



Kingdom of Swaziland

Sustainable Energy for All

Action Agenda

July, 2016

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LIST OF ACRONYMS

AA/IP	Action Agenda and Investment Prospectus
AfDB	African Development Bank
CSO	Central Statistics Office
DSM	Demand-side Management
EE	Energy Efficiency
EU	European Union
FINCORP	Swaziland Development Finance Corporation
FSE&CC	Federation of Swaziland Employers and Chamber of Commerce
GHG	Green-house gases
GTF	Global Tracking Framework
GWh	Gigawatt hour (10^9 watt-hours)
kW	Kilowatt (10^3 watts)
IPP	Independent Power Producer
IRENA	International Renewable Energy Agency
ISO	Independent System Operator/International Standards Organisation
LPG	Liquefied Petroleum Gas
MNRE	Ministry of Natural Resources and Energy
MW	Megawatt (10^6 watts)
NEPAD	New Partnership for Africa's Development
PPP	Public Private Partnership
PV	Photovoltaic
RSSC	Royal Swaziland Sugar Corporation
RRA	Renewables Readiness Assessment
RE	Renewable Energy
REASWA	Renewable Energy Industry Association of Swaziland
RETs	Renewable Energy Technologies
SADC	Southern African Development Community
SAPP	Southern African Power Pool
SE4ALL	Sustainable Energy for All
SEA	Swaziland Environment Authority
SEC	Swaziland Electricity Company (Formerly SEB)
SEF	Swaziland Environment Fund
SERA	Swaziland Energy Regulatory Authority
SIPA	Swaziland Investment Promotion Authority
SWASA	Swaziland Standards Authority
SWSC	Swaziland Water Services Corporation

EXECUTIVE SUMMARY

Country Overview and Energy Outlook

As a young and developing country, energy consumption continues to rise in the Kingdom of Swaziland far outstripping local production. The country's developmental goal of being in the top 10% of the medium human development group of countries founded on sustainable economic development, social justice and political stability by year 2022 is **threatened by energy insecurity** whereby petroleum products are 100% imported and electrical energy is up to 75% imported from Mozambique, South Africa and the Southern African Power Pool (SAPP) members. The electricity sector is still dominated by the state owned Swaziland Electricity Company (SEC) with only one independent power producer (IPP) connected to the grid.

Energy access still remains a challenge with **50% of rural population using solid fuels for cooking** solutions. This has left about 161,913 households affected by household air pollution possibly contributing to scores of death due respiratory complications. Access to electricity is currently being addressed through **grid extension** by SEC with government and donor support. Government occasionally finances off-grid renewable energy projects. Swaziland is on course to reach **universal access of electricity by year 2022** in line with the national Vision 2022. The challenge, however, still remains on attaining the same access to clean cooking solutions.

Hydropower and biomass based co-generation play a significant role in electricity generation in Swaziland. Although the country is postulated to have significant solar and wind resources, the 2015 Renewable Energy Zoning Study does not only **highlight substantial priority areas for wind and solar photovoltaics development** but also points to potential challenges with land use rights in an agricultural dominated economy. The solar and wind energy maps under development will validate the potential. Solar and wind energy could play a significant complementarity role to hydropower and biomass based energy generation which, unfortunately, are **susceptible to risks of climate change**. Rooftop solar PV can be promoted through net-metering and feed-in tariffs while solar water heating has huge potential in the domestic and hospitality and tourism sector.

The **domestic sector** has been the focus of energy efficiency, with awareness and distribution of energy saving bulbs being the main initiatives. In the industrial sector there is scope for energy efficiency with, for example, the existing sugar mills not being optimized for power generation where the boilers are operating at low pressures. Through the newly established Construction Industry Council, there is an opportunity to implement energy efficiency in the built environment through, establishment of ethical standards, practices and procedures. Appliance-and equipment

labelling-and standards are also effective approaches to promoting energy efficiency being considered. There is potential to save **substantial amounts of energy per year in 2030** through the implementation of the Regional Roadmap for “Leapfrogging to Efficient Lighting, Appliances and Equipment in SADC” which will prioritise areas for high impact, rapid deployment and cost-effectiveness such as **lighting, refrigerators, air conditioners, water heaters and distribution transformers**.

Targets by 2030

The following targets have been identified to meet the objectives of SA4ALL:

Energy Access Targets:

- Minimum of 5,000 households connected to the grid electricity per annum to reach 75% access to electricity at household level
- Build a 300 MW coal power plant to enhance security of supply by 2025
- 100% access to electricity at household level attained by 2022
- Effective policies and incentives for improved cook stoves established by end 2017
- Regulatory structures and mechanisms for LPG established by end 2017
- Penetration of improved cook stoves increased by 10% per year from 2020
- Penetration of LPG for cooking increased by 10% per year from 2020
- GIS database for rural energy access developed by 2017
- Rural energy master plan and implementation strategy to attain universal access to energy including LPG, improved cook stoves, SHS and biogas developed by 2018
- 100% access to clean energy at household level attained by 2030

Renewable Energy Targets

- Solar and wind maps developed by 2016
- 30 MW, IPP developed, solar PV power plant on line by 2018
- 20% of all public buildings to have solar water heating by 2020
- 140 MW hydro developed by SEC by 2020
- 130 MW co-generation from bagasse (IPP) by 2020
- 80 MW from wood waste from IPPs (with 30 MW online by 2019)
- 10 % ethanol blending by end of 2016
- 50% renewable energy penetration in the energy mix by 2030

Energy Efficiency Targets

- 60 GWh energy savings per year attained by 2018
- An energy efficiency appliance labelling and standards programme designed and adopted by 2018
- Energy efficiency policy and regulations developed by 2019
- 500,000 LEDs distributed to households by 2020
- 180 GWh energy savings per year attained by 2025

Relevant Nexus Targets

- Update the National Energy Policy by 2016
- Develop a National Integrated Resource Plan by 2016
- Promote solar crop drying, solar and wind water pumping to increase food security
- Promote efficient solar lighting kits to improve on- and enhance education, health and gender security
- Enhance research capability in climate change modelling and adaptation for the energy sector
- Develop standards, codes and frameworks to ensure quality, reliability and safety of energy supply

Priority Action Areas

Electricity will continue to be a major service for energy access and grid extension and off-grid renewable energy technologies will receive greater attention from the government. A **planning framework for approaching rural energisation** is therefore necessary in order to meet the SE4ALL objective of attaining universal access by 2030. Prioritized interventions in energy access include:

- Increasing local electricity generation capacity from indigenous renewable energy sources;
- Promotion of productive use of energy; and
- Access to modern energy for cooking through LPG and improved cook-stoves.

Additional **hydropower and co-generation** from **forestry residue and sugar residue** will substantially increase the dominance of renewable energy in the supply mix and also make Swaziland reach **self-sufficiency** in terms of power supply. Feasibility studies should be undertaken to identify hydropower, biomass, solar and wind energy projects. The prioritized interventions for renewable energy include:

- Developing appropriate policy and regulatory instruments to promote renewable energy;
- Gathering reliable data on renewable energy resources.

The prioritized interventions in energy efficiency include:

- Addressing the **lack of policy** to promote energy efficiency programmes, which could be done through labelling and certification for efficient household appliances.
- Addressing the **lack of awareness** of the benefits of efficient use of energy among the public, private sector investors and financial institutions.
- Adopting energy-efficient refrigerators, efficient lighting, air conditioners and distribution transformers.

The **water-food-energy-health nexus** issues are very critical in Swaziland where women still play a vital role in the growing of food, its harvesting and preparation as well gathering water and firewood. The **Tinkhundla is expected to buttress its integrated and participatory role by mainstreaming topics** that affect mainly women such as access to renewable energy technologies and LPG, climate change and health.

Finally, an effective **coordination capacity and 2 tier structure** is proposed so as to sustain momentum over the SE4ALL implementation span and mainstream the initiative's core objectives in political and business decisions. The Steering Committee and the National Expert Group are proposed to be set-up to ensure the effective coordination of the Action Agenda and its follow up. The Department of Energy Affairs will be the SE4ALL Coordinator/Secretariat for Swaziland.

PREAMBLE

The Action Agenda is prepared jointly with the Investment Prospectus so that there are synergies. It is prepared in a consultative manner as enunciated by national guidelines for drafting public policy:

1. It builds on the Rapid Gap Analysis and Action Plan developed in 2014
2. It supports the government vision that 25 years from the year 1997, the Kingdom of Swaziland will have considerably improved its world standing in terms of measurable indices of human development.
3. It focuses on all priority action areas of energy access, renewable energy, energy efficiency, nexus targets and enabling environment.
4. Addressing energy access is key to the government's developmental aspirations.
5. The Ministry of Natural Resources and Energy shall play a critical role in driving and coordinating the SE4ALL Action Agenda.
6. Efforts are made to bring the Action Agenda to the attention of –and the involvement of development partners.
7. Attention is given to capacity building to design, implement and manage projects prioritized in the Action Agenda.

INTRODUCTION

Swaziland's energy situation and context

Swaziland is a monarch governed by His Majesty King Mswati III, who is also head of state. The three organs of government, as enshrined in the Constitution, are the Executive, a two-tier Legislature and the Judiciary. A participatory, community based political system, the Tinkhundla, governs the electoral process in Swaziland. The Prime Minister is the head of the executive.

Swaziland is bordered by Mozambique and South Africa and occupies a geographical size of 17,360 km². Figure 1, illustrates the geographic map of Swaziland.



Figure 1: Geographic map of Swaziland

Source: WorldAtlas

With a young and growing population of approximately 1.269 million people in 2014 and a gross domestic product (GDP) growth rate of 2% in 2014 according to the World Bank, the Kingdom of Swaziland, is considered a middle-income country. The population is largely rural and agriculture is a significant player in the economy.

Almost 60% of the country's revenue is from the Southern African Customs Union (SACU)¹. The regional bloc's Common Monetary Union dictates the member countries' monetary policy and Swaziland's currency, Swazi lilangeni, exchanges at parity with the South African rand.

Energy supply remains a challenge as Swaziland imports all its petroleum products and about 75% of its electrical energy requirements. Access to clean energy sources still remains about 50% in rural areas. Almost 100% of the electricity supply from internal generation is from hydropower and sugar cane based co-generation.

Swaziland's energy policy strives to promote sustainable economic development, social justice and political stability, by supporting poverty eradication, employment creation, gender equity, social integration and environmental protection in fulfilment of the national development goal. The country's National Development Strategy, formulated in 1997, espouses that "by the year 2022, the Kingdom of Swaziland will be in the top 10% of the medium human development group of countries founded on sustainable economic development, social justice and political stability".

A 2013 review of the National Development Strategy² by the Ministry of Economic Planning and Development (MEPD) revealed that amongst the Strategy's achievements, the rural electrification programme had managed to attain electricity access of about 44.3% of the rural population as well as electrifying all clinics in the country and more than 90% of rural schools. Additionally, the rural electrification programme has stimulated income-generating activities and improved the quality of life of rural dwellers. The Programme was launched to ensure that all parts of the country can access electricity and is continuing with the extension of electricity lines to rural schools, health care facilities, Tinkhundla centres, youth care centres, and densely settled communities around the country with the objective that developmental impacts are spread out ahead of the progress on household connections.

With the global aim of achieving sustainable energy for all by the year 2030 through the three key objectives of: (1) ensuring universal access to modern energy services; (2) doubling the rate of improvements in energy efficiency; and (3) doubling the share of renewable energy in the global energy mix, the Sustainable Energy for All (SE4AL) initiative provides a platform for

¹SACU was formed in 1910 and has as its members; Botswana, Lesotho, Namibia, South Africa and Swaziland

²MEPD. 2013

Swaziland to address energy access, energy efficiency, and renewable energy in an integrated way.

Energy situation and regional context

Swaziland is a member of the Southern African Development Community (SADC), an economic community of 15 countries³ bound by a common vision, of a “**Common Future**, a future within a regional community that will ensure economic well-being, improvement of the standards of living and quality of life, freedom and social justice and peace and security for the people of Southern Africa.” The regional integration agenda is implemented through the Regional Indicative Strategy Development Plan (RISDP) with a 2005 -2025 operating span.

The regional energy sector plans include:

- The SADC Protocol on Energy of 1996, which promotes the harmonious development of national energy policies and matters of common interest for the balanced and equitable development of energy throughout the Region.
- The SADC Regional Energy Access Strategy and Action Plan (2010) that recognises the urgency of improving energy access and set the goal to have halved the number of people without access to energy in their respective territories within 10 years. Strategies to achieve this goal are left to the individual countries to formulate using the ideas in the regional plan.
- The Regional Infrastructure Development Master Plan Energy Sector Plan of 2012 which guides the implementation of “hard” infrastructure (electricity generation plants, transmission lines, etc.) and “soft” interventions (policies/strategies and regulatory frameworks, institutional frameworks and capacity building, financing, etc.).

The following regional energy deficiencies and challenges are highlighted in the Regional Infrastructure Development Master Plan:

- Low (5%) access to electricity in rural areas;
- Severe shortage of bulk electricity since 2007;
- Lack of funding to plug the supply gap;
- Low tariffs, poor project preparation, issues with Power Purchase Agreements, and absent regulatory frameworks stunting investment and financing in the energy sector;
- Weak infrastructure to transport electricity and petroleum and gas products;
- Pricing and infrastructure hurdles such as grid connections, manufacturing, and quality testing that impede development renewable energy; and

³ SADC member states are: Angola, Botswana, Democratic Republic of Congo, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe.

- High carbon footprint emanating from over reliance on coal, which supplies 75 % of power generation in the region.

There is a big variation in the tariffs applied across SAPP member countries (Figure 2). The lowest tariffs are in the hydropower dominated countries of the Democratic Republic of Congo (DRC) and Zambia that also have significant share of local generation.

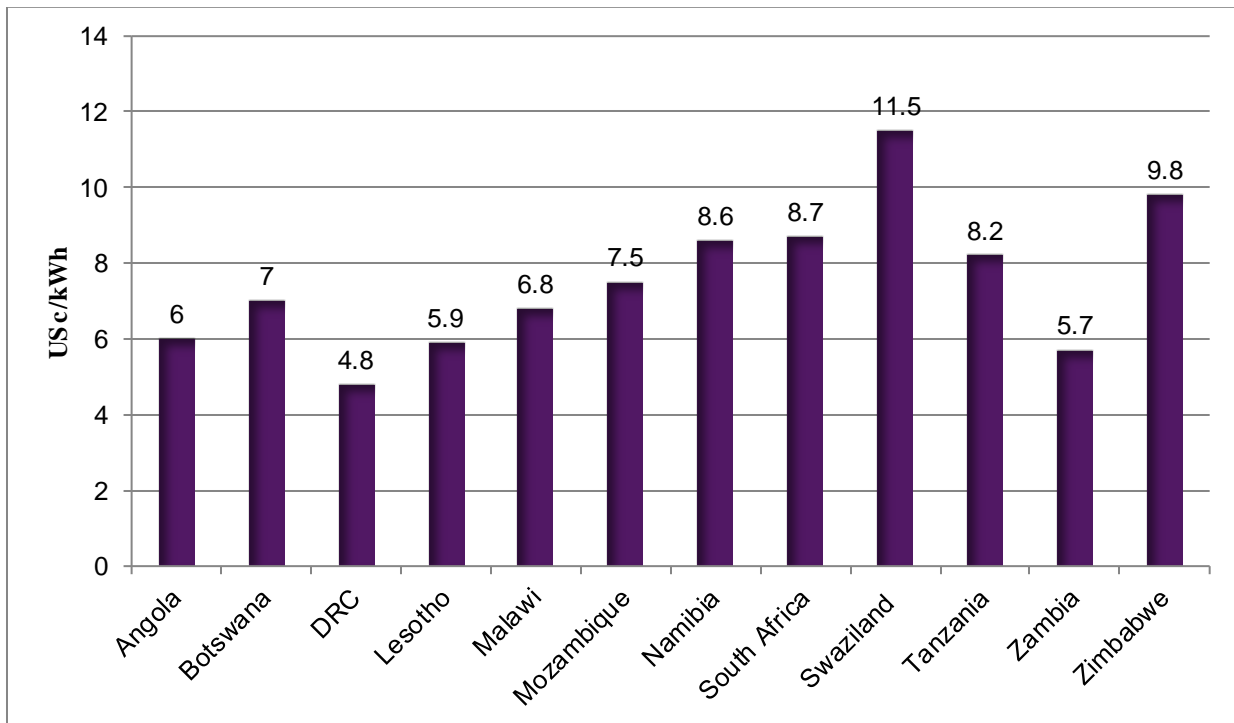


Figure 2: Average electricity tariff in SAPP 2014/15

Source: SAPP 2015 Annual Report

Specific to the electricity supply industry, SADC’s Southern African Power Pool (SAPP) bemoans the following deficiencies that characterise the industry:

- Insufficient generation capacity to meet the growing demand.
- Lack of transmission and distribution infrastructure to deliver electricity to end-users. High transmission and power distribution losses which increase the cost of supply to consumers.
- Limited regional trade of power owing to transmission constraints and particularly along the transmission corridor.

According to the 2009 SAPP Pool Plan, addressing these challenges will require funding in excess of US\$80 billion.

Swaziland is connected to the regional transmission network through Mozambique (400 kV line) and South Africa (132 kV and 400 kV lines) as exhibited in Figure 3.

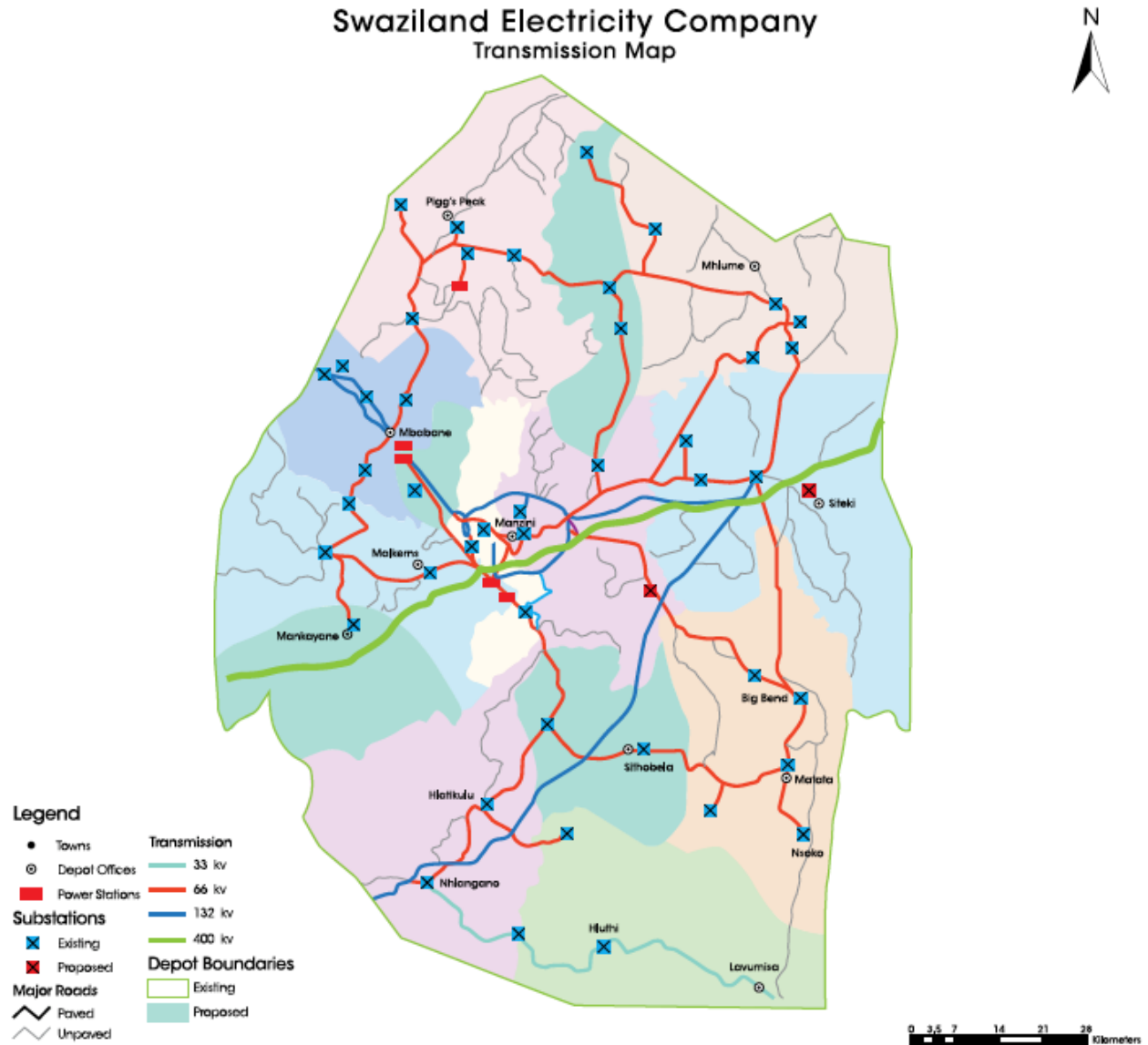


Figure 3: Swaziland national grid network and regional interconnectors

Source: IRENA, 2014

Swaziland energy sector context

Policy:

The Ministry of Natural Resources and Energy (MNRE), according to its Vision Statement, aims “to be the leading agency in creating a conducive environment that promotes the efficient and effective utilization, beneficiation and management of natural resources in the country in order

to enhance sustainable socio-economic development". The National Energy Policy of 2003 is still the guiding document on national policy development.

Regulation:

In the context of energy, the Ministry is assisted by the Swaziland Energy Regulatory Authority (SERA) established in terms of the Energy Regulatory Act, 2007 (Act No. 2 of 2007) ("ER Act"). SERA provide regulatory oversight on all forms of renewable and non-renewable energies and functions mainly by applying electricity industry regulation and regulatory governance. SERA has conducted a number of studies as well as developed codes to assist in executing its mandate, which include; the tariff methodology, grid code, quality of supply service standards and the cost of supply study.

Supply:

Petroleum supply is completely deregulated with private owned, mainly multi-national corporations, responsible for importation and distribution of petroleum products. The retail prices are regulated by MNRE.

Swaziland Electricity Company (SEC), a government wholly owned vertically integrated utility, dominates electricity supply. SEC currently has a monopoly on importation, transmission and distribution, and controls all hydropower generation stations that supply electricity via the national power grid. There are also independent power producers in the biomass co-generation sector with only one producer feeding into the grid through a negotiated power purchase agreement with SEC.

SEC implements rural electrification with the financial support of the government and development partners.

Figure 4, provides a schematic representation of interaction of players and supporting regulatory instruments in the electricity supply industry in Swaziland (Draft Renewable Energy and Independent Power Producer Policy (MNRE, 2015)).

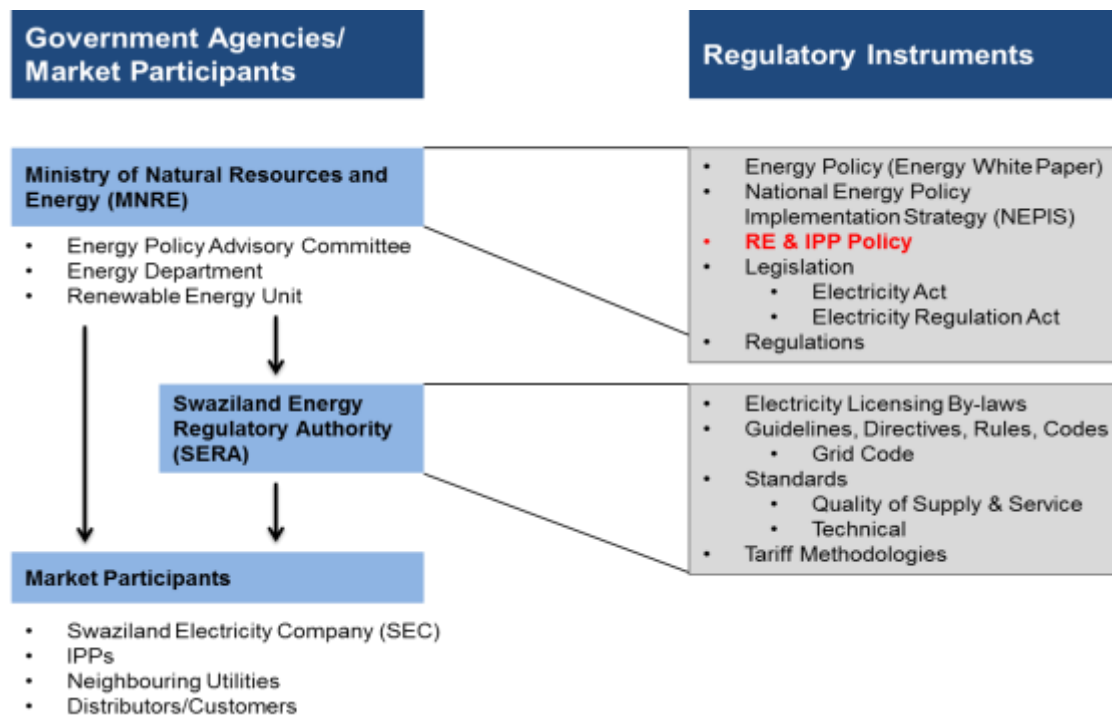


Figure 4: Power sector institutional framework

Source: MNRE, 2015

Energy access:

In order to bridge the development infrastructure gap between urban and rural areas, the government embarked on rural electrification programmes in the mid-1990s. The initial programmes were backed by technical, financial and policy studies conducted in the late 1990s, which identified the institutional framework required for the implementation of the rural electrification programme, including planning for increased power demand. The MNRE started the rural electrification programmes with off-grid and grid extension projects, mostly on pilot basis. Grid extension gained momentum when the then Swaziland Electricity Board, now SEC, joined the programme with technical and manpower support and the programme targeted public, institutions and community facilities for electricity connections.

Introduction to Action Agenda, Investment Prospectus and players involved

The Action Agenda and Investment Prospectus (AA/IP) for SE4ALL in Swaziland is prepared with the support of the United Nations Development Programme (UNDP). The AA is a concise, pragmatic and action oriented umbrella framework for achieving the SE4ALL goals. The IP is a time bound short-to-medium term document that will provide an approach to operationalizing the AA towards achieving SE4ALL goals 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. Independent consultants have been engaged to facilitate both the AA and IP.

Stakeholder consultations

With the guidance of the Department of Energy in MNRE, consultations on the SE4ALL initiative started with the drafting of the Rapid Gap Analysis and Action Plan and were further enhanced during development of the AA/IP. Consultations involved government ministries and their agencies, the private sector including the financial institutions as well as the civic society and communities across the country (see Annex for list of stakeholders consulted). The consultations focused on concerns and expectations with respect to the three objectives of the SE4ALL and were aimed at identifying implementable programs and projects, including their investment requirements. The draft AA/IP was further interrogated through a series of workshops in Mbabane.

The consultative process is in line with Swaziland's national guidelines for drafting public policy documents published in April 2011. The guidelines advise that policy dialogues should be carefully constructed and deliberative meetings held that address both politically controversial and technically complex aspects of the policy issues.

Some of the projects and initiatives identified during consultations for the AA/IP include:

1. Development of the energy-wide integrated resource plan and review of the White Paper on Energy Policy by MNRE.
2. Establishment of the Green Climate Fund by the Ministry of Environment and Tourism.
3. Development and adoption of energy efficiency and green building codes by Ministry of Public Works and Transport, Department of Public Works and key partners.
4. Development of quality standards for renewable energy and energy efficiency through Swaziland Standards Authority.
5. Baseline studies of the feasibility of financing of renewable energy and energy efficiency projects by local financial institutions
6. Development of an investment framework for the energy sector with the support of Swaziland Investment Promotion Authority.
7. Conducting a detailed feasibility study on co-generation.

One of the AA/IP consultation missions to Swaziland coincided with a similar mission by the European Union (EU) Delegation's Technical Support Facility. The Facility is designed to assist Swaziland in refining policies and regulatory frameworks that allow for increased investments in the energy sector.

PART 1: VISION AND TARGETS UNTIL 2030

1.1 Energy sector trajectory

For the purpose of SE4ALL AA, a **baseline year for energy access, renewable energy and energy efficiency targets is chosen as 2013** on the basis of the 2013 Energy Access Household Survey.

The energy sector in Swaziland is growing steadily for all energy resources consumed as indicated in Figure 5. The biggest consumption is recorded in wood & other wastes at between 14,000 and 19,000 TJ per year. Diesel recorded a step rise in consumption from about 4,000 TJ in 2011 to 12,000 TJ in 2013. A dip in electricity consumption in 2012 was contradicted by a rise in all other forms of energy particularly LPG and wood and other wastes.

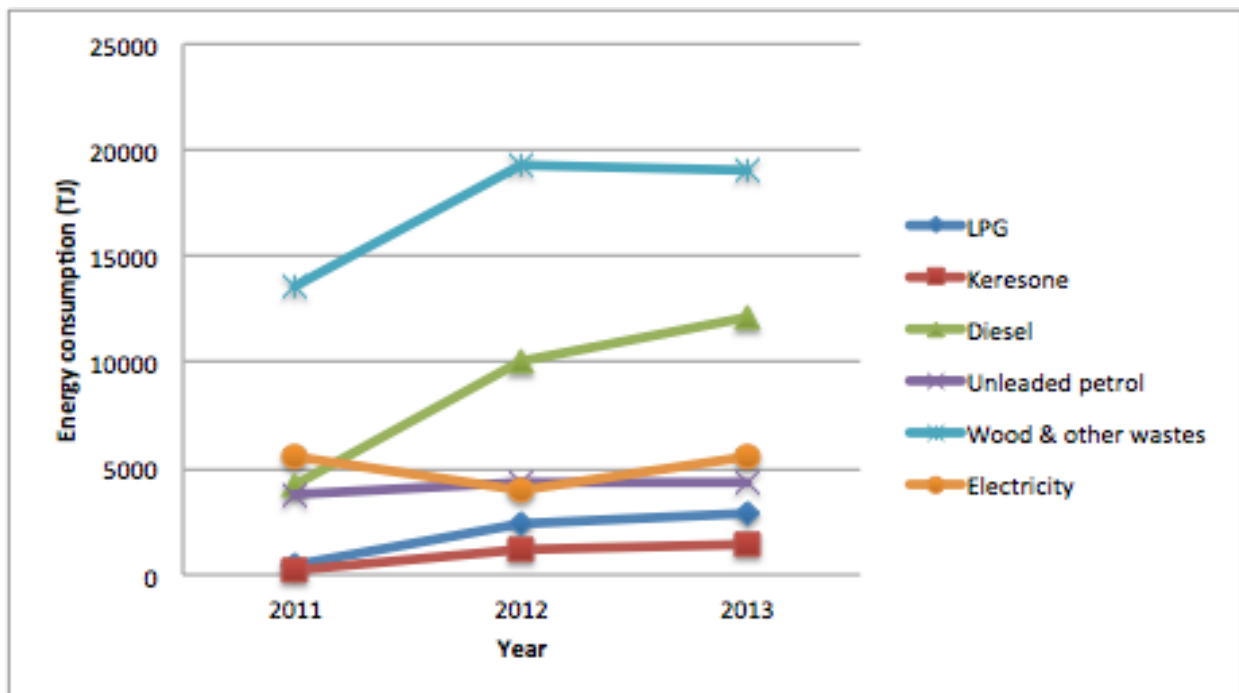


Figure 5: Final energy consumption 2011-2013 in Swaziland

Source: MNRE, 2015

In the absence of an energy plan with long-term supply and demand projections, the energy sector trajectory is therefore estimated from rudimentary iterations based on the energy balance.

The electricity sector is the most advanced in terms of data collection and planning, providing regular statistics through SEC. Energy consumption is forecasted to rise from 1,534 GWh in 2015 to 1,828 GWh in 2025 and demand is forecasted to equally rise from 271 MW to 323 MW over the same period as illustrated in Figure 6 (SEC, 2015 & SAPP, 2014). The projections from SAPP appear to be on the high side given the sharp rise in 2015 between historically recorded trends against future projections.

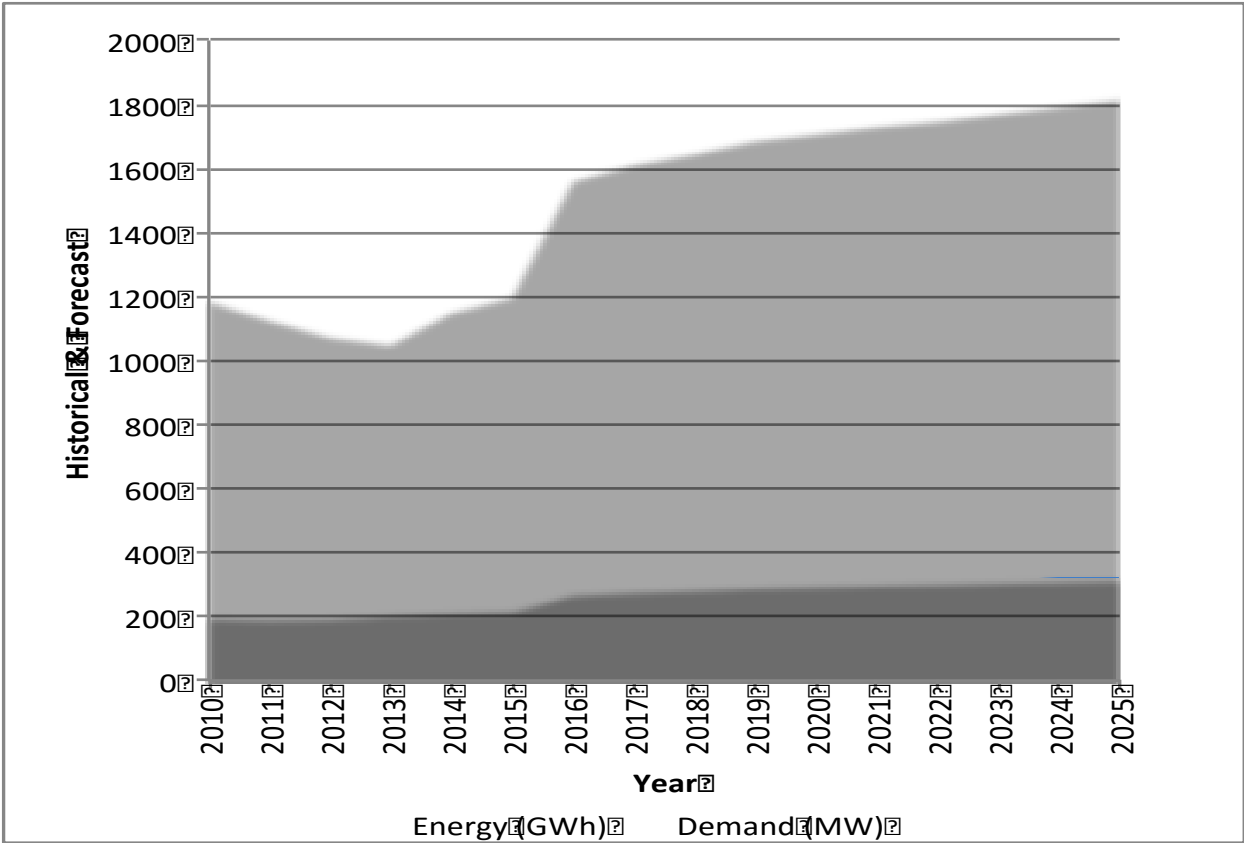


Figure 6: Electricity consumption and demand forecast for 2015-2025

Source: SEC 2015 & SAPP, 2015

The total installed generation capacity in Swaziland in 2014 stood at 159.6 MW from SEC generation and self-producers in sugar and paper industries. With a fleet of 4 hydropower stations; Ezulwini (20 MW), Edwaleni (15 MW), Maguduza (5.6 MW) and Maguga (19.5); and the Edwaleni Diesel Power Station (9.5 MW), SEC is the main generator of power in Swaziland as well as the sole transmission and distribution systems operator. The balance is met through imports from Southern Africa Power Pool (SAPP) member utilities with Eskom of South Africa and Electricidade de Mozambique (EDM) of Mozambique, contributing a bulk of the electricity imported. Figure 7, exhibits a comparison between imported energy and local generation over

the years in Swaziland. Imports have been rising since 2011 (to almost 80% of annual consumption).

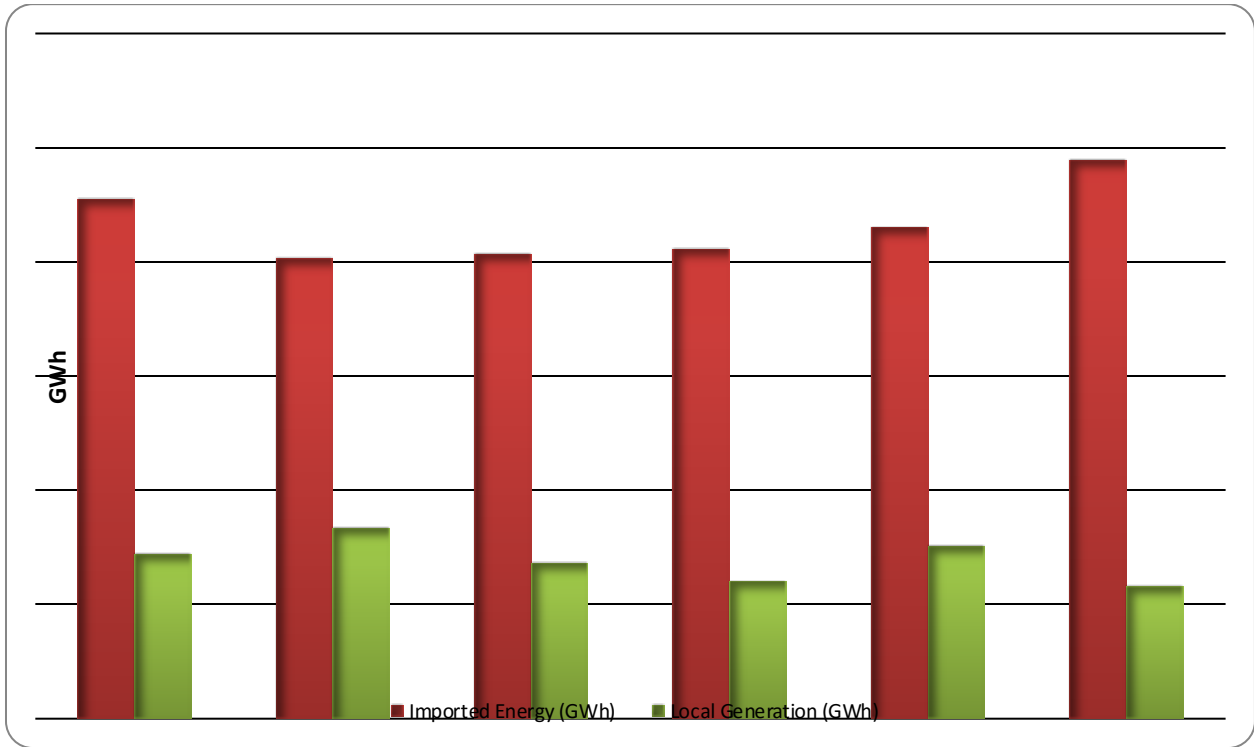


Figure 7: Imported energy vs local generation

Source: derived from SEC annual reports

In order to improve the security of supply, the government must develop and implement viable indigenous electricity generation facilities.

Electricity demand in the past 5 years has risen sharply by about 8.6% although relatively small in absolute numbers from 202.39MW in 2010 to 221.74 MW in 2014 (see Figure 8).

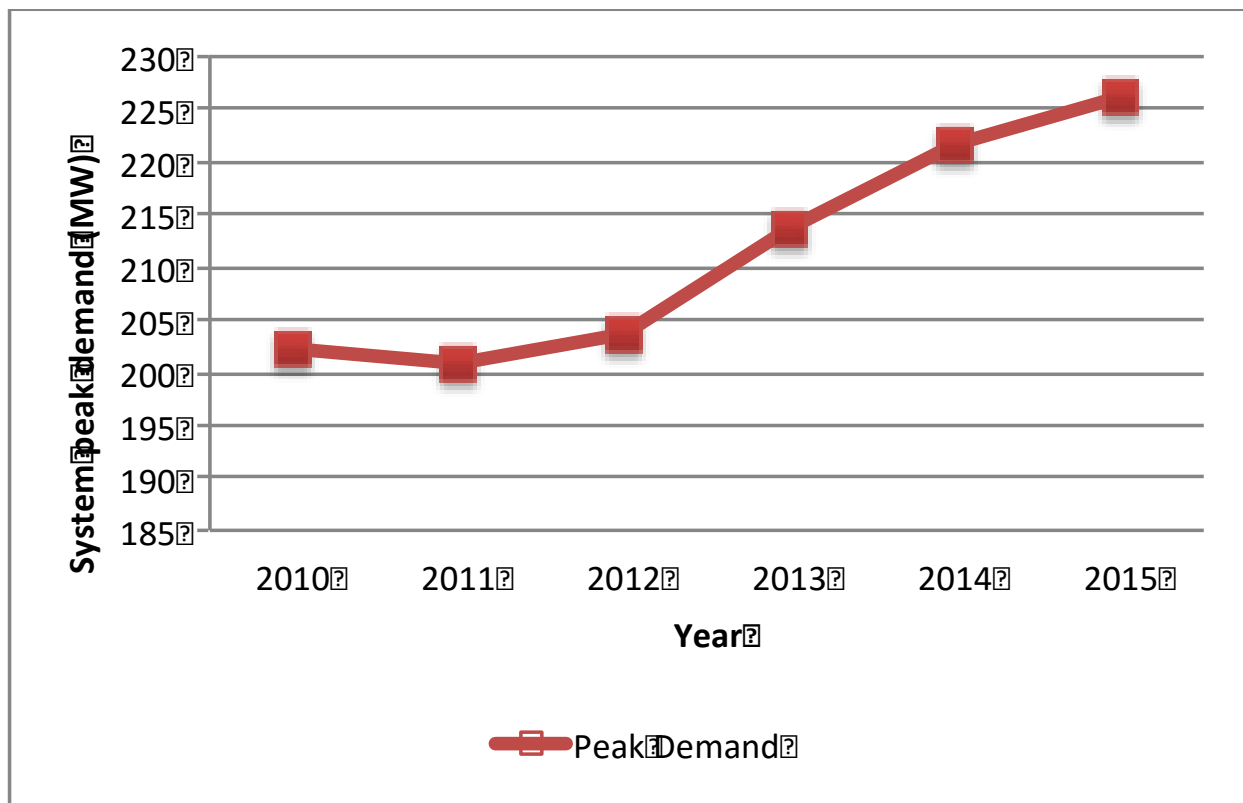


Figure 8: Peak system demand for 2010 -2014

Source: SEC, 2014

Swaziland does not have a long-term plan yet for the energy sector such as the integrated resource plans⁴, but the generation plan from SEC postulates new internal electricity generation to come from coal, biomass, solar and hydro. The 300 MW Lubhuku Coal Power Plant which is expected to come on line in 2022 will meet almost all the country’s demand. The target is that by 2018, 70% of the electricity demand should be met through internal generation and 10% (E10) mandatory blending of all petrol with ethanol should be in effect.

Box 1: Energy Sector Trajectory

- National Energy Policy reviewed, by 2016,
- An integrated resource plan (IRP) is developed by 2016
- The 300 MW coal fired power plant bankable feasibility study conducted, by 2016, and construction to start by 2020
- E10 (ethanol-petrol blending) in place, by 2016,
- 70 % of electricity demand supplied by internal generation sources, by 2018,
- 300 MW coal fired power plant on line, by 2025,

⁴ An electricity integrated resource plan is being developed by SEC on behalf of MNRE and is expected to be finalized in 2016

1.2 Energy access targets until 2030

National electricity access stands at approximately 55% aggregated as 65% urban and 45% rural (IRENA, 2014). According to the Swaziland Rapid Gap Analysis and Action Plan, the national electricity access rose to 61%, with urban and rural households having electricity access of 77% and 50%, respectively in 2013 (MNRE and CSO, Swaziland, 2013). Figure 9, illustrates the distribution of electricity access by region with Hhohho Region having the highest electricity access at 66%, followed by Manzini Region at 64% and Lubombo at 63%, whilst the lowest was Shiselweni Region at 40%. For lighting 60% of the citizens use electricity as a source of energy whilst 30% use candles and 10% paraffin whilst the use of solar is still negligible.

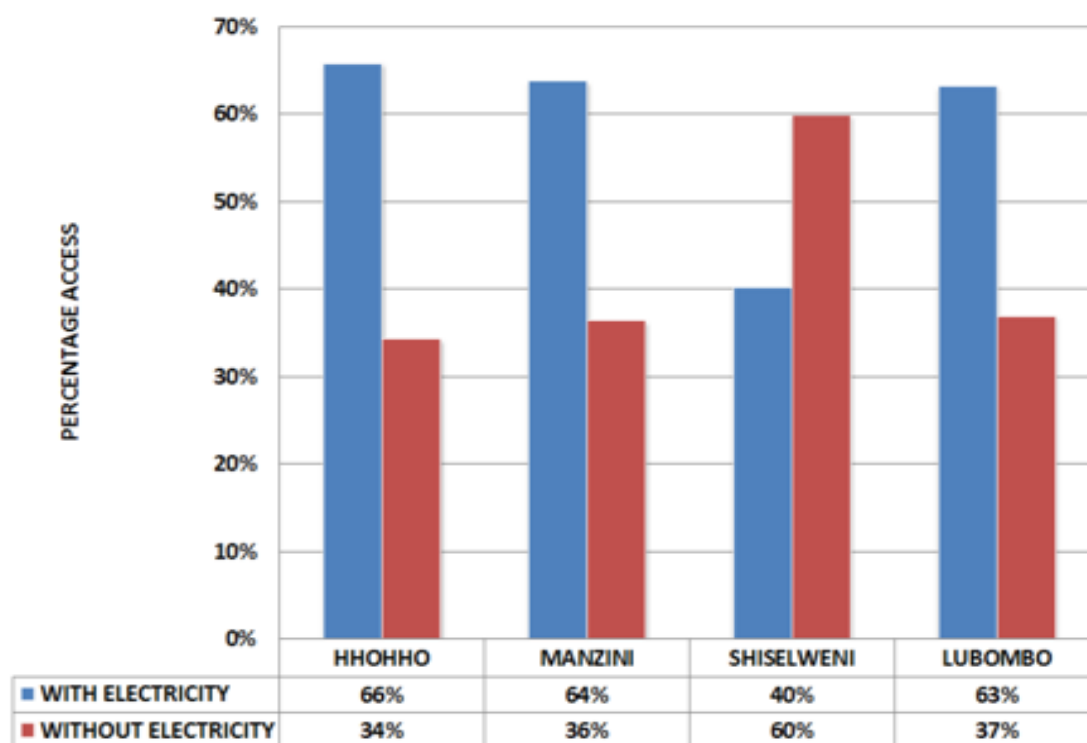


Figure 9: National electricity access at regional level as of 2013

Source: MNRE, 2014

It is clear that Swaziland still uses a binary framework for measuring access to access to electricity, which has been proven globally to fail to capture the multidimensional nature of energy access. If the new multi-tier approach⁵ to measuring access to energy is adopted, access to energy will not be as high as stated above since it will measure access to households, productive enterprises and community institutions for both electricity and household energy.

⁵The multi-tier framework is a new approach recently developed by the World Bank to measuring access to energy. The tiers are defined based on a combination of attributes that reflect the performance of the energy supply with each tier reflecting the ability of the energy supply to cater to specific energy applications.

As a member state of the Southern Africa Development Community (SADC), Swaziland is expected to align its plan for universal access to modern energy with that of the SADC Regional Energy Access Strategy and Action Plan of 2010 (SADC, 2010). SADC’s plan is “to harness regional energy resources to ensure, through national and regional action, that all the people of the SADC Region have access to adequate, reliable, least-cost, environmentally sustainable energy services. The operational goal is to endeavour to halve the proportion of people without such access within 10 years for each end use and halve again in successive 5 year periods until there is universal access for all end uses.”

Based on the SADC Regional Energy Access Strategy and Action Plan, the target for access to modern clean energy solutions in Swaziland should be **67.5% by 2020** and **universal access attained by year 2025**.

MNRE’s Strategic Plan for 2014-2018 has accelerated even more ambitious targets of; **75% access to electricity at household level by 2018 and universal access by 2022**. Although universal access to electricity may be attained by 2022, clean cooking still remains a challenge. Cooking solutions are primarily based on solid fuels in rural areas (see Table 1).

Table 1: Percentage of households using different types of energy sources for cooking by region-rural areas (2010)

Energy Source	Rural Hhohho	Rural Manzini	Rural Shselweni	Rural Lubombo	Rural Total
Fuelwood	75.5	72.2	73.9	80.7	75.3
Coal	0.0	0.0	8.2	0.0	1.9
Electricity	15.1	16.7	11.6	11.2	13.9
Paraffin	3.0	3.4	1.6	0.2	2.2
LPG	6.4	7.8	4.8	7.9	6.7
Total	100.0	100.0	100.0	100.0	100.0

Source: Computed from the Swaziland Household Income and Expenditure Survey, 2009/10

According to, REN21 (2015)⁶ about 161,913 households are affected by household air pollution (HAP) causing 714 deaths per year from that pollution. Access to modern clean energy solutions such as electricity, LPG and improved cook-stoves will go a long way to address some of the

⁶ There are noted discrepancies in statistics provided by different agencies. Energy statistics is an area requiring immediate and major attention for improvement in Swaziland just like in most countries in Africa.

tragedies, hardships and inconveniences associated with the use solid fuels for cooking. But according to the National Energy Policy (2003), although access is a priority, affordability of energy is a major concern for low-income households and needs to be adequately addressed.

If a multi-tier approach is adopted for access to clean cooking, the entire cooking system has to be analysed and this will require extensive collection of data on the cooking system. The SE4ALL Global Tracking Framework is still to develop the metrics for cooking.

The thrust for addressing electricity access is through grid extension implemented by SEC with funding coming from the Republic of China on Taiwan, MNRE; Micro Projects, Rural Development Fund. However, there is no clear-cut strategy and programme to drive overall energy access that includes electricity and cooking energy. Other SADC countries such as Mozambique, Tanzania, Zambia and Zimbabwe are addressing the challenges associated with energy access by establishing and resourcing specialised institutions, the rural electrification agencies or authorities that work closely with national utility and the ministry responsible for power. In all cases and approaches to addressing energy access, special tariff levies are applied for funding the rural electrification programme.

A clear planning framework is therefore necessary for Swaziland to holistically address access to both electricity and clean cooking. This could be in the form of a Rural Energy Master Plan that also prioritises productive use of electricity as well as technologies such as solar (SHS) systems for remote households and biogas. Such a plan with targets, implementation strategy and key responsibilities would need to be adequately resourced.

If the technology-neutral multi-tier measurement framework that is based on attributes of supply and covering grid and off-grid solutions is adopted, a comprehensive approach to access to energy covering household, productive engagement and community facilities will see the Kingdom of Swaziland comprehensively fulfilling its Vision 2022. Given the importance of access to energy for socio-economic development, Swaziland should therefore prioritise access to energy for the attainment of Vision 2022. In setting targets for energy access, Swaziland will have to stretch its horizon beyond just connections as illustrated in Figure 10, below to consider and incorporate off-grid solutions, the quality and quantity of electricity supply, clean cooking, productive use and community facilities.

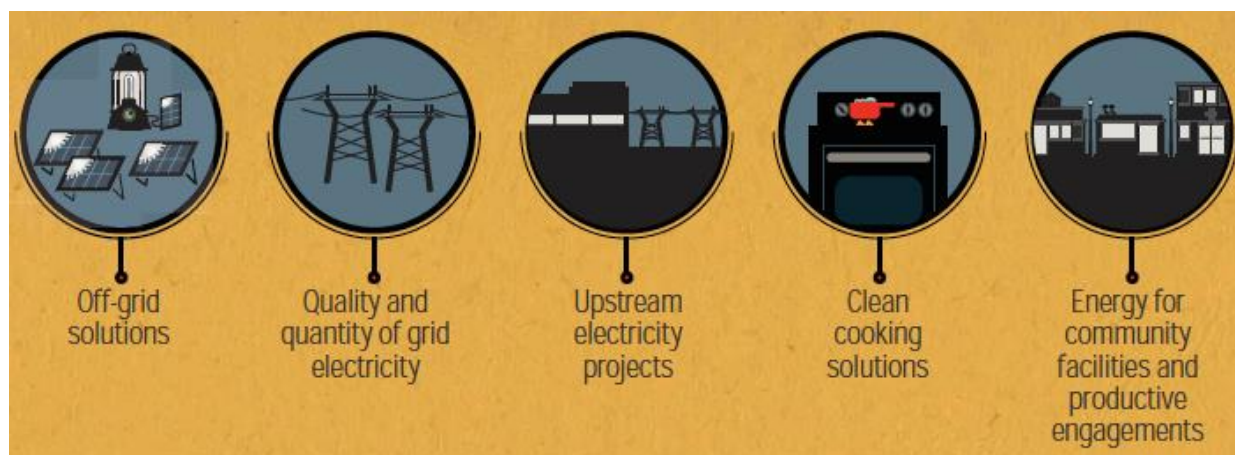


Figure 10: Comprehending access to energy

Source: World Bank Group⁷

Table 2 summarises the targets for access to energy using the multi-tier approach with consideration for cooking solutions, off-grid electricity solutions, grid extension and upstream electricity generation. A simplified version of the multi-tier matrix for energy access is exhibited in Annex 3.

Table 2: Targeted minimum tier of energy access

No. of Households	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5
40,000	Provide solar lanterns and improved cook stoves by 2018				
18,500			Provide new grid connection for lighting, television and phone charging by 2018		
20,000		Provide solar home systems, improved stoves, LPG & biogas by 2022			
220,000 (National)					Add new generation of 510 MW by 2025 to increase quality and quantity of grid electricity

⁷<http://www.worldbank.org/energy/beyondconnections>. Accessed. 20 March 2016

Box 2: Targets for Energy Access

- Minimum of 5,000 households connected to grid electricity per annum by 2018, reaching 75% access to electricity at household level
- Build a 300 MW coal power plant to enhance security of supply by 2020
- 100% access to electricity at household level attained by 2022
- Effective policies and incentives for improved cook stoves established by end 2017
- Regulatory structures and mechanisms for LPG established by end 2017
- Penetration of improved cook stoves increased by 10% per year from 2020
- Penetration of LPG for cooking increased by 10% per year from 2020
- GIS database for rural energy access developed by 2017
- Rural energy master plan and implementation strategy to attain universal access to energy including LPG, improved cook stoves, SHS and biogas developed by 2018
- 100% access to clean energy at household level attained by 2030

1.3 Renewable energy targets until 2030

The role of indigenous renewable energy resources in the energy mix of Swaziland is crucial given that the country imports all its petroleum products and a large proportion of its electric power needs from South Africa, Mozambique and a small portion from the SAPP Day-Ahead Market (DAM). Indigenous renewable energy will also increase the energy security of the country. The contribution of renewable energy to the electricity supply from internal generation is already significant with hydro stations contributing about 77% and the balance coming from thermal generation, mainly bagasse plants. Unfortunately, Swaziland imports almost 75% of its electricity, mainly from ESKOM, South Africa which itself still has coal dominated internal generation. In 2013-2014, Ubombo Sugar Limited (USL), an independent power producer, contributed about 3.7% to the national electricity supply through the company's sugar cane co-generation plant. Royal Swaziland Sugar Corporation's (RSSC) Muhlume and Simunye plants have utilizable capacity of 45 MW and a potential of up to 100 MW while USL has up to 39.5 MW of co-generation capacity. Only USL has a power purchase agreement with SEC to feed power into the grid. SEC has signed a memorandum of understanding with RSSC to collaborate on developing grid in-feed frameworks as well as with a sawmill for 10 MW grid in-feed from wood waste.

Going forward: hydropower, bagasse from sugar cane and wood waste are likely to play a significant role in power generation. A detailed feasibility study on co-generation, understanding the entire value chain from cane in the field or wood plantation - to sugar mill/saw mill - to electricity on the bus bars, is necessary for an investment decision to be done. The hydropower feasibility studies being conducted with the support of the African Development Bank (AfDB) as well as co-generation optimization studies will cement the role of renewable energy in the electricity supply mix. Table 3 provides a list of renewable power projects pursued by SEC and independent power producers.

Table 3: Renewable energy projects proposed in Swaziland

Year of Commission	Project Name	Capacity (MW)	Current Status
2018	Lower Maguduza Hydro	12	Awarded to successful bidder (AIIM/OMIGSWA) EIA report submitted Construction to start after (Certificate of Compliance, Government Guarantee and land acquisition)
N.A	Daroway Hydro Power	5	PPA being negotiated with SEC
2020	Lower Maguga Hydro Electric Scheme	1	Awaiting Response from IPP on Feasibility Study
N.A.	Lubovane Hydro Power, Siphofaneni	0.85	Feasibility Study completed
2018	KaLanga Solar PV (WunderSight Project)	21	Tariff negotiations finalised & PPA signed IPP to apply for Generation License to SERA IPP is seeking financiers for the project Environmental Impact Assessment to start in June 2016 Lease agreement finalized, awaiting approval
2018	Fibon Solar Power	20	Tariff negotiation finalized. PPA signed IPP finalising land purchase with seller IPP seeking Government Guarantee / other state commitments Construction to start in 2016
2018	Lavumisa Solar PV	5	SEC appoints consultant for feasibility study Study to be concluded in 2016
2016	Ka-Langa Solar PV Project	0.95	Power Purchase Agreement (PPA) signed Generation License issued Construction started in Aug 2015
N.A	RSSC Biomass Generation	100	MoU signed with SEC
2020	Montigny Biomass Plant (Usutu)	30	MoU signed with SEC
2020	Symbion Biomass Plant (Havelock)	10	MoU signed with SEC
N.A.	Clean Energy Africa Biomass Plant, Ngodwane	10	MoU signed with SEC
Total		215.80	

Source: MNRE, 2016

* All solar and biomass projects are independent power producer (IPP) driven.

When all these projects are implemented, about 216 MW of renewable power will be added to the grid. An enabling framework in the form of a transparent procurement mechanism, away from a negotiated PPA, is preferred to unlock private sector investment in renewable energy in Swaziland.

Swaziland already produces significant amounts of ethanol mainly for the export market. Current production of ethanol at national level is 60 million litres per year. For blending purposes, the ethanol will need to be dehydrated. Mandatory blending accompanied by a favourable pricing regime will help ethanol producers to invest in infrastructure for the production of anhydrous ethanol. Ten percent (E10) blending with sugar cane derived ethanol is proposed by 2016 by MNRE.

It must be noted that over reliance on hydropower and biomass/bagasse for power generation brings with it risks associated with climate change. The rainfall patterns are likely to change due to climate change and thus endangering hydropower production. The current exploitation of solar PV in Swaziland is still very low, but growing as more applications of solar that include water pumping, water heating and crop drying are gaining market penetration. The utilizable potential of the solar resource is still to be determined to factor in land availability if utility scale is considered. Most of the land in Swaziland is used for agricultural purposes hence energy farming must be considered in the context of dual land use. The IRENA study of 2015 on Renewable Energy Zoning for Eastern and Southern Africa (Wu, et al. 2015) highlights the priority areas for development of solar PV and wind energy in Swaziland as illustrated in Figure 11 and Figure 12.

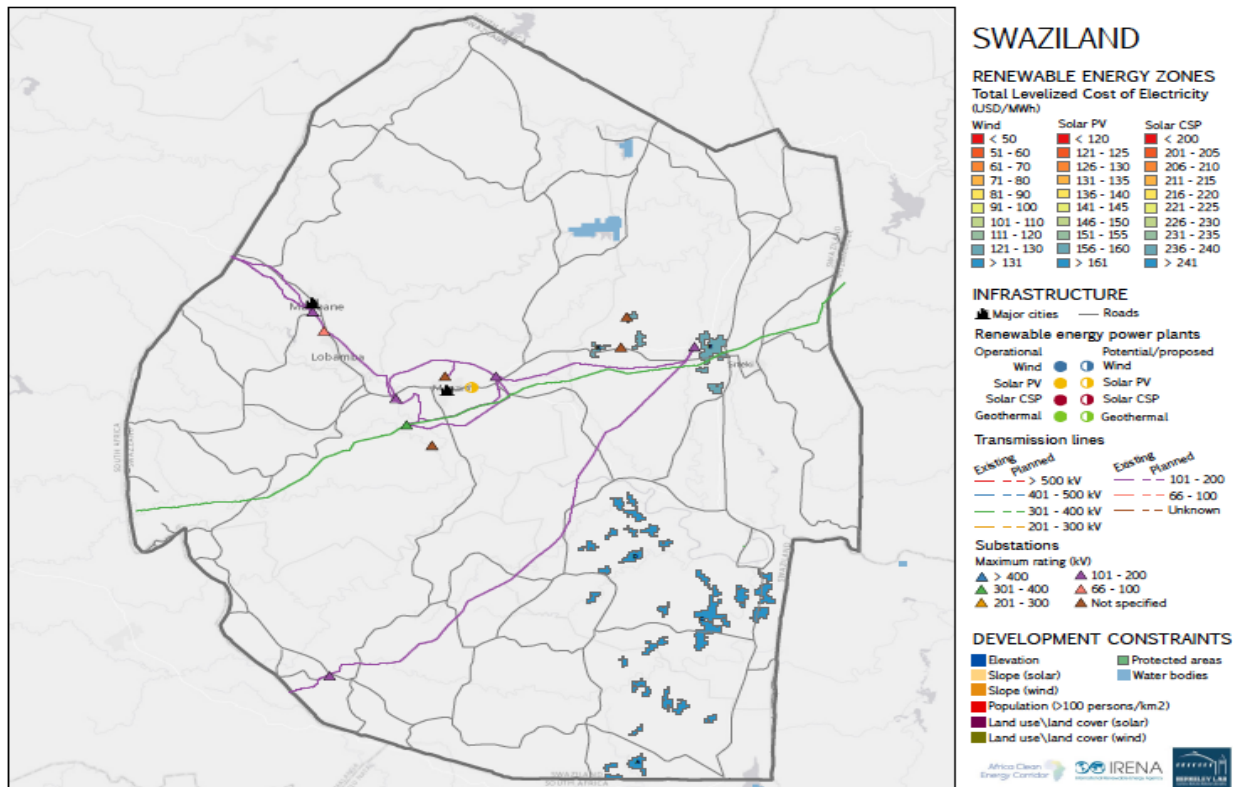


Figure 11: Solar PV energy zones in Swaziland

Source: Wu, et al., 2015

The wind energy zones, illustrated in Figure 12, include agricultural land thus increasing the co-utilisation of the land.

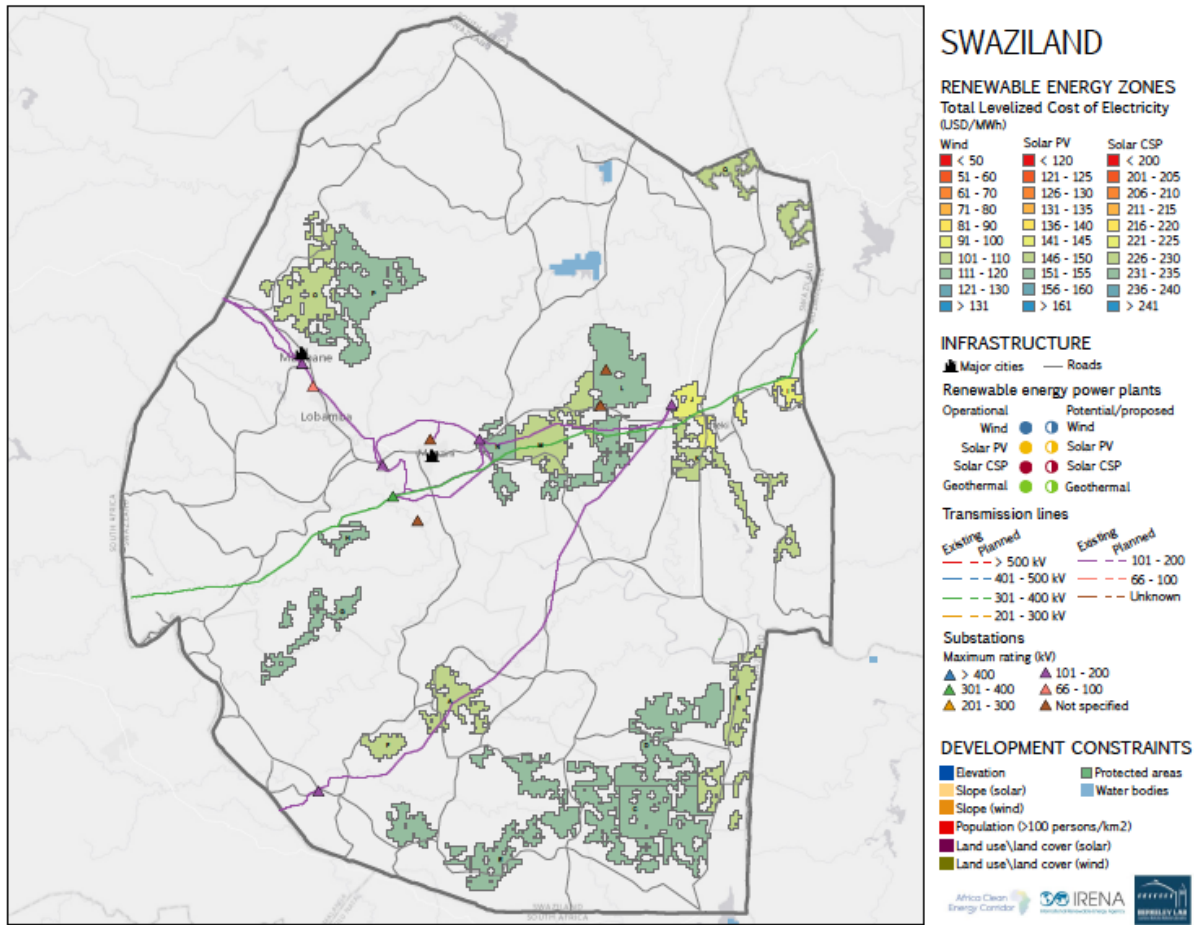


Figure 12: Wind energy zones in Swaziland

Source: Wu, et al., 2015

The study not only identifies the solar PV and wind zones but also ranks them according to levelised cost of electricity (LCOE). The zones were identified taking into consideration access to roads, terrain, proximity to load centres, land use (protected areas and other productive purposes), etc. to come up with the LCOE for each zone. Locations of existing or planned renewable energy power plants, transmission lines, substations, and load centres are also indicated on the maps. By combining Figure 11 and Figure 12, it is clear that solar PV and wind zones can be co-located in Swaziland.

It is important then that the zones are validated by ground assessments that include strategic environmental assessments, land use and land tenure, ground measurements and generation connection capacity assessments, amongst other activities. The information generated will assist

both the policy maker as well as system planner to prioritise the development of the zones into concrete renewable energy projects as well as understand any grid reinforcements that may be required for the renewable energy projects to be developed.

Complementarity between co-generation, solar and wind on one hand and hydropower on the other hand can be attained with proper planning. Figure 13 illustrates the water inflows into the main Luphohlo Dam which supplies water to the Ezulwini, Edwaleni and Maguduza hydro power stations with a combined installed capacity of 40.6 MW against a total national installed capacity of 60.1 MW of hydropower. Water levels and subsequently power production levels are low in the months of May to November (Figure 14). By contrast, solar radiation levels are generally high with clear skies from August to November. Solar may thus complement hydropower in Swaziland.



Figure 13: Monthly average inflows in Luphohlo Dam

Source; SEC, 2014

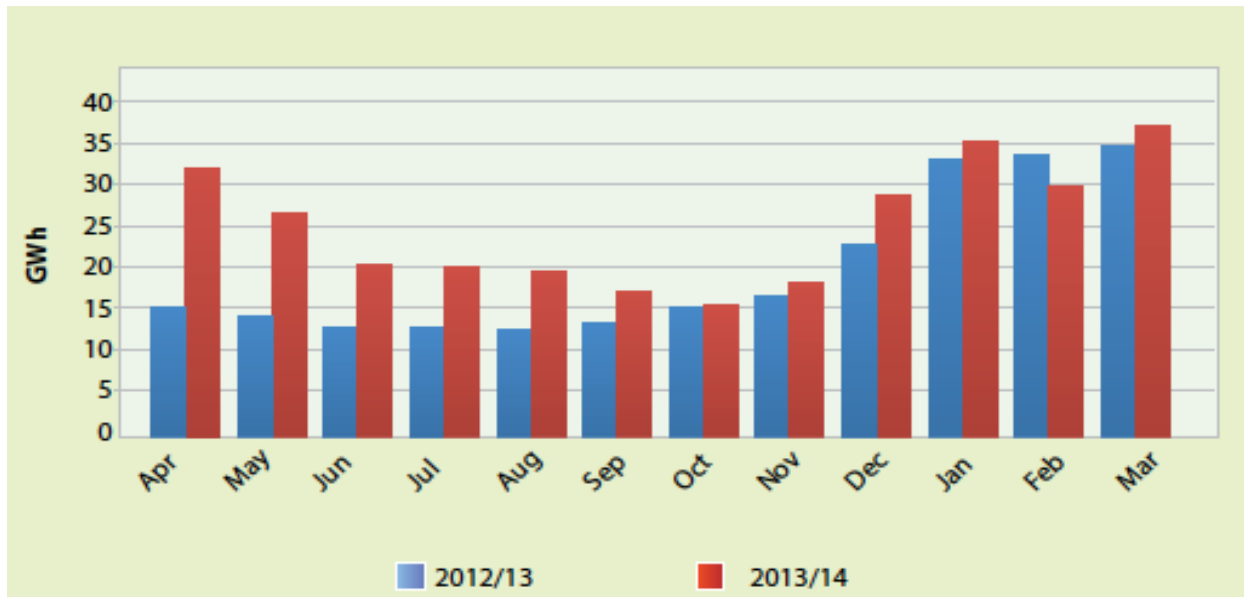


Figure 14: Monthly production levels of electricity

Source: SEC, 2014

Complementarity with wind would also need to be explored so as to optimize siting and production of renewable power. The months of August to October are also challenging to SEC as system losses are high due to imports as transmission distances increase. Reducing imports with internal generation will also reduce system losses.

For the renewable energy target until 2030, the following are envisaged:

- Additional generation capacity fed into the grid; 134MW hydropower, 130 MW from sugar cane bagasse and 80 MW from forestry residue, thus making Swaziland self-sufficient in power generation.
- 20% public buildings equipped with solar water heaters by 2020.
- Solar and wind maps prepared and zones validated for development.
 - Mandatory blending of ethanol and biodiesel at 10% and 5%, respectively.

Box 3: Renewable energy targets up to 2030

- Solar and wind maps developed by 2016
- 30 MW solar PV power plant (IPP) on line by 2018
- 20% of all public buildings to have solar water heating by 2018
- 140 MW hydro (SEC) by 2020
- 130 MW co-generation from bagasse (IPP) by 2020
- 80 MW from wood waste from IPPs (with 30 MW online by 2019)
- 10 % ethanol blending by 2016
- 50% renewable energy penetration in the energy mix by 2030

1.4 Energy efficiency targets until 2030

Using energy intensity⁸ as a proxy indicator for energy efficiency, Swaziland is one of the 3 countries in SADC (the other two being Madagascar and Namibia) that have seen an upswing in energy intensity between 2010 and 2012 as illustrated in Figure 15. The same period also witnessed a decline in energy consumption in the industrial sector (see Figure 12) that can be hypothesized to production of high value products that can be generalized to contribute favourably to the gross domestic product (GDP) or downscaling in production by major consumers.

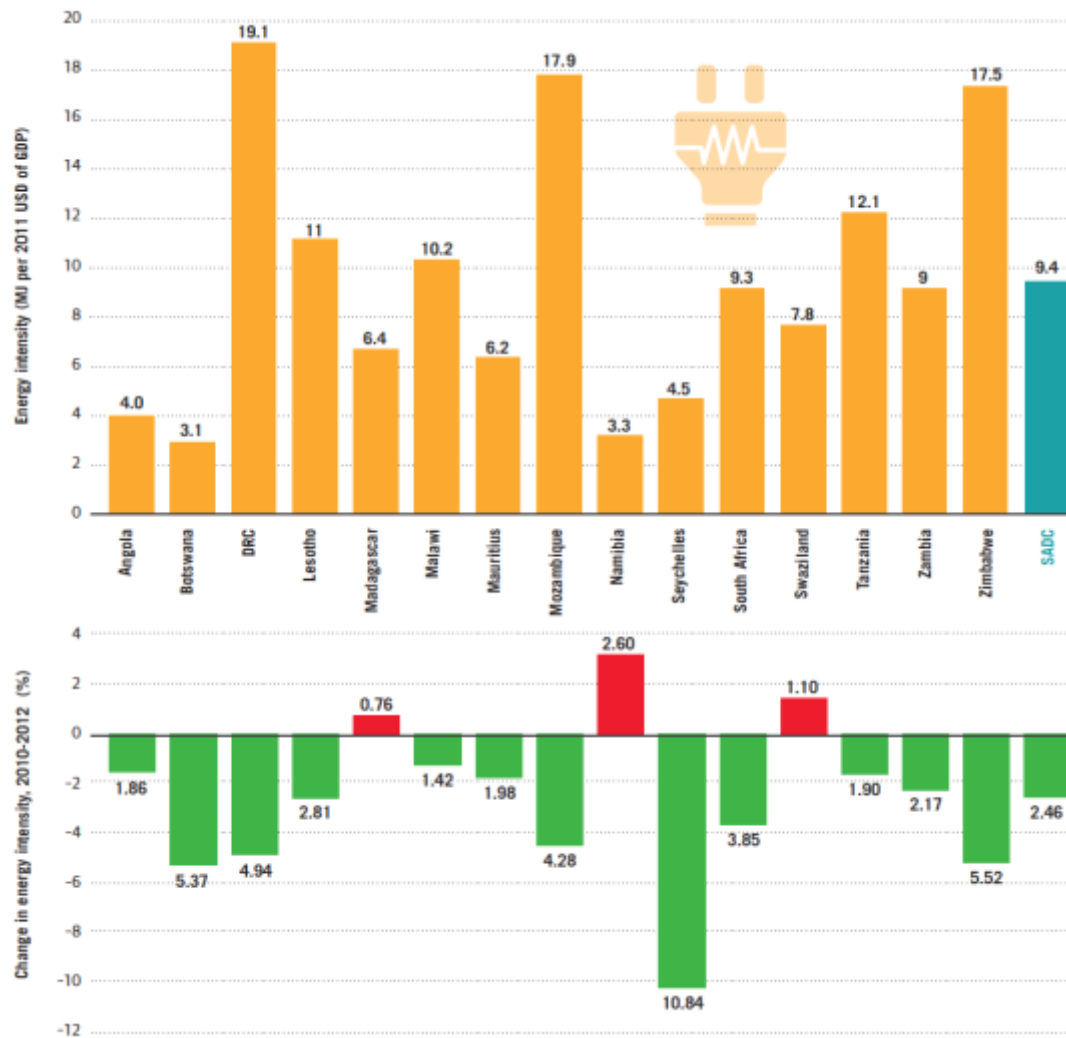


Figure 15: Energy intensity in SADC member states 2011, with corresponding change in energy intensity, 2010-2012

Source: REN21. 2015

⁸ Energy intensity is defined as the amount of energy required to produce one US dollar of GDP

In response to the regional power crisis witnessed from 2008, all SAPP member states have initiated energy efficiency initiatives which include the introduction of energy saving bulbs like the Compact Fluorescent Lamps (CFLs), solar water heaters, industrial and commercial load shifting, hot water load (ripple) control (HWLC), technical audits, time-of-use-tariff, pre-payment metering, commercial lighting and power correction factor. The aim was to save 1,650 MW by 2014 at regional level (SAPP, 2011). The results of implementation of these measures are yet to be published.

As a member of SAPP, SEC has been running an extensive demand-side management (DSM) programme, initiated in 2008. Compact fluorescent lighting is promoted under this programme, and approximately 90% of electrified households are now using pre-paid meters. In addition, to promoting efficiency in the industrial sector, a time-of-use tariff has been introduced for industrial customers (SEC, 2012).

The CFL promotion programme has been pursued vigorously by SEC through road shows and free distribution of the lamps to domestic consumers. When deployed on a large scale, CFLs may increase harmonics, which may consequently increase losses on the distribution network. To address this, SEC has installed harmonic filters in some substations. The campaign to encourage the public to save electricity included the provision of energy saving guidelines/tips for the public to implement.

The domestic and agricultural sectors are the only sectors that have recorded increases in energy consumption over the period 2010 - 2014 whilst industrial sector has been on a steady decline in consumption over the same period, save for 2014 when it picked up, see Figure 16. It is therefore evident why SEC has focused on domestic sector for CFL distribution and energy efficiency awareness campaigns.

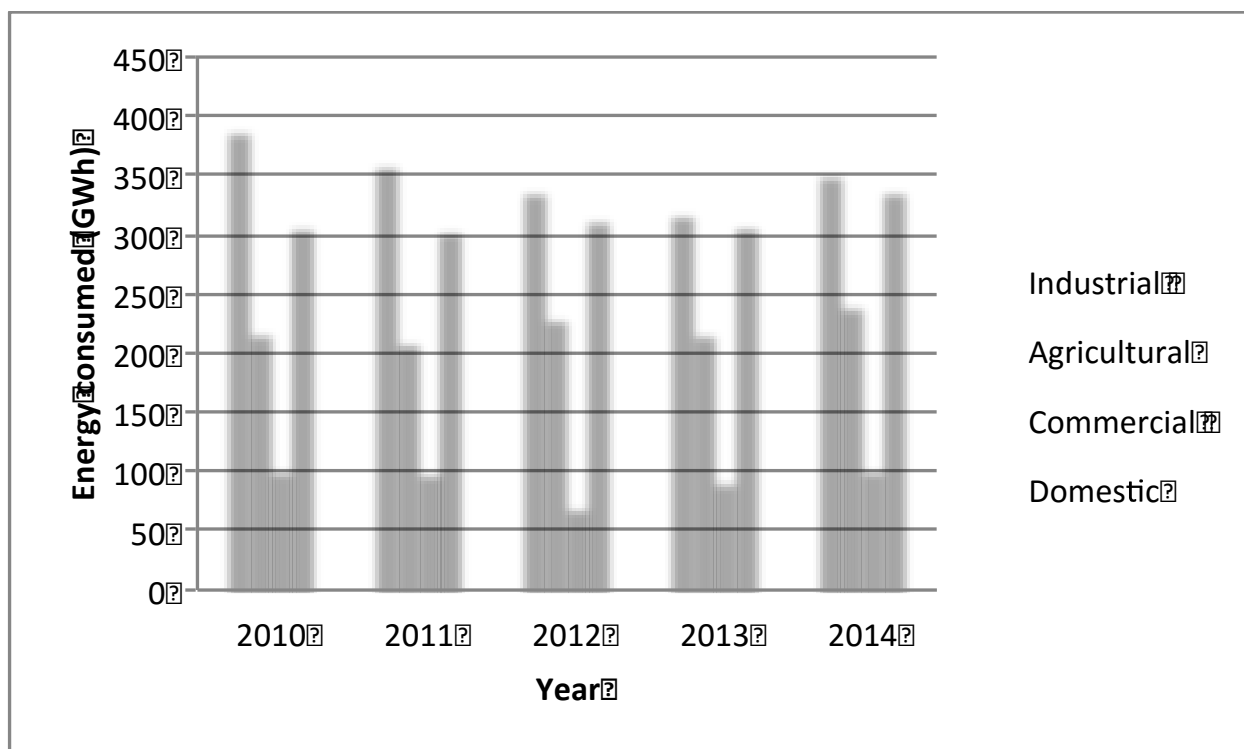


Figure 16: Sectoral energy consumption for period 2010 – 2014

Source: derived from SEC, 2014

For agriculture, a number of measures such as the use of timers, computerisation and use of low-energy pumps could reduce energy requirements for irrigation and improve competitiveness of agricultural products. The 2003 Energy Policy already advocated for measures such as the provision of information and use of low-energy equipment. Other measures that could be implemented in the agriculture sector include proper data recording and management, improved irrigation practices, power factor correction, elimination of air and water leaks in compressors and irrigation systems and improving boiler efficiencies where such equipment is available.

Building codes programme is an area for promoting energy efficiency that has not been given the necessary attention in Swaziland. In many countries, buildings account for about 40% of energy usage and offer many potential opportunities for energy savings and self-generation. A few countries in the region have started paying attention to the buildings sector by adopting energy efficient building codes. In Namibia and South Africa, green buildings councils that are affiliated to the World Green Building Council, although voluntary in terms of their operation, are the main drivers of promoting energy efficiency in buildings. Building codes are national or local rules that govern the design and /or use of that building and they can either be voluntary or mandatory. Energy efficient building codes are the most cost-effective tools to reducing energy use in buildings on a long term-term basis.

In Swaziland there is a general understanding that the newly established Construction Industry Council, which will regulate the construction industry through policy implementation, establishment of ethical standards, practices and procedures will promote energy efficiency in the sector. Appliance-and equipment labelling-and standards are also effective approaches to promoting energy efficiency. Mauritius and South Africa are two countries in SADC that have taken leadership in that front and South Africa is looking at implementing its programme in 2015.

According to REN21 (2015), SAPP initiated, in 2015, a Regional Roadmap for “Leapfrogging to Efficient Lighting, Appliances and Equipment in SADC”. Prioritised areas by SAPP members for high impact, rapid deployment and cost-effectiveness are lighting, refrigerators, air conditioners, water heaters and distribution transformers. SEC is expected to drive these energy efficiency measures for Swaziland.

The potential saving from implementing energy-efficient refrigerators, air conditioners, distribution transformers, efficient lighting and solar water heating could save Swaziland more than **180 GWh per year**, which is about **10% of future electricity use in 2025**.

Box 4: Energy efficiency targets up to 2030

- Attain 60 GWh energy saving per year by 2018
- Attain 180 GWh energy savings per year by 2025
- EE policy and regulations developed by 2019
- 500,000 LEDs to households distributed by 2020
- Design and adopt an energy efficiency appliance labelling and standards programme

1.5 Relevant nexus targets until 2030

Swaziland needs modern and sustainable energy resources for development and the sustenance of livelihoods and by adopting the SE4All initiative, sustainable energy supply and productive use of energy are coalesced in a holistic manner.

The National Energy Policy is old and long overdue for review to incorporate latest developments in technologies, strategies and processes in Swaziland and elsewhere. For instance, the costs of most renewable energy technologies have fallen sharply in the last decade making them very competitive to other energy sources. Smart grid technology, storage devices, green buildings, etc. are now coming to the core of modern energy systems and these would need to be considered in the new energy policy frameworks.

SERA, which was established through the SERA Act (2007), has a number of regulations, processes and studies in place to help it in its work. To support the development of renewable energy in Swaziland, SERA is conducting a Subsidy Framework Study. To further enhance its work and support the SE4ALL objective, SERA will need support in:

- Building its capacity in developing bankable power purchase agreements
- Developing, together with MNRE, a comprehensive renewable energy potentials database - building on the renewable energy zoning work conducted by IRENA.
- Identifying DSM initiatives and quantification of potential savings.

The Ministry of Tourism and Environmental Affairs is coordinating a Swaziland Green Stamp programme that rates and recognises companies that are promoting renewable energy, energy efficiency and water efficiency. There is a proposal to establish a Climate Fund to cover climate change-related activities although the Swaziland Environment Fund (SEF) has already expanded its scope from just addressing land degradation to now include green energy projects. One possibility could be to get the SEF to be accredited by the Green Climate Fund so that it may tap into international climate finance.

The Ministry of Economic Planning and Development is working with MNRE to ensure that energy plays its role as key driver of enhanced future socio-economic development in Swaziland by supporting budgetary proposals for strategies and activities that are aligned to that goal. To that effect, the following strategies are prioritized for nexus targets:

Agriculture:

Agriculture has always been the backbone of Swaziland's economy and the sector is diversified to include sugar cane, citrus fruit, cotton, maize and other cereal production, as well as forestry and livestock. The Ministry of Agriculture, is actively promoting wood efficient cookstoves including the popular "Basintuthu" stove in rural communities. Wood-waste based briquettes have also been tried for fuel use but the cost of production was very high. Agro-processing is a top priority for the ministry where they are looking at securing and promoting efficient large scale solar dryers for vegetables, legumes (for soups), tomatoes and fruits. Current solar dryers in the market are too small for commercial drying for the export markets.

Opportunities for sustainable energy in the sector include;

- Vegetable Drying – to preserve the vegetables grown under the rain. The dried produce can be exported thus earning foreign currency but they may also be consumed locally.
- Frozen vegetables – solar and wind energy can provide energy needed for processing and keeping vegetables frozen.

- Water pumping - solar and wind energy are ideal for pumping water for drinking and irrigation.
- Agricultural waste is a good source of energy (biogas, co-generation feedstock and biofuels).
- In-pipe hydropower generation from the irrigation pumping stations could contribute to power generation.

Health:

Renewable energy and energy efficiency play an important role in the health sector by:

- Vaccine refrigeration and ice pack freezing – the 50% or so of rural population without access to modern and clean sources of energy may benefit from solar and wind energy refrigerating for vaccines.
- Lighting – The 161,913 households that are affected by household air pollution and the related 714 estimated deaths per year due household air pollution can be prevented through micro solar lighting technology.
- Telecommunication – solar and wind powered radio and telecommunication infrastructure increases reliability in communications to connect with health clinics and facilities in the region.
- Sterilization – solar and biogas assisted water heating may help sterilization of equipment and material.

Climate Change:

The Government of the Kingdom of Swaziland acknowledges the challenges arising from climate change and the country's limited capacity to cope with its impact. Climate change adaptation and mitigation are a top priority for the Government. Swaziland's Intended Nationally Determined Contribution (INDC) to the United Nations Framework Convention on Climate Change indicates that water resources will be impacted severely, with 40% projected reduction in the country's river flows. Swaziland's contribution to a low carbon and climate resilient future will include increasing renewable energy in the energy mix, introducing ethanol blending to petrol and phasing out consumption of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆)⁹.

Given the projected reduction in river flows due to climate change induced varying hydrological patterns; MNRE should seriously consider its vigorous campaign for hydropower development. Renewable energy based power generation projects such as co-generation and hydro are

⁹Sulfur hexafluoride is used in electrical transmission and distribution equipment, including circuit breakers

favourable candidates to contributing to climate change mitigation but they are also highly susceptible to climate change due to rainfall variability.

As such Swaziland will need to invest in:

- Water storage for hydropower; and
- Efficient irrigation technology and practices in the agriculture sector.

This will unfortunately push up the cost of mitigation.

Research and Technology Development:

- Enhance research and development capabilities of University of Swaziland and other institutions to better understand energy systems and technology development for climate change mitigation and adaptation;
- Enhance the institutional capacity in MNRE, SERA and SEC to plan and manage the development of the energy sector to efficiently meet the SE4ALL objectives;
- Develop and regularly update energy resource maps for better informed planning;
- Investigate in-pipe hydropower potential in collaboration with Swaziland Water Services Corporation to harness energy from water flowing through water pipe network;
- Establish cost-reflective pricing policies for all types of consumers which make energy affordable yet encouraging conservation and efficient use of resources;
- Develop standards, codes and frameworks to ensure quality, reliability and safety of energy supply; and
- Formulate appropriate models to subsidize (or cross-subsidized) electricity for markedly low income people/consumers in a quest to supply low cost power to all citizens.

Box 5: Key relevant nexus targets

- Update the National Energy Policy by 2016
- Develop a National Integrated Resource Plan by 2016
- Promote solar crop drying, solar and wind water pumping to increase food security
- Promote efficient solar lighting kits to improve on- and enhance education, health and gender security
- Enhance research capability in climate change modelling and adaptation for the energy sector
- Develop standards, codes and frameworks to ensure quality, reliability and safety of energy supply

PART 2: PRIORITY ACTION AREAS

2.1 Energy access

2.1.1 What is the current status and trajectory

National electricity access rose to 61%, with urban and rural households having electricity access of 77% and 50% at the end of 2013, rising from the year 2012 estimates of 55% national, 65% for urban households and 45% for rural households. The rise in access is attributed to commendable efforts by MNRE and SEC, with the support of development partners, to increase electricity access through grid extensions and to a limited extent, off-grid solutions. Figure 9, illustrates the distribution of electricity access by region and the unevenness across the regions of Swaziland is evident.

Fuel-wood is the main source of energy in rural Swaziland with fatal consequences of hundreds of deaths per year resulting from household air pollution. Modern and clean energy solutions such as electricity, LPG and improved cook-stoves can address the tragedies, hardships and inconveniences associated with the use solid fuels for cooking, provided the affordability and socio-acceptance concerns of the technologies is addressed. Improved cook-stoves have not been widely disseminated and their use still remains at pilot stage. The Basintuntu cook-stove, which has proven to be popular with users, has not come with technical back up thus failing the users.

2.1.2 What are the existing plans/strategies and what are the gaps?

In line with the National Development Strategy, Swaziland wishes to achieve universal access to electricity by year 2022. The current national strategy to attain universal access focuses on grid extension, implemented by SEC with funding from government and development partners. Unfortunately, there is no clear documented strategy on addressing the needs for cooking with clean and affordable energy sources. Currently various technologies such as improved cook stoves, LPG for cooking, biogas and solar home systems are promoted outside a structured supporting framework. A sustainable approach to rural electrification that includes a basket of technologies and devices like LPG and energy efficient cook-stoves to meet thermal needs is necessary.

The prioritized interventions for universal access to modern energy services in Swaziland, as presented by Country Action Plan towards Sustainable Energy for All in Swaziland include:

- Increasing local electricity generation capacity;

- Promotion of productive use of energy; and
- Access to modern energy for cooking through LPG and improved cook-stoves.
- Access to electricity for lighting and powering small devices using solar home systems

Most of the activities associated with the interventions will be around awareness raising, creating infrastructure that will increase uptake of LPG and cook-stoves as well as training and incentivizing the uptake of improved cook-stoves.

Electricity will continue to be a major service for energy access and grid extension and off-grid renewable energy technologies will receive greater attention from the government. A planning framework for approaching rural energisation is therefore necessary in order to meet the SE4ALL objective of attaining universal access by 2030.

What are the gaps?

- The current focus is on electricity access. There is no programme to address access to clean cooking and thermal needs
- The thrust for energy for productive use is missing as this will improve livelihoods and diversify incomes for the households enhancing their ability to pay for the electricity
- Promotion of solar home systems is not programmed. The technology will go a long way in addressing access to remote homesteads that are not likely to be reached by the grid by 2030
- The role of biogas in meeting thermal and to an extent electrical needs is not emphasised
- There is no master plan on rural energisation or policy for rural energy to provide a comprehensive coordinated approach to off-grid and rural energy provision.

2.1.3 What are the actions needed to achieve the overarching objective under energy access?

Some of the proposed actions to achieve energy access include:

- Increasing local electricity generation capacity through;
 - Mnjoli Dam - 1.5 MW
 - Lower Maguduza Hydro Power – 20MW
 - Mini-Hydroelectric Power Plant at Lubovane Dam at Siphofaneni – 0.85MW
 - Ngwempisi hydropower cascade (3 dams) – 120MW
 - Biomass-fired (forestry residues) power plant at Bhunya– 35MW
 - Biomass-fired (sugarcane residues) power plant at Mhlume or Simunye – 30MW
 - A coal fired power plant - 300 MW increase the quality and quantity of electricity

- Establishing effective implementation frameworks for rural energisation that covers improved cook stoves, solar home systems, biogas;
- Developing and implementing a programme on testing and certification of improved cook stoves;
- Awareness raising on the safe use of LPG as well as benefits associated with its use;
- Creation of a local LPG Safety Association to facilitate a forum for LPG suppliers, end-users and Government to raise and address industry issues collectively for the benefit of all citizens of the country;
- Developing LPG retail infrastructure and networks as well as new business models to facilitate rapid uptake of the technology;
- Regulation of the maximum retail price of LPG to ensure affordability of this energy source, particularly for low-income households; and
- Introducing about 50 units of advanced biomass cook-stoves for cooking in public institutions, hotels and restaurants.
- Introduction of a programme to promote solar home systems to remote households

2.1.4 Which (global) High-Impact Opportunities are relevant?

High-Impact Opportunities (HIO) are areas of action around which to organise multi-stakeholder actions across all relevant sectors of the economy; and tangible entry points for stakeholders interested in taking action in specific areas of interest. On energy access, the following are some of the HIO for Swaziland:

- building sustainable local value chains for clean and efficient cooking solutions;
- building market demand by raising awareness of their health, economic, environmental, and gender benefits;
- investing in the infrastructure and local distribution supply chains required for LPG;
- developing tiered standards for efficiency, emissions and safety;
- designing cooking appliances that meet consumer needs and price points;
- deployment of off-grid renewables and lighting and charging systems, including solar lighting; and self-contained systems that provide uninterrupted power when the grid fails.

2.2 Renewable energy

Swaziland imports all its petroleum and about 75% of its electricity needs hence the development of indigenous renewable energy resources is imperative so as to increase energy security and manage importation costs.

2.2.1 What is the current status and trajectory?

Almost all the electricity generated internally is from renewable energy sources, namely; hydro and sugar cane based co-generation. In 2013/2014 hydropower stations supplied 302.5 GWh and the co-generation plant by USL, 44.9 GWh to the national grid contributing 24.9% and 3.7%, respectively. USL is the only licensed IPP to feed renewable power to the grid and has the potential to push up the supply to 55 GWh per year.

Current feasibility studies for hydropower by MNRE have the potential to avail an additional 146.5 MW to the grid from different sites. The solar and wind maps under development, also by MNRE, will provide clarity of the potential for these resources. Swaziland has made available a capacity up to 60MW generated using intermittent resources such as solar PV and wind. So far, Swaziland has signed PPAs with IPPs with interest in solar PV up to 46 MW. It is anticipated that co-generation from forestry residue and sugar residue will provide an additional 35 MW and 80 MW, respectively.

Currently there are no programmatic activities that support either domestic or institutional solar water heating either as renewable energy resource or energy efficient devices.

2.2.2 What are the existing plans/strategies and what are the gaps?

The INDC has prioritised renewable energy as contributing to national mitigation efforts. The mitigation actions include the doubling the share of renewable energy in the energy mix including generation as well as reducing the use of non-sustainable biomass. The second action is the 10% blending of ethanol.

MNRE Strategic Plan (2014-2018) has prioritised a number of actions that will help it manage the national energy resources efficiently and effectively. Most of these actions will be towards the development of renewable energy. As such MNRE is finalising the development of an IPP policy and intends to develop feed-in tariffs as one of the mechanism to procure renewable power. The plan is to increase the renewable energy resources in the local power generation from 28% to 50% by 2018.

Although the 50% renewable energy contribution goal is possible but the timeline appears over ambitious. The projects that are planned are not that advanced in terms of preparation to come on line by 2018. It is still difficult for IPPs to come on board in the absence of an elaborate IPP policy framework and renewable energy procurement framework.

The prioritized interventions for increasing the contribution of renewable energy in the national energy mix, as presented in the Country Action Plan towards Sustainable Energy for All in Swaziland include:

- Developing appropriate policy instruments to promote renewable energy
- Development and implementation of renewable energy projects as well as demonstration projects on viable renewable energy technologies
- Gathering reliable data on renewable energy resources

What are the gaps?

- There is no structured procurement framework to support renewable energy
- The Renewable Energy and IPP policy is yet to be implemented
- There is no comprehensive resource database for renewable energy potential for use in developing bankable projects
- Although the potential for solar water heating is high, there is no programme on to support the technology in the domestic, and hospitality and tourism sectors. There is no strategy on how the 20% target all public buildings to have solar water heating by 2020 will be achieved.
- There is no mandatory policy to promote ethanol and biofuels for energy supply

2.2.3 What are the actions needed to achieve the overarching objective under renewable energy?

The government has set a number of targets to increase the share of renewable energy in the energy mix and the following actions will be undertaken:

- Install solar water heaters in 20% of all public buildings by 2020; A strategic action plan is required to guide the attainment of the target.
- Enforce national standards on solar water heaters with the support of the Swaziland Standards Authority (SWASA) by 2018;
- Establish fiscal incentives to promote renewable energy by 2022;
- Establish a demonstration centre for renewable energy technologies by 2022;
- Increase local electricity generation capacity with the projects listed in Section 2.1.3;
- Utilise the preliminary data for wind and solar PV zones to validate them with on-the-ground assessments for bankable projects; and
- Introduce mandatory blending starting off with ratios of 10% ethanol to 85% petrol.

Possible regulatory and policy instruments to promote grid-connected renewables will include;

- Feed-in-tariff for biomass and hydro power
- Tendering for large scale PV and wind
- Net-metering for roof top based PV
- Government subsidies for rural electrification with PV

2.2.4 Which (global) High-Impact Opportunities are relevant?

The HIO for renewable energy applicable to Swaziland include;

- wind, PV, hydropower, and bioenergy technologies,
- specific policies and business models to support the identified technologies (e.g., grid access, feed-in tariffs, tendering and net-metering and government subsidies).

2.3 Energy efficiency

2.3.1 What is the current status and trajectory

Energy efficiency has primarily been driven from the angle of DSM with SEC being the main promoter. With the increasing new household connections, the domestic sector is now a significant contributor to electricity consumption compared to other sectors as illustrated in Figure 16. SEC has focused on this sector with two main energy conservation measures; awareness campaigns on energy saving tips and distribution of CFLs. Regarding the industrial sector, SEC, again, is running awareness campaigns on saving tips as well as the utilization of a time-of-use tariffs.

The existing sugar mills of USL and RSSC are not optimized for power generation especially the boilers that are operating at low pressures.

2.3.2 What are the existing plans/strategies and what are the gaps?

The recently adopted SADC Roadmap for “Leapfrogging to Efficient Lighting, Appliances and Equipment in SADC” will see Swaziland saving **substantially** per year in 2030 by adopting energy-efficient refrigerators, air conditioners and distribution transformers. A strategy to adopt and deploy these energy efficient technologies would need to be developed and the cost there-of determined.

The MNRE Strategic Plan (2014-2018) identifies a number of energy efficiency actions that include:

- Awareness raising via different media channels
- Appliance labelling and standards for lighting and refrigeration

- Distribution of 500,000 energy efficient lamps and banning inefficient lamps
- Mobilising financial resources to cover the cost implementing energy efficient measures
- Energy auditing in public and private buildings

The actions need to be supported by enabling policy and regulations for them to take effect. MNRE needs to designate a national driver for energy efficiency. Missing is the role of solar water heating in contributing to energy efficiency goal. The technology has proven a winner for hot water preparation at household level and at tourist facilities.

Prioritized interventions for energy efficiency, as presented in the Country Action Plan towards Sustainable Energy for All in Swaziland, include:

- Addressing the lack of policy to promote energy efficiency programmes, which could be done through labelling and certification for efficient household appliances.
- Addressing the lack of awareness of the benefits of efficient use of energy among the public, private sector investors and financial institutions by demonstrating the benefits of efficient use of energy and conducting benefit-cost-analysis of the proposed measures.
- Addressing the lack of awareness of the benefits of efficient use of energy among the public, private sector investors and financial institutions by incentivizing and encouraging the efficient use of energy.

What are the gaps?

- There is no institutional framework in place to support energy efficiency save for DSM work conducted by SEC
- There are no standards and a labelling framework for energy efficiency devices and technologies
- The focus of energy efficiency awareness on lighting, power factor correction, and load management for large electricity consumers. There is no programme that addresses energy efficiency holistically in all sectors of the economy including agriculture, transport, buildings, etc.
- There are no incentives for undertaking energy efficiency or disincentives to the contrary

2.3.3 What are the actions needed to achieve the overarching objective under energy efficiency?

Some of the actions that will ensure that the overarching objective of energy efficiency is attained are:

- 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;
- Supporting the Construction Industry Council and Swaziland Standards Authority 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 such as Swaziland Water Services Corporation and others.
- 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 or at subsidized cost to carefully selected communities – 500,000 CFLs per year for 3 years - migrate to LEDs eventually;
- Promoting energy-efficient 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 implement a policy on energy efficiency rating and standards for appliances and equipment; and
- Encouraging industry to embrace ISO 50001, the energy management standard.

SEC and SERA will need to adopt a measurement and verification (M&V) framework to quantify the savings from the measures stated above. Such a framework will, on top of other things, quantify the potential savings from adopting the identified measures.

2.3.4 Which (global) High-Impact Opportunities are relevant?

The following High-Impact Opportunities are relevant to Swaziland:

- Reducing distribution losses and improving reliability;
- Improving the efficiency of existing co-generation power plants;
- Promoting variable-speed motors; energy management practices and systems; 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; and freight mode shifting (e.g., from trucks to trains);
- 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 behaviour 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.

2.4 Additional nexus targets

As a country that prides itself in upholding traditional culture, there are strong rural establishments in Swaziland that make the water-food-energy-health nexus issues critical. Women still play a vital role in the growing of food, its harvesting and preparation as well gathering water and firewood. Youth unemployment is very high in Swaziland hence sustainable energy should be viewed as a contributor to efforts in addressing the high unemployment menace. It is, therefore, imperative to mainstream gender into energy, water, food and climate change policies and strategies.

With the Tinkhundla system of governance in place, it is encouraged to use this bottom-up development planning process that is enshrined in the constitution of Swaziland to mainstream sustainable energy and climate change in the development agenda of the country. Since the major role of Tinkhundla is the development of a participatory and integrated development plan, topics that affect women mainly such as access to renewable energy technologies and LPG, for example, should be discussed together with other issues.

The additional targets for nexus include:

- Mainstreaming gender into policies and programmes and evaluating their effectiveness.
- Integrating climate change into programmes and projects and evaluating their effectiveness.
- Organising regular inter-ministerial and inter-agency meetings to review SE4ALL policies, programmes and projects.
- Mainstreaming SE4ALL in the Tinkhundla.

- Preparing and implementing annual programmes for public education and awareness creation.
- Developing standards for enhanced devices and strengthen regulations.
- Mainstream climate change in all energy activities, policies and regulations.

2.5 Enabling action areas

As indicated in Part 1 as well the energy access, renewable energy, energy efficiency and additional nexus Priority Action Areas, there is still a lot to be done mainly by the Government in creating an enabling environment for Swaziland to meet the objectives of SE4ALL. It is encouraged that Swaziland continue the path of engaging with the regional and international development partners to enhance the successful implementation of the priority action areas, taking advantage of knowledge sharing on proven technologies as well as best practices in the rollout of sustainable energy interventions. Notable among these potential partnerships relate to the Global Alliance for Clean Cookstoves, the Global LPG Partnership and the Africa Clean Cooking Initiative, IRENA, World Bank's RISE programme amongst others.

Some of the enabling action areas include:

- Reviewing and updating the National Energy Policy.
- Developing an energy integrated resource plan and subsequent sector plans.
- Training programmes for officials of energy institutions on capacity for project feasibility studies, development and implementation.
- Engaging with Swaziland Investment Authority (SIPA) in developing bankable projects from feasibility studies for promotion to investors.
- Engaging and working with SAPP's Project Preparation Facility to prepare generation projects into bankability.
- Working on addressing the risk perceptions on infrastructure projects, which tend to push up the cost of capital in developing countries including Swaziland.
- Developing business models that enable private sector to participate in rural energisation programmes allowing them to remain viable but at the same time making their services affordable.
- Technical training programmes for productive use of energy in SMEs.
- Training programmes for officials of Central Statistical Office on gathering data on energy access and utilization.
- Conducting consultations with stakeholders in LPG market value chain and developing and implementing regulatory structures and mechanisms for LPG market chain including its pricing.

- Conducting stakeholder consultations and developing and implementing domestic policy and legislation for promotion and development of cook-stoves.
- Enhancing the capacity of research and development institutions to contribute to the body of knowledge on Swaziland energy sector challenges and solutions.
- Establishing Improved Cook-stove Test Laboratory with appropriate equipment and skilled personnel.
- Working with SWASA to establish, adopt and implement appropriate standards for improved cook stoves, energy efficiency and renewable energy technology.
- Fully engaging with the financial sector in the design and implementation of improved cook stove programmes.

PART 3: COORDINATION AND FOLLOW-UP

3.1 National SE4ALL coordination structure

Due to the shared commitment by partners, the SE4ALL initiative has the convening power that will help build a common agenda, spur concerted action toward the set goals, and bring about greater coordination of local and development assistance. Since the initiative has the capacity to mobilise and leverage large-scale investment by fostering the enabling conditions, it is therefore important that the highest degree of coordination be adopted to effectively identify synergies and foster multi-stakeholder partnerships to address the challenges faces in meeting the SE4ALL objectives.

An effective coordination capacity and structure at national level is needed so as to sustain momentum over the SE4ALL implementation span and mainstream the initiative's core objectives in political and business decisions. A number of Priority Action Areas that have been identified would need to be delivered. Given the inclusive nature of SE4ALL, the coordination structure must be broad-based to include government, business sector, civic society and development partners. In coordinating SE4ALL 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.

Swaziland has a good history of implementing programmes through multi-stakeholder coordination structures with a couple of examples in the climate and desertification projects. A multi-stakeholder National Climate Change Steering Committee was established in 2011. The committee was tasked with overseeing the implementation of the National Implementation Strategy on Climate Change and other subsequent policy documents and actions. The Committee spearheaded the development of the country's 2014 Climate Change Strategy and Action Plan and the 2015 National Climate Change Policy. The composition of the committee is members from a total of 14 institutions cutting across the public sector, private sector, civic society, academia and municipalities.

The National Steering Committee on Desertification is a multi-disciplinary committee responsible for coordinating and guiding the implementation of the provisions of the United Nations Convention to Combat Desertification and coordinate efforts by stakeholders. It's composed of representatives from the following organizations; the private sector, civic society, the University

of Swaziland, Energy Department, Meteorology Department, Disaster Task Force, Information Unit of the Ministry of Agriculture, Forestry Department, National Environment Education Programme, Land Use Planning Section, Economic and Policy Administration Section, Deputy Prime Minister’s Office, Swaziland Environment Authority, and UNDP. The representation in the committee is such that 68% is government and 32% is from private sector, civic society and the academia. An interesting fact is that 27% of the committee is women.

The National SE4ALL coordination structure proposed will borrow heavily from structure set-up of other similar programmes and will be composed of 2 committees: Steering Committee and the National Expert Group. The composition of the groups by institution and their roles are provided in the Tables 4 and 5. MNRE is will play a pivotal role in coordinating the work of both committees. The Department of Energy Affairs assumes the role of National SE4All Coordinator/Secretariat.

3.1.1 Composition of the Steering Committee

The steering committee is composed of government ministries, agencies, private sector and civic society. The MNRE and Ministry of Tinkhundla Administration and Development will chair and deputise the Steering Committee, respectively (see Table 4).

Table 4: The Steering Committee for SE4ALL

Institution	Role
Ministry of Natural Resources and Energy	Chairperson
Ministry of Tinkhundla Administration and Development	Deputy Chairperson
Ministry of Tourism and Environmental Affairs	Member
Ministry of Agriculture	Member
Ministry of Public Works and Transport	Member
Ministry of Economic Planning and Development	Member
Ministry of Finance	Member
Ministry of Health	Member
Ministry of Housing and Urban Development	Member
Swaziland Investment Promotion Authority	Member
Federation of Swaziland Employers and Chamber of Commerce	Member
Swaziland Energy Regulatory Authority	Member
Swaziland Electricity Company	Member
Renewable Energy Association of Swaziland	Member
Co-ordinating Assembly of Non-Governmental Organisations	Member
Swaziland Sugar Association	Member
United Nations Development Programme	Observer
TOTAL	17

3.1.1.1 Duties and responsibilities of Steering Committee

The Steering Committee mixes technical expertise and socio-economic and political expertise required to meet objectives of SE4ALL for Swaziland by providing strategic policy guidance. They will **meet quarterly** in the execution of their mandate.

Key duties and responsibilities include:

1. Endorse the actions, plans and projects that contribute to the objective of SE4ALL and ensure their mainstreaming into the national development programmes.
2. Review, monitor and evaluate the implementation of energy access, energy efficiency, renewable energy and cross cutting plans and programmes.
3. Mobilise and coordinate resources needed for the implementation of the SE4ALL priority action plans from government, private sector, development partners and others.
4. Allocate the secured resources efficiently.
5. Review the implementation of the actions, plans and projects.
6. Mobilise and coordinate resources required for implementation of the action plans.
7. Authorize/establish ad hoc thematic groups.
8. Commission follow-up analysis of the Priority Action Plans.

3.1.2 Composition of the National Expert Group

The National Expert Group is largely made of technocrats who are the foot soldiers, programming the SE4ALL action plans. Reporting to the Steering Committee, the National Expert Group will invite experts from anywhere when needed for technical support. The National Expert Group is composed of technocrats in government ministries, specialized agencies, private sector and civic society. The MNRE and Ministry of Economic Planning and Development will chair and deputise the National Expert Group, respectively.

3.1.2.1 Duties and responsibilities of National Expert Group

The Group will **meet twice every quarter** and may divide themselves into thematic or working groups to effectively execute their mandate. One important working group could be dealing with investment and financing possibly chaired by Swaziland Investment Promotion Authority.

Key duties and responsibilities include:

1. Identify the implementation modalities and programmes of the SE4ALL action plans.
2. Identify and analyse the plans, actions and projects to be implemented in support of the SE4ALL objectives.
3. Follow up the implementation progress of the identifies actions
4. Support the processes that will lead to the identification of energy access, renewable energy and energy efficiency projects.
5. Identify the funding requirements and sources of funding for the programmes.

6. Increase awareness of the general public on issues of energy access, renewable energy and energy efficiency through various media channels.
7. Support mainstreaming of objective of SE4ALL in national priorities and policy papers.
8. Identify partners for the Priority Action Areas and engage key bilateral and multilateral donors,

Table 5: The National Expert Group

Institution	Role
Ministry of Natural Resources and Energy	Chairperson
Ministry of Economic Planning and Development	Deputy Chairperson
Ministry of Tourism and Environmental Affairs	Member
Ministry of Agriculture	Member
Ministry of Public Works and Transport	Member
Ministry of Health	Member
Ministry of Housing and Urban Development	Member
Swaziland Investment Promotion Authority	Member
Federation of Swaziland Employers and Chamber of Commerce	Member
Swaziland Energy Regulatory Authority	Member
Swaziland Electricity Company	Member
Renewable Energy Association of Swaziland	Member
University of Swaziland	Member
Swaziland Environment Authority	Member
Swaziland Standards Authority	Member
Swaziland Water Services Corporation	Member
Swaziland Development Finance Corporation	Member
Swaziland Sugar Association	Member
United Nations Development Programme	Member
TOTAL	19

3.2 Follow-up analysis

The efficient delivery of the Priority Action Plans and projects and their effectiveness can only be achieved if there is a follow up analysis of their design and implementation. The Steering Committee of the SE4ALL Action Agenda must support in-depth studies of some of the proposed actions, and independent follow-up analysis of the Action Agenda’s design and implementation.

The key follow-up analysis must consider detailed action plans and projects, and scenario studies. The identified Priority Actions will need to be broken into specific projects with timelines and budgets with assigned responsibilities. Additional actions may arise during the course of implementation of the list of actions identified above. These actions would need to be reviewed to capture and integrate developments emanating from the new strategies for the energy sector including the IRP, updated the Energy Policy, etc.

The follow up analysis should also include:

- In-depth studies and analysis of climate change scenarios especially on the hydrological patterns and their impact on the energy sector.
- Assessment of costs of different pathways to the SE4ALL goals given the rapid changes in the energy sector from technological breakthroughs in generation to socio-economic dynamics.

3.3 Monitoring, evaluation and reporting

The SE4ALL Action Agenda is complex in that it involves various projects and programmes involving various stakeholders. It is important to track the implementation and progress made by these projects in meeting the SE4ALL objectives. Such a tracking framework will not only enhance accountability and transparency but also will help review and implement corrective measures to enhance the effectiveness of the actions.

A detailed Monitoring, Evaluation and Reporting (MER) system for tracking and reporting on program time-bound milestones and accomplishments will be prepared by the SE4All Secretariat and validated by the SE4All coordination committees at the beginning of the project implementation which will be periodically updated.

Designing and implementing a MER system is an essential task that will allow Swaziland to track, assess and report progress on the achievement of expected outcomes under the SE4All initiative. The MER, as tool, allows for identifying key issues that need to be addressed to ensure a proper implementation of the Action Agenda. It will also allow the Kingdom of Swaziland to review and update the Action Agenda in the future. The MER system will therefore comprise a Monitoring Plan, an Evaluation Plan, and a Reporting Plan.

The overall objective of the MER process is to track national progress toward the three core objectives, draw lessons from successes and gaps in implementation of the action and activities, by:

- Reviewing annually the Action Agenda implementation, underlining the achievements and gaps;

- Measure progress made against the targets;
- Highlighting and drawing lessons based on reality on the ground; and
- Allowing for the feedback loop to shape the direction of the actions and activities

Monitoring

The monitoring exercise in Swaziland would be linked to the SE4ALL Global Tracking Framework (GTF) that has concrete indicators for measuring and tracking global progress towards meeting the three objectives. Swaziland will use the GTF to measure and track progress in energy access, renewable energy, and energy efficiency at national level. For measuring energy access, the GTF uses a more pragmatic multi-tier approach that presents access as a combination of seven attributes of energy supply (see Figure 17). This is contrary to the traditional binary measurement of energy access, with or without connection, which does not capture the variations of energy supply.

		Tier 0	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5	
Attributes	1. Peak capacity	Power	Very low power, minimum 3 watts	Low power, minimum 50 watts	Medium power, minimum 200 watts	High power, minimum 800 watts	Very high power, minimum 2 kilowatts	
		and Daily capacity	Minimum 12 watt-hours	Minimum 200 watt-hours	Minimum 1.0 kilowatt-hours	Minimum 3.4 kilowatt-hours	Minimum 8.2 kilowatt-hours	
		or Services	Lighting of 1,000 lumen-hours per day	Electrical lighting, air circulation, television, and phone charging are possible				
	2. Duration	Hours per day	Minimum 4 hours	Minimum 4 hours	Minimum 8 hours	Minimum 16 hours	Minimum 23 hours	
		Hours per evening	Minimum 1 hour	Minimum 2 hours	Minimum 3 hours	Minimum 4 hours	Minimum 4 hours	
	4. Affordability	Cost of a standard consumption package of 365 kilowatt-hours per annum is less than 5 percent of household income						
	3. Reliability						Maximum 14 disruptions per week	Maximum 3 disruptions per week of total duration less than 2 hours
	5. Legality						Bill is paid to the utility/prepaid card seller/authorized representative	
	6. Health and safety						Absence of past accidents/ no perception of high risk in the future	
	7. Quality						Voltage problems do not affect use of desired appliances	

Figure 17: Multi-tier matrix for access to household electricity supply

The GTF is also evolving to bring forward indicators that reflect relevant and practical attributes for access, energy efficiency, renewable energy and the nexus. It is important has as the global metrics for energy access to cooking are developed and refined, Swaziland adopts these to measure and track progress in that sector using a multi-tier approach. Figure 17, illustrates the framework for tracking access to energy. The SE4All Secretariat will need to plan the collection and tracking of key indicators for the priority actions. Table 6, shows an example of indicators that may be used in Swaziland.

Table 6: Illustrative list of indicators for the SE4All initiative

Goal	Indicators	
Sustainable economic growth	Deaths by indoor air pollution (deaths/year)	
	GDP per capita (USD/person/year)	
	National electricity generation capacity (MW)	
	Poverty in rural and urban areas (%)	
SE4All Global Objective 1: Universal access to modern energy services		
Increase electricity access	National electricity access rate (%)	Percentage of population with electricity access calculated as % of households with connections
	Energy consumption per capita (kWh/person/year)	
Increase access to modern cooking solutions	National access rate to modern cooking solutions (%)	Percentage of population with access to modern cooking solutions.
SE4All Global Objective 2: Doubling the share of renewable energy in the global energy mix		
Increase renewable energy share in the national mix	Share of renewable energy in the national energy mix (%)	Proportion of installed capacity from renewable energy sources over the total installed capacity
	On-grid renewable energy installed capacity (MW)	
	Off-grid renewable energy installed capacity (MW)	
	Sustainable biomass used in process heat (%)	
SE4All Global Objective 3: Doubling the global rate of improvement of energy efficiency		
Reduced energy intensity	Reduction in the annual rate of energy intensity per year (%)	
	Energy losses in electricity supply (%)	

Evaluation

The evaluation of the SE4All will 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 will ensure a broad and representative perspective on the achievements and challenges in the implementation of priority actions, and will 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 two-fold:

- To contribute to improving program effectiveness and delivery towards Swaziland's SE4All 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 SE4All initiative.

During the annual SE4All evaluation, the SE4All Coordinator will review:

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

Reporting

The Department of Energy Affairs, as the National SE4All Coordinator shall report on an annual basis on the progress and performance towards the implementation of the SE4ALL Action Agenda. A Performance Assessment report will be prepared annually using the monitoring and evaluation results and shared with stakeholders for awareness, socialization and proper contributions on their part. The report will clearly show the baseline scenario and the progress made against the targets set.

Regular updates will be made to the SADC Secretariat, and the SE4All Africa Hub (a partnership between the African Development Bank, the African Union Commission, the NEPAD Planning and Coordination Agency and UNDP).

3.4 Link to 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 SE4ALL target is only made possible with the right and adequate investments. For Swaziland, the Action Agenda and Investment Prospectus were jointly developed to ensure the desired strong link. The Investment

Prospectus contains investment opportunities as well as “hard” and “soft” priority projects identified in the Action Agenda. The projects in the IP are those that can be implemented in the short term and have been prepared adequately to attract investments.

PART 4: CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

The Action Agenda is developed at a time when the Kingdom of Swaziland is aspiring to be in the top 10% of the medium human development group of countries founded on sustainable economic development, social justice and political stability by the year 2022. The country, however, is not self-sufficient in energy supply, relying on 100 % imports for its petroleum and up to 75% of electricity requirements.

Energy access is still a key challenge as about 50% of rural habitants rely on solid biomass for cooking with household air pollution affecting about 161,913 households. Swaziland Electricity Company (SEC) is implementing grid extension projects with the support of the government, whilst there are ad hoc off-grid renewable energy projects implemented by the Ministry of Natural Resources and Energy. Swaziland aspires to attain universal access by year 2022. Affordability of energy services in rural areas is a challenge but it could possibly be alleviated through a nexus approach to development.

Internal power generation is almost 100% hydro and co-generation from biomass and additional hydropower both have the potential to make Swaziland self-reliant in renewable energy if the current projects under consideration are development. Over reliance on hydropower, however, increases the threats of security of supply due to drought and climate change. Solar photovoltaics and wind energy have the potential to contribute to the energy mix but the priority areas for both resources, as identified by IRENA's 2015 Renewable Energy Zoning study, will need to be validated by ground assessments. The sugar industry is a big producer of ethanol, which is all exported. If blending is made mandatory and appropriate pricing adopted, the 60 million litres of ethanol currently produced by the sugar industry can be off-loaded into the local market.

Energy efficiency is presently promoted under demand-side management initiatives. The domestic sector has been the main priority for SEC largely because it is subsidized by the commercial and industrial sector and energy consumption is rising annually in that sector. The recently adopted SADC Roadmap for "Leapfrogging to Efficient Lighting, Appliances and Equipment in SADC" has the potential of substantial savings of energy per year in 2030 in Swaziland through the adopting of energy-efficient refrigerators, air conditioners and distribution transformers. A strategy to adopt and deploy these energy efficient technologies would need to be developed and the cost there-of determined.

A number of Priority Action Areas have been identified on Energy Access, Renewable Energy, Energy Efficiency, Additional Nexus Targets and Enabling Action Areas. Swaziland should prioritise increasing local electricity generation capacity from indigenous renewable energy resources; promotion of energy efficiency programmes, which could be done through labelling and certification for efficient household appliances; and continue the path of engaging with the regional and international development partners to enhance the successful implementation of the priority action areas, taking advantage of knowledge sharing on proven technologies as well as best practices in the rollout of sustainable energy interventions.

Creating enabling frameworks for Priority Action Areas to be implemented is a must and SE4ALL must be mainstreamed in Tinkhundla to take advantage of its participatory and integrated development approach and ensure that topics that affect women mainly such as access to renewable energy technologies and LPG can be discussed together with other issues.

An effective coordination capacity and structure at national level is proposed so as to sustain momentum over the SE4ALL implementation span and mainstream the initiative's core objectives in political and business decisions. The monitoring and evaluation exercise should be linked to the SE4ALL Global Tracking Framework that has concrete indicators for measuring and tracking global progress towards meeting the three objectives.

4.2 Recommendations

Key recommendations for the Action Agenda for Swaziland are outlined in Table 7, below.

Table 7: Summary of Key Recommendations

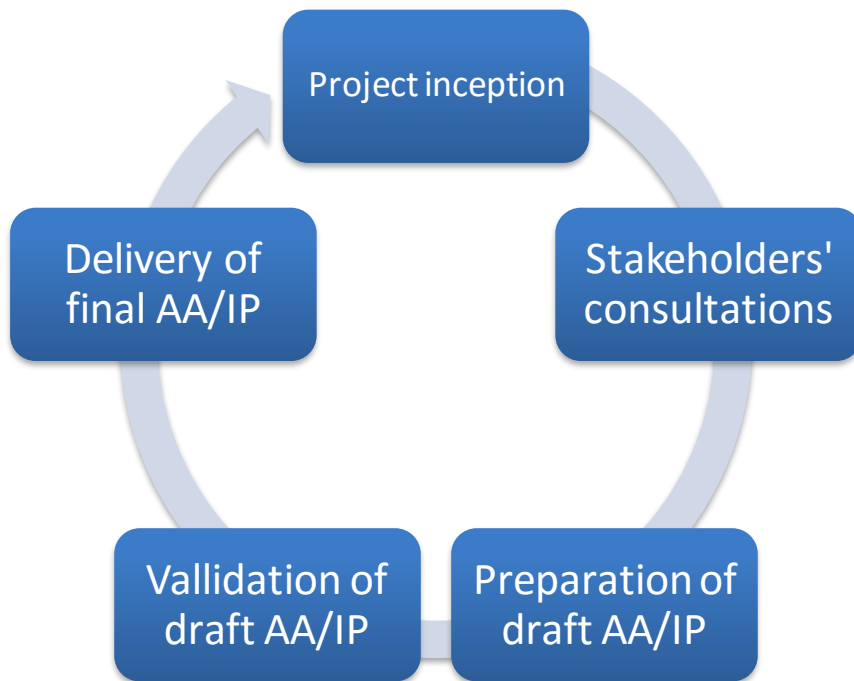
Priority Action Area	Recommendations	Responsible Party	Priority
1. Increase generation from indigenous renewable energy resources in the supply mix	<ul style="list-style-type: none"> • Create enabling frameworks with incentives for IPPs to participate in. • Develop an integrated resource plan • Finalise feasibility studies for hydropower • Validate solar and wind energy zones identified by IRENA 	MNRE	Very urgent
2. Improve access to modern energy for cooking and lighting	<ul style="list-style-type: none"> • Develop a Rural Energy Master Plan with key responsibilities and adequate resources • Promote the use of LPG and clean cookstoves • Promote the deployment off-grid renewables and lighting and charging systems, including solar lighting; through viable business models 	MNRE	Very urgent
3. Use ethanol as substitution to petroleum	<ul style="list-style-type: none"> • Introduce mandatory blending starting off with ratios of 10% ethanol to 85% petrol. 	MNRE	Very urgent
4. Promote energy-efficient refrigerators, air conditioners, distribution transformers and other appliances	<ul style="list-style-type: none"> • Introduce an energy efficiency policy, appliance labelling and standards and increase energy awareness. • Encourage industry to embrace and adopt ISO 50001 	MNRE, Swaziland Standards Authority	Very urgent
5. Upscale enabling action areas	<ul style="list-style-type: none"> • Review and update the National Energy Policy. • Develop an energy integrated resource plan and subsequent sector plans. • Build capacity on project feasibility studies and implementation. 	MNRE and SERA	Very Urgent
6. Increase awareness on project opportunities	<ul style="list-style-type: none"> • Develop bankable projects through feasibility studies • Engage SIPA for promotion to investors. 	MNRE, SIPA, SEC	Very urgent
7. Promote energy efficiency in the built environment	<ul style="list-style-type: none"> • Introduce energy efficient building codes • Promote the establishment of green building council of Swaziland 	Construction Industry Council, Ministry of Public Works and Transport	Urgent

Priority Action Area	Recommendations	Responsible Party	Priority
8. Increase gender participation in the nexus targets	<ul style="list-style-type: none"> Mainstream the nexus targets in the Tinkhundla 	Ministry of Tinkhundla and MNRE	Urgent
9. Improve quality and data availability	<ul style="list-style-type: none"> Train officials of Central Statistical Office and MNRE on gathering data on energy access and utilization. 	MNRE	Urgent
10. Coordinate the implementation of AA	<ul style="list-style-type: none"> Establish an effective multi-stakeholder coordination structure comprising of the Steering Committee, the National Expert Group and the Validation Stakeholder Group 	Office of the Prime Minister and MNRE	Urgent
11. Measure and track the progress	<ul style="list-style-type: none"> Measure and track the progress in meeting the SE4ALL objectives using the GTF. 	MNRE	Urgent

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ANNEX 1: SWAZILAND ACTION AGENDA DEVELOPMENT PROCESS



ANNEX 2: STAKEHOLDERS' CONSULTATIONS

The following list comprises entities engaged in the stakeholder consultations:

I. Mbabane

1. Ministry of Natural Resources and Energy
2. Ministry of Tourism and Environmental Affairs
3. Ministry of Agriculture, Department of Home Economics
4. Ministry of Tourism and Environmental Affairs, Department of Meteorology
5. Ministry of Public Works and Transport, Department of Public Works
6. Ministry of Agriculture, Department of Land –Use Planning
7. Ministry of Economic Planning and Development
8. Swaziland Electricity Regulatory Authority
9. Swaziland Electricity Company
10. Swaziland Standards Authority
11. Swaziland Development Finance Corporation
12. Swaziland Investment Promotion Authority
13. Swaziland Environment Authority
14. Swaziland Water Services Corporation
15. United Nations Development Programme

II. Simunye

Royal Swaziland Sugar Corporation

I. Big Bend

Swaziland Sugar Industry

II. Siteki

Nsubane Community Group

Annex 3: Simplified multi-tier matrix of energy access

Attributes of energy supply		Tier 0	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5	
Capacity	Household electricity	No electricity*	Very low power	Low power	Medium power	High power		
	Household cooking	Inadequate capacity of the primary cooking solution				Adequate capacity of the primary cooking solution		
Duration and availability	Household electricity	<4 hours	4-8 hours		8-16 hours	16-22 hours	>22 hours	
	Household cooking	Inadequate availability of the primary cooking solution				Adequate availability of the primary cooking solution		
Reliability	Household electricity	Unreliable energy supply				Reliable energy supply		
Quality	Household electricity/cooking	Poor quality of energy supply			Good quality of energy supply			
Affordability	Household electricity	Unaffordable energy supply		Affordable energy supply				
	Household cooking	Unaffordable energy supply				Affordable energy supply		
Legality	Household electricity	Illegal energy supply			Legal energy supply			
Convenience	Household cooking	Time and effort spent sourcing energy cause inconvenience			Time and effort spent sourcing energy do not cause inconvenience			
Health and safety	Household electricity	Unhealthy and unsafe energy system				Healthy and safe energy system		
	Household cooking ^a	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5	

Source: World Bank/ESMAP