By end of FY 2013/14
	8. Introduce fair pricing to farmers, mining entities and independent power producers by eliminating Road Maintenance Levy		None	<ul style="list-style-type: none"> <li>Revenue loss by the government</li> <li>Lack of sector coordination</li> <li>High initial costs (affordability).</li> <li>Unsustainable use of biomass (woodfuel)</li> <li>Lack of awareness on</li> </ul>		By end of FY 2013/14
	9. Regulate quality and quantity of coal imports	None	By end of FY 2012/13			
	10. Ban IP flame stoves and promote safe and less	None	By end of FY 2013/14			



	polluting IP stoves			energy efficient technologies		
	11. Eliminate VAT on LP Gas		None	<ul style="list-style-type: none"> <li>Low rate of electrification</li> </ul>		By end of FY 2013/14

Priority Area	Programmes	Activities	Progress	Challenges	Support needed	Time lines
2. To ensure energy security of supply.	Implement electricity generation projects	Implement solar power projects	<u>Ongoing: LEGA</u> - Moshoeshoe 1 Airport - Ramarothole			
		Implement wind power projects	<u>Ongoing: LEGA</u> - Breeze Power - Powernet			
	Support tree-planting projects for wood fuel	Support the MFLR Afforestation projects	<u>Ongoing: DOE</u> - MFLR	Uncontrolled, unsustainable overharvesting of wood	None	Annual activities
	Operate the Lesotho State Oil Company	Procure and store 90 days worth of fuel Develop strategies to secure and to equitably supply LPG as and Paraffin by introducing smaller cylinders Enhance availability of IP at fair and affordable prices to the rural especially during cold seasons e.g. No upward adjustment of IP from April to September;	<u>Ongoing: DOE</u> -LESOC	None	Initial budget: (Awarded M15million in 2012/13)	By end of FY 2012/13
4. Encourage energy efficiency (minimise energy wastage).	Encourage use of solar technology	Street lighting projects	<u>Ongoing: DOE-LEU</u>	Lengthy procurement processes	None	By end of FY 2012/13
		Water heater projects (in new houses and institutional buildings)	None	Inadequate knowledge and therefore non-prioritisation	Concise policy stance	To be determined

	Encourage use of energy saving technology	Phase out bar heaters and promote oil heaters	None			To be determined
		Phase out and Replace incandescent bulbs and promote energy saving bulbs	None			By end of FY 2013/14
	Energy Auditing	Undertake energy Audits	None		<ul style="list-style-type: none"> <li>•Human capacity development</li> <li>•Procurement of tools and accessories</li> </ul>	By end of FY 2012/13

**1.2 An estimate and order of magnitude, if available, of the costs and investment requirements for making progress on the three goals of SE4ALL. It is understood that these are only rough estimates and using available data. A more detailed analysis would follow during the phase of preparation of the Action Plan for SE4ALL**

**Annex 2 - Initiating a Sustainable Energy for All initiative in Countries: Some suggested steps**

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- **RC – as convener and facilitator of the SE4ALL initiative in the country makes initial contact with Government authorities to ascertain interest and commitment to engage**
- **Decision to engage on the SE4ALL initiative as an instrument/platform for ramping up action in selected energy areas of interest for the country and with a view to achieving universal energy access for all by 2030 is received by Government**
- **Decision to undertake assessment and analysis to mobilize action at country level (Rapid Assessment/ Gap Analysis) and design of process to undertake them – with expert support (national or international) with an all inclusive approach and in consultation with stakeholders to ensure proper feedback, adequate coverage of data, and proper buy-in from the start**
- **Designation of national focal point/institution to lead the process and to coordinate with relevant ministries and stakeholders including private sector and civil society**
- **With the support of the UN Resident Coordinator office or other support under SE4ALL if and when necessary, organization of stakeholder consultations with key stakeholders in each of the key potential partners (private sector, donor community, civil society) to enrich process mentioned immediately above while Rapid Assessment is being prepared**
- **Finalization of Draft Rapid Assessment and presentation to large stakeholder consultation**
- **Finalization of Rapid Assessment taking into account the inputs from the stakeholder consultation**
- **Presentation of report to institutions made responsible to act as focal point for SE4ALL in the country with the facilitation of the Resident Coordinator**
- **Plan of Implementation with detailed prospective partners and roles (EU, US, WB, Regional Development Banks, E+ of Norway, UNDP, UNIDO, others)**

### Annex 3 Budget Allocations for Energy

Source of Budget Finance	Budgeted Amount (Maloti)	% allocated to Ministry of Natural Resources	% for Ministry of Natural Resources	% Allocated for Energy Projects
GOL	2,110,861,300	41%		1%
Donor Grants	2,183,153,199	43%		0.27%
Donor Loans	812,079,051	16%		44%
	5,106,093,550		24%	7%

Source: Ministry of Finance

Project	Financier	2010/2011	2011/2012	2012/2013	2013/2014
Rural Electrification	GOL		10,000,000	10,000,000	
Capacity Building in Electricity & Water	GOL				
Electricity Access Pilot Project	GOL	12,349,000	5,000,000	5,000,000	
Rural Electrification	GOL		10,000,000	33,652,432	37,017,675
Lesotho Electricity Supply Project	LEC		8,000,000		
Lesotho Electricity Supply Project	ADF		325,000,000		
Lesotho Electricity Supply Project	IDA	50,000,000			
Renewable Energy Rural Electrification	GEF		6,000,000	6,000,000	
Renewable Energy Rural Electrification	GOL	14,000,000	6,000,000	5,000,000	
Total	GOL	102,349,000	359,000,000	70,649,021	59,766,597

Source: Ministry of Finance