



*Government of
Swaziland*

*Ministry of Natural
Resources and Energy*



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Programme Framework for Affordable Renewable Energy in Swaziland (PARES)

Programme Concept, February 2018

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Abbreviations

AfDB	African Development Bank
CCU	Climate Change Unit
COMESA	Common Market for East and Southern Africa
CSER	Centre for Sustainable Energy Research
DoE	Department of Energy
DRE	Decentralised Renewable Energy
EML	Electricity Market Liberalization
ESKOM	Electricity Supply Commission of South Africa
EU	European Union
GCF	Green Climate Fund
GEF	Global Environment Facility
GWh	Gigawatt-hour
IEA	International Energy Agency
IEC	International Electrotechnical Commission
IPP	Independent Power Producer
IRENA	International Renewable Energy Agency
kW	Kilowatt
MNRE	Ministry of Natural Resources and Energy
MTEA	Ministry of Tourism and Environmental Affairs
MW	Megawatt
MWh	Megawatt-hour
NCCC	National Climate Change Committee
NDS	National Development Strategy
NEP	National Energy Policy
NEPIS	National Energy Policy Implementation Strategy
NGO	Nongovernmental Organisation
PARES	Partnership for Affordable Renewable Energy in Swaziland
PRSAP	Poverty Reduction Strategy and Action Plan, 2007
RE	Renewable Energy
REAF	Rural Energy Access Fund
REASWA	Renewable Energy Association of Swaziland
REEESAP	Renewable Energy and Energy Efficiency Strategy and Action Plan

REIPPPP	Renewable Energy Independent Power Producer Procurement Program
RES	Renewable Energy Systems
RSSC	Royal Swaziland Sugar Corporation
SACREEE	Southern African Centre For Renewable Energy and Energy Efficiency
SADC	Southern African Development Corporation
SAPP	Southern African Power Pool
SDG	Sustainable Development Goals
SE4ALL	Sustainable Energy for All
SEC	Swaziland Electricity Company
SERA	Swaziland Energy Regulatory Authority
SHS	Solar Home Systems
SIPPP	Swaziland Independent Power Producer Policy
SKEPRE	South-South Knowledge Exchange Programme for Renewable Energy
TPES	Total Primary Energy Supply
UNDP	United Nations Development Program
UNISWA	University of Swaziland
USD	United States Dollar
USL	Ubombo Sugar Limited
WHO	World Health Organisation

Executive Summary

The Kingdom of Swaziland, situated in the southern part of Africa imports almost all of its base load grid electricity from its neighbours, and this is generated mainly from fossil fuels. Swaziland has great potential for generating clean and affordable on-grid electricity from its renewable energy (RE) resources (e.g. solar, wind, small hydro, and residues from the sugar and timber industries), and could meet the entire national demand of 220 MW of on-grid electricity if fully exploited, and further have excess power for exporting to the Southern African Power Pool.

Around 79% of Swaziland's population is based in rural areas¹ with livelihoods predominantly dependent on subsistence agriculture, and is therefore highly vulnerable to climate change. Poverty head count was estimated around 73% in rural areas in 2010 while at only 31% in urban areas. The rural electrification rate in rural areas in Swaziland is 65% with some rural communities located in remote areas that are inaccessible to the power grid. Rural electrification developments must therefore include both on-grid and off-grid solutions in order to accelerate the delivery of sustainable and affordable RE nationally.

This document presents a results framework for achieving affordable clean energy for all in Swaziland through Partnership for Affordable Renewable Energy in Swaziland (PARES), and is directed at the primary implementers of the programme. The programme will be executed by MNRE through its Department of Energy, in partnership with the Climate Change Unit at the Ministry of Tourism and Environmental Affairs. Implementation will be supported by UNDP which will be responsible for the strategic development partnership framework for PARES programme funding, as well as implementing the RE development project financial facilities.

The PARES global development objective is *to support Swaziland's transformational shift to a low-emission and resilient development by accelerating the delivery of sustainable and affordable renewable energy to the people of Swaziland*. The programme's target major outcomes include:

- A significant decrease in rural poverty through the roll-out of affordable and sustainable RE systems
- An attractive investment environment and sustainable market for RE through the structural transformation and institutional development of the electricity sector

¹ WHO, 2017.

- Increased adaptive capacity and resilience of the economy of Swaziland and its population against climate change through integrated sustainable management and policy coherence for water dependent energy resources (hydro and bioenergy)
- Improved capacity for driving technical and policy innovation through regional knowledge exchange platforms and research networks
- Increased collaboration, coordination and participation of key national stakeholders, International Financing Institutions and technical agencies through a well-defined partnership framework

The programme implementation requires investments on four strategic objectives as follows:

1. Promoting off-grid solutions and formulation of pro poor investment support programme for decentralized RE deployment: *USD 7.70 million*
2. Promoting and supporting investment in on-grid RE solutions: *USD 9.02 million*
3. Securing biomass power resources through increased sustainability, efficiency and productivity: *USD 6.1 million.*
4. Institutional and personnel capacity building for up-scaling the deployment of RE in Swaziland: *USD 0.90 million.*

Integrated Research, Monitoring and Evaluation component (USD 380,000) and supporting adaptive management (USD 1.8 million), contribute to the total programme management budget around USD 2.18 million. The total programme budget is *USD 25.9 million and the anticipated timeframe is 2018-2024.*

1 Access for All to Affordable Clean Energy in Swaziland

1.1 Background – Purpose of the Document

This document presents a results framework for achieving affordable clean energy for all in Swaziland through the Partnership for Affordable Renewable Energy in Swaziland (PARES)., and is directed at its primary implementers. These include two units in the Government of Swaziland Department of Energy in the Ministry of Natural Resources and Energy (MNRE) and the Climate Change Unit (CCU) in the Ministry of Tourism and Environmental Affairs (MTEA). Implementation will be supported by UNDP which will be responsible for the strategic development partnership framework for PARES funding, as well as implementing the Renewable Energy (RE) development project financial facilities. It has been prepared to facilitate participatory discussions between the primary implementers as they work with stakeholders by building consensus and ownership around shared objectives to achieve specific outcomes of the PARES programme. The specific outcomes for the programme include:

- Delivery of sustainable and affordable clean renewable energy (RE) to the people of Swaziland
- Significant reduction of poverty in rural populations through the roll-out of an investment programme for affordable off-grid RE systems
- A transformed electricity sector that is more investment friendly to both on-grid/off-grid RE development projects
- An integrated sustainable resource management system for the energy resources that promotes resilience of the economy of Swaziland against climate change

1.2 Brief Country Profile

The Kingdom of Swaziland is a small landlocked country with an area of 17365 km² and a population of 1.1 million². It is located between 25.72° and 27.32°S and 30.79° and 32.13°E in the southern part of Africa (Figure 1). The country is bounded by South Africa in the north, west and south, and by Mozambique on the east. Although Swaziland is classified as a lower-middle income country, its economic output is undermined by the extreme high prevalence of HIV in the adult population and a high youth unemployment rate of 53% (details in Annex 1). Around 79% of Swaziland's population is

² Central Statistical Office, 2017.

³ WHO, 2017

based in rural areas³ with livelihoods predominantly dependent on subsistence agriculture and is therefore highly vulnerable to climate change. Poverty head count was estimated around 73% in rural areas in 2010 while at only 31% in urban areas. Climate change presents Swaziland with serious challenges in the decades ahead and over the past two decades a high frequency of El Nino drought has been observed. The impact of climate change on water, and consequently on energy security and food security (reduced irrigation, destruction of livestock, less potential for rain-fed agriculture, scarcity of drinking water), severely impacts women and youth, and thus contribute to the high poverty rate cycle in the rural areas.

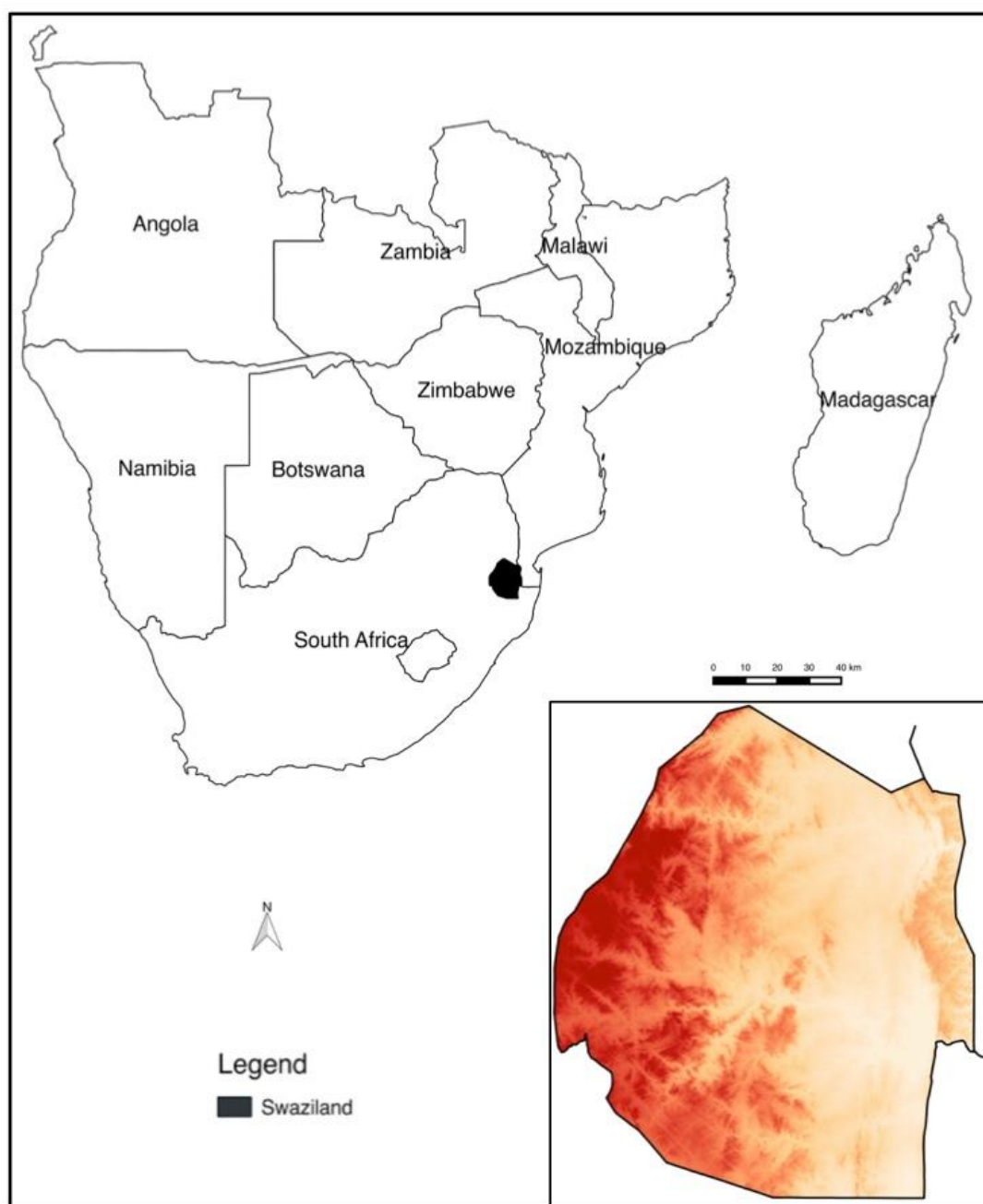


Figure 1 Locational map of Swaziland in Africa

1.3 Swaziland Mix and Energy Insecurity

Energy security and energy poverty are at the heart of Swaziland's vulnerability to climate change, its economic fragility and widespread poverty. Lack of access to affordable energy undermines the country's development goals and disproportionately affects women. Swaziland's energy demand is currently served by six primary sources that include (a) local resources constituting hydroelectricity and domestic biomass in the form of wood fuel mainly from the indigenous forests and bagasse from the sugar industry, and (b) imports in the form of petroleum products, electricity, and bituminous coal,

as shown in Figure 2. It must also be pointed out that the bagasse contribution includes supplementation with wood chips from the timber industry. The country relies entirely on imported electricity for base load which is normally around 80% of the total electricity consumption. During drought periods when the national hydro capacity becomes unavailable, 100% of the electricity consumed is imported. The future of the electricity supply is insecure as the current electricity import agreement with South African energy utility, ESKOM expiring in the year 2025. ESKOM itself is currently faced with challenges in upgrading its electric power stations, and therefore there is a great uncertainty in the renewal of another long term agreement. A quick and viable solution to this energy insecurity is the rapid up-scaling of the country's vast potential for RE.

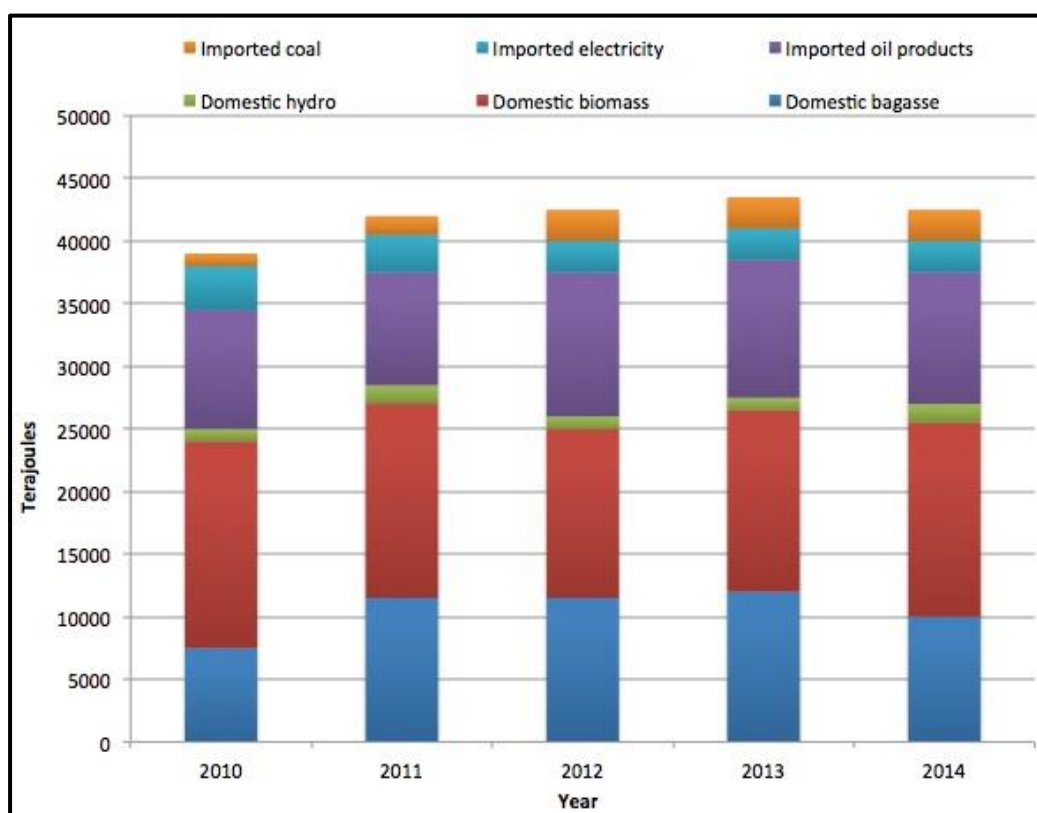


Figure 2 The total energy supply for Swaziland for the period 2010 – 2014

1.4 Potential of RE in Swaziland

RE has a vital role to play in Swaziland's energy future. The country is endowed with RE resources such as solar, wind, small hydro, residues from the sugar industry and forest products. Studies indicate that through its potential for hydropower (1000 MW), solar (1010 MW) and wind energy (1285 MW), the country could not only be 100% self-sufficient in energy, but additionally would have substantial export capacity, given that currently the national demand is 220 MW of electricity. A developed RE sector in Swaziland has the potential to increase access to electricity significantly, which would in turn

increase energy security, offer environmental benefits and create green jobs, while providing reliable affordable electricity.

- **Biomass energy:** - Currently, biomass energy sources (firewood, bagasse from the Sugar industry, wood chips from the timber industry) contributes to over 60% of the total primary energy supply (TPES) in Swaziland. Firewood is mainly used by 90% of the rural population for cooking and heating purposes. Timber and sugarcane (bagasse) are the two key potential resources for biomass electricity in the country, and there are already negotiations to produce and sell up to 35 MW of electricity from forestry products. The country's two sugar companies, Ubombo Sugar Limited (USL) and the Royal Swaziland Sugar Cooperation (RSSC), combined installed generation capacity of 105 MW⁴ of electricity from sugarcane bagasse, and with additional investment for new generation capacity and improvement in efficiency can potentially export 60 MW to the national grid. USL is already supplying the national grid and in the 2015/2016 financial year it supplied 55.6 GWh of electricity which was 31% of local grid-electricity production.
- **Hydropower:** - Hydropower is currently the main domestic national source of RE (electricity) produced in the country with recorded capacity of approximately 60 MW in 2016. Swaziland Electricity Company (SEC), the national power utility company, operates four grid-connected hydropower plants in Swaziland, namely, Edwaleni (15 MW), Ezulwini (20 MW), Maguduza (5.6 MW) and Maguga (19.8 MW). All of these stations work as peaking power plants and for emergency power generation. In the case of Swaziland, hydropower is used for peaking or as an emergency source of power mainly due to inadequate water resources. Existing dams in the country are prone to siltation due to land use change in the catchment area. In addition, there have been major changes in rainfall patterns in the recent years, giving rise to uncertainty in power generation from hydropower schemes. Recent surveys indicate that Swaziland has a potential of 110 MW technically exploitable hydropower, with 61 MW economically exploitable with current technologies.
- **Solar energy:** - Solar energy is one of the most viable RE in Swaziland, both for off-grid and on-grid solutions, given that the country receives 4-6 kWh/m² solar radiation per day. A recent survey conducted by MNRE indicates that the country has potential of 1010 MW that is commercially viable in different locations of the country as shown in Table 1. In addition, there are a number of small privately owned solar PV systems operating in parallel to the grid. Finally, there is one pilot grid connected solar PV of 100 kW located near the town of Siteki in eastern

⁴ USL and RSSC installed capacities are 40MW and 65MW, respectively

Swaziland installed and operated by an Independent Power Producer (IPP). This IPP plans to increase its power production to 22 MW.

- **Wind energy:** - Various wind power resource studies have been undertaken in Swaziland resulting in inventories of possible wind power sites under various zones that are also shown in Table 1. With the help of these zoning studies, a total of 17 potential zones for wind power generation have been identified. These have a total production capacity of approximately 2.2 million MWh.

Table 1. A review and analysis of some of the potential sites for wind and solar energy generation

Name of Site	Land Area	Estimated Potential	
		Solar PV (MW)	Wind (MW)
Palata	1.4 km ² flat land for solar PV or wind turbines	50	100
Mgamane	40 km ² flat land for solar PV or wind turbines	300	300
Gege	4 km ² flat land for solar PV or wind turbines	80	100
Lomahasha	0.27 km ² flat land for solar PV or wind turbines	10	50
Mhlumeni	6 km ² flat land for solar PV or wind turbines	100	100
Bhunya	Forest area: not suitable for PV installations	Not possible	100
Mambane	0.2 km ² flat land for solar PV, other land suitable for wind installations	10	100
Nkhaba 1	4 km ² rocky terrain difficult for solar PV, but suitable for wind power	60	50
Nkhaba 2	1.6 km ² flat terrain for solar PV or wind installations	40	35
Ntabamhloshana	2.6 km ² terrain for solar PV or wind installations	40	20
Sibebe 2	0.6 km ² terrain for solar PV or wind installations	20	30
Total		1010	1285

Source: MNRE, 2016

1.5 Key Challenges Faced by the RE Sector

While the exploitation of RE sources to deliver clean and affordable energy is apparent for Swaziland, and is also the most viable solution to reduce the over-reliance on imported energy, there are a number of challenges that are faced by the RE industry.

- 1. Uncertain investment conditions.** Currently, electricity from RE sources in Swaziland does not compete favorably in terms of pricing with electricity imported from existing power plants in neighbouring countries. The introduction of RE sources – such as biomass, solar, wind and small hydro – for power generation requires deliberate policy or regulatory instruments that guarantee a special tariff and compel utilities to give them preference in dispatch. These market conditions are necessary for grid in-feed of RE technologies developed by IPPs. Current investment conditions are also affected by high initial investment cost of energy generation from solar, wind and small hydro, as well as barriers to the availability of land with secure tenure for private sector investment in large-scale solar PV development.
- 2. Lack of awareness of RE options and their potential.** There is very limited or an unavailability of information on the cost comparison on RE sources vis-à-vis conventional sources of energy in the country.
- 3. Over-reliance on traditional biomass.** Swaziland's increasing population has placed a high burden on the country's indigenous woodlands and forests. Biomass resources are coming under intense pressure through the cutting of trees for fuelwood as it is still the major cooking and heating fuel in Swaziland, with 52% of population still reliant on it in 2010. The over-reliance on fuelwood, combined with clearing of land for agricultural production settlements has resulted in a rural energy crisis where demand for household energy has outstripped supply. This combination of high demand, aggravated by low-end use efficiency, has contributed to environmental degradation, rural poverty and rural energy shortage.⁵
- 4. Climate change.** In recent years, Swaziland has experienced extreme weather events including a persistent El Nino drought system that often impact severely on the primary resource, water, leading to deficiencies for hydropower, loss of irrigation capacity, shortages of water for urban areas and low access to clean water for rural communities. Many of Swaziland's dams are shallow, resulting in low storage capacity, a situation exacerbated by high levels of siltation which is a combination of increasingly degraded catchments and more frequent

⁵ Kingdom of Swaziland. Sustainable Energy For All, Country Action Plan. 2014

severe storms causing accelerated run-off. Decrease in dam water storage impacts on sugarcane biomass production, the current main source for RE.

5. **Non-availability of incentives to develop RE-based capacity.** Swaziland lacks an integrated national energy policy formulation to support RE growth and to encourage feed-in to the national grid and also net-metering.
6. **Limited local research and development to promote local capacity development:** Swaziland has limited facilities that are dedicated to the development of RE technologies.
7. **Slow deployment of roof-top solar PV panels and solar heating geysers.** There is no benefits from economies of scales due to the slow deployment of rooftop solar PV and solar water heaters. The prices remain high making RE adoption less attractive.
8. **Inadequate human capacity to deal with RE technologies.** The country does not have adequately skilled personnel to design, install, operate and maintain RE technologies. There is currently overreliance on international expertise.
9. **Absence of minimum performance standards to control the quality of RE related equipment imported into the country.** There are not enough RE standards to control the quality of imported equipment, installation, and operation and maintenance. There are also no systems in place for the accreditation of installers.
10. **Poor supply chain for RE.** There are limited local suppliers of RE leading to issues on the poor availability alternative sources and bottlenecks in supply.

2 PARES Programme Description

2.1 PARES Scope

The goal of the PARES programme is to accelerate the delivery of sustainable and affordable RE to the people of Swaziland. The development objectives are to (i) significantly impact on rural poverty through the roll-out of an investment programme for affordable off-grid RE systems; (ii) enable the structural transformation of the electricity sector, leading to an attractive investment environment and sustainable market for RE and including a financial facility to provide seed capital for equity or debt co-financing for RE development projects; and (iii) establish an integrated sustainable resource management system for the energy resources.

The primary scope of the project is to facilitate investment in RE and build capacity for RE production at all levels, while supporting enabling framework conditions. It will focus on public-private partnerships and help accelerate Swaziland's transition to a well-functioning power market, attractive to private sector investment and leading to free competition and stabilized, secure and affordable sustainable energy for the nation.

The programme is designed around 4 main themes:

1. **Energy access:** - Poverty alleviation, local economic development and social transformation.
2. **Enabling investment environment:** - Structural transformation of the electricity sector and development of a sustainable market for RE; long term financing mechanisms.
3. **Sustainability and resilience:** - Sustainable integrated resource management systems for energy security, increased productivity, efficiency and conservation.
4. **Knowledge management and partnerships:** - Collaboration and South – South exchange programmes for technology and policy innovation; national stakeholder collaboration and coordination, development partners financing framework.

2.2 PARES Results Framework and Associated Budget

The PARES Results Framework is outlined here. It constitutes of five components, that include (i) Promoting off-grid solutions and formulation of pro poor Investment Support Program for Decentralized Renewable Energy (DRE), (ii) Promoting investment in on-grid renewable energy solutions, (ii) Establishing an integrated sustainable management system for the energy resources, (iv) School Sustainable Development Initiative and (v) Institutional and personnel capacity building for up-scaling the deployment of RE in Swaziland. These are outlined in the following sections and the associated budgets are also given.

The total budget for the Framework activities is USD 23,720,000. Programme implementation, including an integrated Research, Monitoring and Evaluation (RME) component (USD 380,000) and supporting adaptive management (USD 1.8 million), contribute to the total programme management budget of around USD 2.18 million. The total programme budget is USD 25.9 million and the anticipated timeframe is from 2018 to 2024.

2.2.1 Promoting off-grid solutions and formulation of pro poor Investment Support Program for Decentralized Renewable Energy (DRE)

The objective of this component is to accelerate energy access to Swaziland's rural population, using the SADC adopted Total Energy Access (TEA) approach. This is a proven means for leveraging the most out of RE investments at the community level. Success is dependent on a site-specific, comprehensive and inclusive planning process. These processes will be designed and tested under this component through the demonstration projects. These will take place where inclusive development planning has been initiated through the Chiefdom Development Plans (CDP). The main output of the component will be an Investment Support Program for Decentralized (or Distributed) Renewable Energy for Swaziland (ISP-DRE), founded on an enabling macro and micro level environment which identifies and addresses all key questions and issues, real and perceptual, which potentially hinder public and private sector investment in the off-grid sector in Swaziland. This will contribute substantially to meeting Swaziland's primary goal in addressing Climate Change, which is to build the resilience of the people and the economy of the nation. Access to affordable, renewable energy for the more marginalized and natural resource dependent population will unblock the potential for local economic development and significantly improve opportunities for the development of adaptation strategies.

Table 2. Strategic objective 1: Promote off-grid solutions and create a pro poor investment support programme in Swaziland for decentralized RE			
Developmental Goals	Issues and Obstacles	Outcomes the PARES is Expected to Influence	Budget (USD)
1.1. Create enabling condition for off-grid RE investments	The current investment climate for off-grid is not conducive. Policy, legal, and regulatory frameworks for off-grid RE energy programmes are inadequate.	<ol style="list-style-type: none"> 1. Report on sustainable business model for scaling up off-grid RE systems. 2. Prioritize off-grid solutions in the rural electrification program and making use of funds available in the Rural Electrification 	750,000

		<p>Access Fund which allows influx of external sources of funds.</p> <ol style="list-style-type: none"> Establishment of an off-grid private enterprise financing facility. Exemption of import duty and taxes on equipment for RE products. Establishment of the National Support Program for Decentralized Renewable Energy. 	
1.2. Gain in-depth understanding of the impact of rural electrification programme	Currently the environmental and socio-economic impacts of rural electrification are not well-understood. Energy access map that is necessary to prioritize areas/communities for off-grid RE interventions is not available.	<ol style="list-style-type: none"> Detailed report on the environmental and socio-economic impact of rural electrification. Mapping of priority communities for off-grid RE solutions. 	700,000
1.3. Increase rural electricity access through the development of mini-grid delivery models.	The national utility SEC is finding it expensive to extend the grid to some remote areas which comes with high maintenance cost for low returns. These areas and communities remain isolated from the national grid.	<ol style="list-style-type: none"> Feasibility study that identifies appropriate pilot sites for mini-grid installation. Framework that will ensure alignment to rural development goals. Set-up of at least one mini-grid RE demonstration site in a rural community. 	2,000,000
1.4. Make off-grid RE solutions a key focus of the rural electrification programme	The rural electrification programme currently focuses on ensuring access to the main grid. This approach makes it difficult and costly for isolated communities to access reliable energy.	<ol style="list-style-type: none"> Revision of the rural electrification plan to include off-grid pro-poor solutions (micro-grids and rooftop). Implementation and management of demonstration projects: 4 micro-grids and 200 SHS. 	1,750,000

		3. Financing of off-grid RE solutions through the Rural Electrification Access Fund (REAF).	
1.5. Promote energy efficiency programme in rural areas for cooking and heating.	There is relatively low adoption of wood efficient stoves and as a result people who spend long times in cooking places particularly women and children are exposed to indoor pollution through smoke inhalation by using inefficient wood stoves.	1. Strategy for increased deployment of less polluting cooking and water heating technologies such as improved wood stoves, solar bag cooking and the use of ethanol gel stoves.	300,000
1.6. Establishment of an Off-Grid Private Enterprise Financing Facility	There is no financial facility to fund enterprises that have positive impact on dedicated to support off-grid enterprises that create positive social and environmental impact.	1. Support to design of an innovative Off-Grid Financing Facility for private sector based on a landscape analysis of the market, assessing supply and demand for debt, identifying the key markets and a prioritization framework, recommending design and implementation.	200,000
1.7. Initiative for the establishment of Sustainable Development Centres in Schools	In the general public, the socio-economic value or benefits of renewable technologies is not adequately appreciated.	2. Establishment of pilot centres in 20 schools for off-grid extended to on-grid RE systems. 3. Demonstration of the socio-economic value of RE systems to neighbouring communities through training programmes.	2,000,000
Component 1 Total			7,700,000

2.2.2 Promoting investment in on-grid renewable energy solutions

This component will implement a number of activities and studies that will have a positive impact in improving the investment climate and help accelerate Swaziland's transition to a well-functioning

power market, attractive to private sector investment and leading to free competition and stabilized, secure and affordable sustainable energy for the nation.

Table 3. Strategic objective 2: Promote investment for on-grid RE solutions			
Developmental Goals	Issues and Obstacles	Outcomes the PARES is Expected to Influence	Budget (USD)
2.1. Set-up a conducive investment environment for on-grid RE solutions	Currently, there are no support structures to enhance the uptake of RE by Independent Power Producers (IPP) through the RE and IPP policy. Swaziland also lack fiscal incentives for RE sector that help to reduce capital cost of IPPs to enter the market.	<ol style="list-style-type: none"> 1. Review of the Electricity Act to reflect developments in the liberalisation of the electricity market. 2. Development of regulatory framework for the RE and IPP framework. 3. Establishment of a transparent power purchase agreement methodology between SEC and RE power industries. 4. Establishment of structural incentives for RE producers. 5. Develop the grid capacity to accommodate intermittent power from RE. 6. Declaration of a binding target to increase the share of RE to 50% in the electricity energy mix. by 2030. 	700,000
2.2. Set-up a smart grid pilot project that is operated by the national energy utility SEC.	Current national electricity transmission and distribution does not allow net-metering of RE.	<ol style="list-style-type: none"> 1. A feasibility study report and draft implementation plan for countrywide net metering. 2. Identification, design, and construction of a pilot smart grid at a suitable location. 	6,000,000
2.3. Obtain detailed wind data at already identified potential sites for wind power	Potential sites for wind power have already been identified. Detailed data are now required for use in	<ol style="list-style-type: none"> 1. Detailed wind data obtained according to the IEC regulations and MEASNET standards at 5 sites. 	1,120,000

	the development of bankable projects.		
2.4. Obtain detailed solar data at already identified sites and demonstrate the economic viability of medium solar PV plants	Potential sites for solar PV power have been identified. Detailed site data are required for the development of bankable projects.	1. Economic feasibility studies, support planning and procurement process for at 3 locations of the identified suitable sites for medium scale solar PV plants.	1,200,000
Component 2 Total			9,020,000

2.2.3 Establishing an integrated sustainable management system for biomass power resources

This addresses the key issue of ensuring the sustainability of the biomass power resources upon which both the crucial economic sectors of sugar and forestry depend, as well as providing the vast majority of the RE resources. The linkages of water-energy-food, critical for Swaziland's sustainable development pathway will be explored, using the wealth of literature available and practical lessons learned. A framework for ensuring the sustainability of the primary water resource, and the biomass resources from sugar, timber and other identified sources will be developed. A study will be undertaken to explore strengthening productivity, efficiency and sustainability through a Green Growth Value Chain (GGVC) approach (activity 3.2). This will be complemented by joint-venture projects between the industry and out grower associations which will focus on increased production, efficiency and conservation (activities 3.4 and 3.5). Securing the timber resource in the face of increased climate change threats will be undertaken through improved economic and social integration with surrounding local communities, and specifically through a participatory, incentive based, fire management and ecosystem management programme.

Table 4. Strategic objective 3: Secure bioenergy (bioliquids, biosolids, & biogas), geothermal, and hydropower resources to increase sustainability, efficiency, and productivity.

Developmental Goals	Issues and Obstacles	Outcomes the PARES is Expected to Influence	Budget (USD)
3.1. Establishing a Renewable Energy Resource Sustainability Framework	Available studies provide information on the potential RE power production, without much consideration of the risks involved. For renewable energy resources sustainability there is need to conduct risk analysis	1. Data modelling and analysis to understand current renewable energy system vulnerabilities, 2. Identifying technology solutions and infrastructure options to address vulnerabilities and increase resilience and to offer best options for efficiency improvements.	300,000

	and mitigation frame works.	3. RE policy analysis to ensure sector policy coherence, especially with water and agriculture (water-energy-food nexus). 4. Resource Sustainability Framework indicating areas for priority intervention, e.g. policy reform for integrated resource management, catchment planning.	
3.2. Promoting Green Growth Value Chains in the production zones and water supply chains	The security of the bagasse resource depends on the availability of water for sugarcane irrigation. There is need to strengthen the long-term security of water supply for sugar cane irrigation.	1. Studies on green growth value chains linkages and strategies biomass for resource security. 2. Strategies focused on improving and securing the water/biomass supply chain through joint venture projects with producers, out growers and local communities	3,200,000
3.3. Develop community joint ventures for increased biomass resource security.	Community owned and operated plantations have enough biomass available to power a 30MW biomass power plant singlehandedly.	1. Montigny Wattle Growers: Presently unmanaged community wattle jungles developed into plantations.	900,000
		1. Peak Timbers Out-Growers: Timber value chain enhanced.	300,000
3.4. Develop community biomass resource security.	Biomass energy option is threatened by uncontrolled cutting of trees for firewood and by wild fires.	1. Establishment of a community-based forest fire management system.	500,000
3.5 Increase investment in hydropower developments	Current installation of hydropower is at 60.4 MW while the most recent assessment an additional 116 MW can be generated.	1. Increase in hydropower generation from the investments in Mnjoli dam, Ngwempisi River Cascades, Lubovane & lower Maguduza.	200,000
3.6 Roll out of E10 fuel (mixture of 90% petrol and 10% anhydrous ethanol) and launch trials for diesel-ethanol blends	Infrastructure is not in place for blending and distribution of E10 fuel. No national diesel-ethanol trials have been undertaken.	1. Availability of E10 fuel in all gas stations nationally. 2. Feasibility studies of diesel-ethanol blends.	150,000
3.7 Capacity development for	Great potential for biogas production at dairy farms, piggeries, abattoirs, and	1. Increased high level of skills in the construction of biogas system.	250,000

constructing biogas systems.	food processing industries. No exploitation of biogas in the local entities stated above.	2. Feasibility study on suitable sites for biogas production. 3. Three pilot projects for biogas production using different feed-stocks.	
3.8 Exploration for geothermal power and water heating.	There has not been much activity in exploring the potential of geothermal commercially, yet Swaziland has a number of hot springs covering three out of the four administrative regions.	1. Feasibility study on the viability of commercial use of geothermal energy.	300,000
Component 3 Total			6,100,000

2.2.4 Institutional and personnel capacity building for upscaling the deployment of RE in Swaziland

There will be a programme to increase awareness and build capacity in the country on every aspect of the deployment of the RE sector in Swaziland. Different institutions from government, private sector, NGOs, and research, will be targeted with specific interventions to fully benefit from regarding the possible development of RE projects in terms of technical, economic and financial feasibility, available technologies and costs, legal and regulatory incentives and/or constraints, has hindered the development of RE projects in the country. Despite the bold resolutions taken in the existing NEP (2003) the capacity of the Government for promoting RE has not shown enough progress. The private sector potential stakeholders are mostly foreign companies and have invested in other countries, while local developers and local banks are still limited in numbers and capacity.

Table 5. Strategic objective 4: Institutional and personnel capacity building for up-scaling RE deployment, advocacy and outreach in Swaziland			
Developmental Goals	Issues and Obstacles	Outcomes the PARES is Expected to Influence	Budget (USD)
4.1. Knowledge management and capacity building for technical and policy innovation in DRE	The Renewable Energy Association of Swaziland (REASWA) is an NGO dedicated to promoting the deployment of renewable energy technologies. Even though established in 1998, it does not have adequate capacity to meet its mandate. The University of Swaziland	1. Conduct a needs assessment for REASWA. 2. Provide the necessary support REASWA needs to meet its mandate to promote RE at all levels particularly at grass roots level. 3. Strengthen the CSER at UNISWA to carry	200,000

	(UNISWA) has just established the Centre for Sustainable Energy Research (CSER) and it at its infancy with limited capacity.	out research and training in selected specialty areas to support RE in Swaziland.	
4.2. Improved capacity and institutional development of the energy sector including the establishment of the South-South Knowledge Exchange Programme for Renewable Energy	The uptake of RE has been hindered by low knowledge and limited expertise in areas associated with technical, economic and financial feasibility, available technologies and costs, legal and regulatory incentives and/or constraints. There is need to capacitate personnel in various institutions associated with the deployment of RE. The low activity in RE in Swaziland has led to almost nonexistent participation in the South-South Knowledge Exchange Programme for Renewable Energy (SKEPRE).	<ol style="list-style-type: none"> 1. Build personnel targeted capacity development to institutions such as: Department of Energy at MNRE, Biomass Consortium, National Climate Change Committee (NCCC), REASWA, CSER and other relevant agencies, associations, private sector entities or NGOs active in RE. 2. Entities and individuals in Swaziland benefiting from SKEPRE. 	500,000
4.3 Establish consumer outreach and advocacy programmes for off-grid RE technologies	RE technologies are not well understood in term of capabilities, functionality, and cost-benefit, leading to poor consumer perception.	<ol style="list-style-type: none"> 1. Public awareness programmes on the capabilities of off-grid RE technologies such as <ul style="list-style-type: none"> • roadshows, • pamphlets, • radio/TV programmes • social media • community meetings. 	100,000
4.4 Establish outreach and advocacy programmes to improve market share for on-grid RE technologies	Uncertainty in the market for RE generated electricity. Lack of transparency in power purchase agreements for RE. The value of on-grid RE technologies is still not well appreciated	<ol style="list-style-type: none"> 1. Transparent power purchase agreement covering RE technologies developed. 2. Quantification of the value of RE 	100,000

	in term of sustainability, security, and low carbon footprint of the national grid.	technologies to the national grid.	
Component 4 Total			900,000

2.3 PARES Impact

The impacts on innovation and transformation of the PARES programme will be substantial. Each component is focused on key challenges that need to be addressed to help Swaziland's transition to a green economy.

- The PARES programme will ensure that the approximately 35% of the country's rural population that is presently lacking access to electricity has access to clean RE. This will accelerate poverty reduction and also reduce environmental degradation in rural areas due to the over-reliance on firewood for cooking and household heating.
- Renewable pilot projects on both off-grid and on-grid RE solutions will build an innovative and Swazi approach in the development of RE solutions and minimize the reliance on fossil fuel generated electricity.
- The PARES programme will also create a conducive environment for a lucrative investment on on-grid RE projects and assist the country achieve its goal of deriving 50% of its electricity supply from RE by 2030. Presently the country imports almost all its on-grid electricity from the Southern African Power Pool that derives its power mainly from coal fired power stations.
- The PARES programme will accelerate the country towards accomplishing the SDGs. Linkages of the programme to all the SDGs is given in Chapter 5.

3 Role Players, Targets and Milestones of the PARES Programme

3.1 Role Players

The role players and their contribution to the PARES programme are listed in Table 6. They include government entities, the national utility company, IPPS, the Swaziland Energy Regulatory Authority, UNDP, funding agencies, research institutions and NGOs.

Table 6. Role players and their contribution to the PARES programme	
Main Organization	Role in the PARES
Ministry of Natural Resources and Energy through the Department of Energy (DoE)	<ol style="list-style-type: none"> 1. Execute the programme at national level 2. Provide technical guidance 3. Administration of Rural Energy Access Fund (REAF)
Swaziland Electricity Company	Execute the technical aspects of the programme at national level
Swaziland Energy Regulatory Authority (SERA)	Execute the regulatory aspects of the programme at national level
UNDP	<ol style="list-style-type: none"> 1. Development of the Programme Funding Strategy and Framework and also identify funding sources such as GEF, AfDB, and GCF. 2. Technical Assistance. 3. Coordination with other UN agencies such as UNEP. 4. Manage knowledge and also provide linkage with the South-South Knowledge Exchange Program for Renewable Energy (SKEPRE).
Ministry of Tourism and Environmental Affairs through the Climate Change Unit	Integrate climate change (mitigation and adaptation) technical aspects of the programme at national level.
Private Sector including timber, sugar, solar PV and wind power, industries.	Partnership in project implementation.
NGOs and public and private research institutions	Support RE through the provision of advocacy and public sensitization, enterprise development and business plans for deployment, and research and information dissemination.

3.2 Targets and Milestones

Table 7 sets the targets and the milestones to be achieved through the PARES programme intervention. It also lists the associated institutions responsible for the implementation of the programme.

Table 7. Targets and Milestones of the PARES Programme		
Targets	Milestones	Institutional responsibility

Increase in energy access through off-grid, decentralised, “own-consumption” RE systems such as mini-grids, micro-grids, SHS, Pico PV	30 % of people with no access to electricity have access to electricity through renewable sources by the year 2024.	DoE at MNRE will prepare a national implementation plan and implement it with SEC and other stakeholders. UNDP will source and manage the grants for the programme.
Conducive climate for <i>investment on on-grid RE projects</i>	<ul style="list-style-type: none"> ▪ Swaziland will attract sufficient investment in RE to supply 30% of the country’s energy needs by the year 2024 ▪ Swaziland to source 50% of electricity from RE sources by 2030. 	SERA will assist with the regulatory framework.
Establishment of an integrated sustainable resource management system for the energy biomass power resources	All production zones and ecosystems critical for the supply of bio energy resources to be sustainably managed by the year 2024.	MNRE, NGOs, Research institutions will collaborate to develop and implement sustainable resources management strategies.

4 PARES Linkage to Sustainable Development Goals (SDGs)



SDG 7, Affordable and Clean Energy, is the main SDG addressed by the programme. Table 8 outlines the programme's contribution towards the achievement of the three UNDP targets associated with it.

Table 8. PARES contribution towards achieving the first three UNDP targets of SDG 7		
Targets	Proposed indicators	Contributions of the PARES towards achieving the SDG targets
Target 7.1: By 2030, ensure universal access to affordable, reliable and modern energy services	Percentage of population with electricity access. Percentage of population with primary reliance on non-solid fuels.	<ol style="list-style-type: none"> 1. Increase national electricity access from 65% to universal access in 2030 through grid extension, mini-grids, micro-grids and rooftop solar PV. 2. Decrease the national overreliance on solid fuels in particular coal and wood-fuel from 40%.
Target 7.2: By 2030, increase substantially the share of renewable energy in the global energy mix	Percentage renewable energy share in the total energy consumption. Enabling legislation and framework for renewable energy production established by 2020.	<ol style="list-style-type: none"> 1. Increase the share of renewable energy to at least 50% of the total electricity generation by 2030. Also increase the uptake of rooftop solar PV and water heaters, and alternative cooking methods. 2. Establish a net metering regulations and transparent power purchase agreement. Review of the electricity act to support the liberalization of the electricity market.
Target 7.3: By 2030, double the global rate of improvement in energy efficiency	Rate of improvement in energy intensity (%) measured in terms of primary energy and GDP. Composite Energy Efficiency Improvement Index built up of sub-indicators measuring	<ol style="list-style-type: none"> 1. Adoption of energy efficiency products and conservation measures. 2. Overall national improvement in energy efficiency through modern

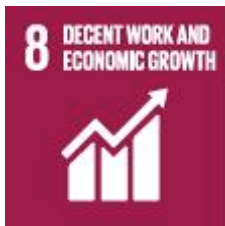



	transport energy efficiency, industrial energy efficiency, power generation energy efficiency, buildings energy efficiency and agricultural energy efficiency.	power generation technologies.
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The success of the PARES will therefore not only accelerate *support to Swaziland's transformational shift to a low-emission and resilient development by accelerating the delivery of sustainable and affordable renewable energy*, but will further play a major role in providing extensive sustainable development benefits. The programme takes a comprehensive approach to accelerating the use of RE in Swaziland. This allows for significant potential to assist Swaziland meet its SDG targets, as well as its commitments to the Paris Agreement and the NDCs. The programme management team will be responsible for a research, monitoring and evaluation programme that will ensure that the PARES programme effectively addresses the SDGs (listed in Table 9) by incorporating them into its strategic results framework and indicators.

Table 9. A snapshot of the sustainable development benefits that the PARES programme is expected to lead to

SDG	Impacts
	<p>Progress in addressing poverty has been limited in Sub-Saharan Africa (SSA), and Swaziland is no exception with a poverty rate of 63%. Access to affordable, reliable and modern energy services supports the goal of poverty eradication. For Swaziland, many of its poorest citizens live in remote rural areas where energy access through the grid would be either unaffordable or too costly. Lack of energy access means little opportunity for economic development. The PARES programme will establish a pro poor energy access fund and programme that will promote a Total Energy Access (TEA) approach and will optimize the potential productive uses and benefits of energy. The positive impact of energy access on poverty is determined by its affordability and achieving this is a focus of the PARES programme.</p>
	<p>In Swaziland, with its dominantly rural population, hunger remains widespread and most prevalent in the most marginalized of the rural communities. These communities or inhabitants are most likely to be the ones without access to electricity. Recent studies demonstrate that most losses in food related projects are caused by bad or non-existent cooling facilities as well as inadequate transportation. The PARES programme pro poor rural access and Green Growth Value Chain approach will have a positive impact on these communities, with new opportunities for small-scale agriculture and investments in opportunities for value chain improvements such as refrigeration and transport. The sustainability of food production will be enhanced through the implementation of the World-Energy-Food (WEF) nexus approach and the formulation of integrated policies supporting food security targets.</p>


	<p>Universal health coverage cannot be achieved without universal energy access. Energy is required to provide reliable power to health facilities in developing countries and to improve health outcomes through the reduction of Household Air Pollution (HAP), a major health hazard (e.g. it is linked to the high incidence of childhood respiratory problems) in Swaziland. By increasing economic opportunities for the poor, will enable citizens to lead more productive lives, supporting their physical and psychological well-being. Energy in the home means less time spent in the time-consuming and onerous task of firewood collection.</p>
	<p>Many schools in rural areas of Swaziland have the potential to generate sufficient electricity through solar and wind to meet all their energy needs and more. School-based micro-grids or mini-grids could supply local homesteads with electricity, allowing learning activities to take place even after nightfall and on days of low daylight (bad weather). The PARES programme will support the Sustainable Development Schools or 'Green Schools' initiative, which uses school infrastructure and RE as the basis to promote productive livelihood and educational activities to catalyze economic development in rural areas.</p>
	<p>Rural women in Swaziland pay a particularly high price for the lack of energy, because they tend to spend most of their time collecting water for domestic or agricultural uses, processing and marketing food and other agricultural or nonfarm products, collecting firewood, and obtaining health services for themselves and their families. This "time poverty" in turn limits their ability to attend school or engage in income-earning activities to improve their own lives and those of their families. If households get access to electricity, potentially large amounts of time spent in fuel-wood collection and in food preparation with traditional fuels could be saved for other economic activities.</p>
	<p>Thermal cooling and resource extraction require substantial amounts of water; while wastewater from the energy sector releases large quantities of thermal and chemical pollution into aquatic ecosystems. In most cases, increasing the share of renewables, such as solar and wind in the energy mix and increasing energy efficiency would support the water targets. However, expanding biofuels or hydropower use could increase pressure on water resources. In Swaziland, the vast majority of water is used for irrigation, and much of this is used in the sugar industry. The country has been experiencing severe water stress during periods of drought, so more sustainable approaches to meeting the water resource requirements will need to be initiated to ensure diminished risk of conflict between industrial needs and those of the ordinary citizen. The PARES programme gives emphasis to sustaining the energy resource by an integrated approach which will require the improved management of the water resource in the key bioenergy production zones or catchments.</p>
	<p>The implementation of the PARES framework will increase the use clean energy technologies in Swaziland, and help towards universal access to energy. The up-scaling of RE power generation will lead to reduction of imported electricity which is mostly generated from coal. Affordable and Clean Energy will stimulate rural socio-economic development, leading to poverty reduction and improved quality of life, and the protection of the</p>

	environment. Incorporation of energy efficiency in the programme will increase the sustainability of energy resources.
 <p>8 DECENT WORK AND ECONOMIC GROWTH</p>	<p>Swaziland's energy dependence on South Africa is regarded as a serious potential threat to the country's economy, not only through predicted long-term spiraling costs of the imported electricity, but also because the security of supply is not guaranteed. Unemployment is seen as the country's major economic challenge, and youth unemployment in rural areas is particularly severe. Improved energy access to rural areas, implemented in conjunction with productive use of energy (PUE) programmes and tailored financing packages for SMEs, can make a difference. Furthermore, deploying renewables and energy-efficient technologies can encourage innovation and reinforce industrial and employment objectives.</p>
 <p>9 INDUSTRY, INNOVATION AND INFRASTRUCTURE</p>	<p>Technical innovation is behind the increasing pace driving the planet to increased use of RE. This is leading to new industries and infrastructure at all different scales, from solar home systems to large scale IPPs. Increased energy access promotes telecommunication services which in turn spurs innovation and industry. By promoting the enabling environment for investment in RE at all levels in Swaziland, the PARES programme will sustainable industries, infrastructure and technical innovation.</p> <p>Digital innovation has an enormous potential in reducing fuel consumption through demand side management and smart meters, and allowing for a better integration of RE sources through smart grids and distributed generation, with clear environmental benefits. The PARES will support the construction of a smart grid to pilot this innovation in Swaziland. This will be accompanied by the appropriate skills development.</p> <p>Generating power on-site rather than centrally is an innovation promoted by the PARES programme that will help eliminate the cost, complexity, interdependencies and inefficiencies associated with the transmission and distribution of electricity.</p>
 <p>10 REDUCED INEQUALITIES</p>	<p>Swaziland's population is largely rural and suffers from poor provision of services – education, health and transport – when compared with the urban areas. 10% of the population is responsible for about half the nation's consumption, while 84% of those living in poverty reside in rural areas. Greater economic opportunities in rural areas are the best route towards reducing these inequalities, and promote economic inclusion. The lack of access to electricity, either through lack of provision or affordability, is a major factor in improving public services and encouraging private investment. Promoting decentralized renewable energy (DRE) will help to decrease the extreme income disparity between rich and poor in Swaziland through improved infrastructure and economic opportunities.</p>
 <p>12 RESPONSIBLE CONSUMPTION AND PRODUCTION</p>	<p>Irrigation, mainly for sugar cane production, accounts for about 95% of Swaziland's water usage. Large-scale irrigation contributes furthermore to high energy inputs. This level of consumption is clearly unsustainable and PARES programme will support measures to more responsible use of water resources along the entire water supply chain, from improving management in critical catchments, to increased efficiency and water conservation measures at the production level. Responsible production will be promoted through the Green Growth Value Chain approach which will help engage</p>

	<p>industrial level producers to form joint ventures with local communities and associations for sustainable added value products that reinforce environmental and socio-economic benefits. PARES programme will develop an integrated resource management framework to ensure the sustainability and efficient use of the bioenergy resources, including water and land. Through this integrated approach, the PARES project will also significantly reduce the ecological footprint of the major bioenergy producers. The PARES programme will also support the structural transformation of the electricity sector in Swaziland, which will promote responsible electricity production through increased competition, opportunities and efficiencies.</p>
	<p>The adoption of the Paris Agreement in December 2015 after years of negotiations was a major achievement and provides the path for addressing climate change in a meaningful way. The energy component will be central in this effort. One of the cruxes of the agreement can be found in the commitment of countries to take climate action, spelled out in the Nationally Determined Contributions (NDCs).⁶ The Swaziland NDC has a strong focus on RE in its mitigation action, and for improved and integrated resource management in its adaptation component. The PARES will support Swaziland in meeting its commitments to the Paris Agreement, specifically in meeting the targets set by the NDC. By encouraging a nexus approach, the PARES programme will assist stakeholders to examine the direct links between energy and climate change, as well as the various actions that need to be taken. The PARES programme will therefore help strengthen the resilience and adaptive capacity of communities most at peril from Climate Change risk while also improving resilience of the national economy by strengthening resource security.</p>
	<p>Land degradation in Swaziland is extensive, and aggravated by poverty which results in the overuse of natural resources, especially through unsustainable use of traditional biomass and over-grazing. The declining ecosystems are not able to recover after the increasingly severe droughts. Climate change has also increased the risks of severe storms and floods, which cause soil erosion on the deforested and over-grazed landscape, which in turn reduces productivity of dams through siltation. Environmental fragility is beginning to affect food security.⁷ PARES programme will give support to improving land use and encouraging land rehabilitation by identifying critical catchments for bioenergy production and supporting policy reform through its integrated resource management framework. Furthermore, sustainable livelihood activities that support rehabilitation and sustainable use will be promoted under the programme.</p>

⁶ Vienna Energy Forum 2017 Report

⁷ IFAD Rural Poverty Portal

	<p>Partnership forms the basis for the PARES programme, recognizing that its ambitious targets can only be achieved through a coordinated and collaborative process. Partnerships will be formed at various levels. Firstly, the programme will be administered through a stakeholder group, ensuring synergies and efficiencies in resource allocation. Secondly, the programme will define an enabling framework for International Cooperating Partners (ICPs), financing institutions, government, private sector and civil society to define and access the appropriate technical support and financing. Thirdly, partnerships will be established through the SKEPRE programme, which will support and encourage technical and policy solutions through a regional exchange programme.</p>
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Annexes

Annex 1: Swaziland Profile

The Kingdom of Swaziland is a small landlocked country of 17,364 km with a population of approximately 1.1 million⁸. In 2016 GDP growth was -0.6% and per capita income approximately \$3,000⁹. Although Swaziland is classified as a lower-middle income country, this is qualified by its high level of inequality, and its position of 155 out of 188 in the 2015 Human Development Index. Poverty head count was estimated around 73 per cent in rural areas in 2010 while at only 31 per cent in urban areas. The high poverty rates in the population increases the dependency rate which is estimated at 76.2% which strains the economy's ability to provide adequate social services, such as health care and education.¹⁰ Investment in human capital and skills development is therefore required to improve the dynamism of the labor market¹¹. While agriculture nominally only account for 9% of Swaziland's GDP, manufactured goods from agricultural products – mainly sugar – account for 56% of the country's exports. The sugar industry is dependent on irrigation, which consumes about 95% of the country's water resources (global average about 70%). Around 79% of Swaziland's population is based in rural areas¹² with livelihoods predominantly dependent on subsistence agriculture and is therefore highly vulnerable to the negative impacts of climate change

Land Use

Swaziland has a dual system of land tenure comprising Swazi Nation Land (SNL), which is communal land held in trust by the King, and Title Deed Land (TDL). Overall, SNL covers approximately 70% of the country, while the TDL makes up approximately 30%. Extensive communal grazing occupies 50% of the available land, ranching 19% and small-scale subsistence agriculture 12%. Commercial forest is the fourth most common land use in Swaziland (8%) and is predominantly based on large plantations operated by the private sector under the TDL. The remaining 10% of the country consists of large-scale crop agriculture, nature reserves, water reservoirs and their catchments, and areas used for

⁸ World Bank, 2017

⁹ Ibid.

¹⁰ WHO 2017

¹¹ IRENA

¹² WHO, 2017.

settlements, industry and recreation.¹³ The distribution of land use practices and the exploitation of natural resources in the country vary according to the land tenure system in each area. In general, small-scale agriculture, extensive communal grazing and some extraction and collection occur on SNL, whereas land uses such as large-scale agriculture, ranching, plantation forestry, parks and reserves are associated with TDL. Although water reservoirs mostly serve TDL, they are also found on SNL.

¹³ Swaziland's First National Communication to the United Nations Framework Convention on Climate Change, 2002.

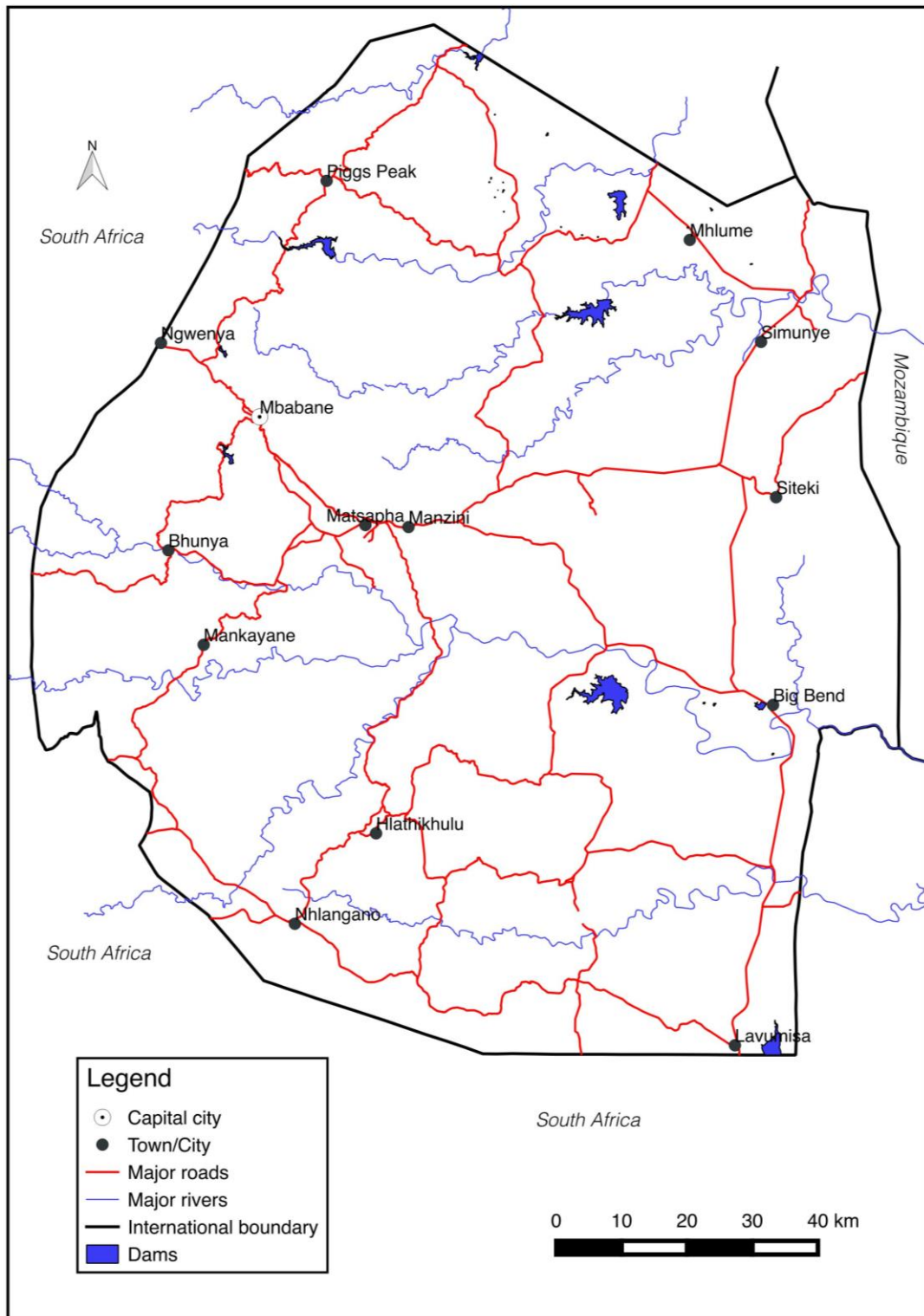


Figure 3 Map of Swaziland, showing major towns and cities, major roads, major rivers, and dams in the country

Climate Change

Climate Change represents a multi-dimensional existential threat to the kingdom of Swaziland, with the potential to severely undermine Swaziland's chances of meeting its SDG targets, especially the apex first goal of "ending poverty in all its forms".

Climate change in Swaziland is expressed through significant variations in precipitation patterns, higher temperatures and increasing frequency and intensity of severe weather events such as droughts, floods and cyclones. This climate variability has resulted in shortened growing seasons. Furthermore, the predicted reduction in rainfall and stream flow (40% by 2050) will greatly decrease the potential for irrigation. Reduction in ecosystem integrity and resilience and a decline in biodiversity is another anticipated impact of climate change undermining the adaptive capacity of the natural resource dependent local communities. These communities are experiencing a rural energy crisis where demand has outstripped supply, a situation compounded to lack of access to electricity by 66% of the rural population.

The most recent disaster was the El Nino induced drought Of 2015/16, perceived to be the worst in 35 years. This had a devastating effect on agricultural production, especially maize which dropped by 64% from the previous year. Livestock was also severely affected with a loss of 11% of the national herd. Dam levels dropped in some cases to as low as 5% in the case of Mnjoli dam, leading to an 80% reduction of sugar cane production in some areas. The water flow of the Ngwavuma River which irrigates sugar in the south of the country, decreased to zero. The drought has resulted in an estimated 350,000 rural people facing livelihood and food deficit – more than one third of the population.

The El Nino drought occurs within a recent historical pattern of disaster as indicated in the table below. Droughts are expected to be more intense and prolonged; floods will be more frequent.

Table 10. Climate change related disasters in Swaziland from 2001 to 2011		
Hazard	Year	Number of People Affected
Drought	2001	347, 000
	2007	410, 000
	2008	287, 634
	2009	256, 283
	2010	170, 000

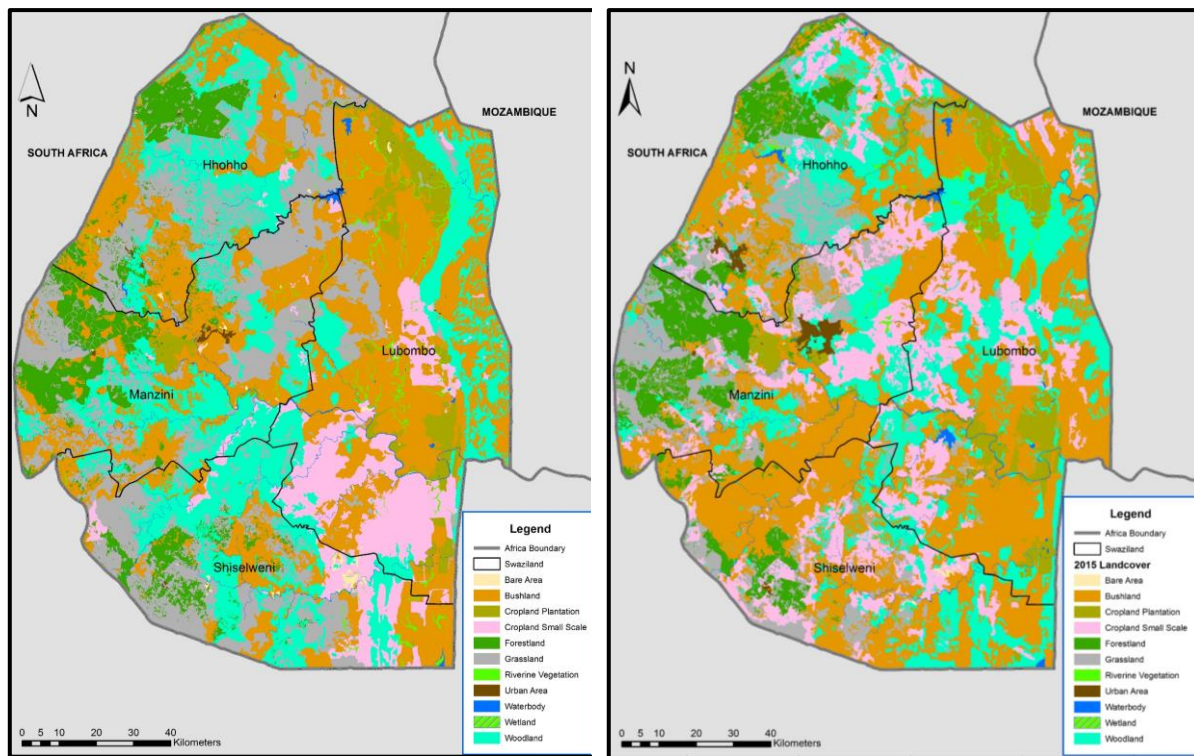
	2011	88, 511
Strong winds/windstorms	1984	632, 500
	2005	1, 150
	2006	6, 535
	2010	1, 000
	2011	+200 families
Hailstorms, thunder and lightning	2000	No data
	2011	+200 families
Floods	2008	272, 000

Source: TNA Adaptation Report (2015)

While floods represent an immediate threat to vulnerable populations, they have the additional impact of eroding deforested and degraded catchments and causing excessive siltation in the dams – many of which are already quite shallow. Strong winds, higher temperatures and extended dry periods have greatly increased fire risk and the threat to the large-scale forestry plantations of the country (in 2007, 80% of the tree plantations in the north of the country were destroyed).

Climate change presents Swaziland with serious challenges in the decades ahead. Water will be the primary medium through which early climate change impacts will be experienced by various sectors and affect sustainable development. Water is also critical in relation to climate change mitigation plans for the country, and its efforts to achieve energy security through biomass based RE. Presently, the country is virtually totally dependent on South Africa for its energy, as the little electricity that Swaziland generates through hydropower has been severely affected by persistent drought and low dam levels. The country's biomass potential from its large-scale sugar cane and forestry industries, combined with the significant solar energy resources, is enough to for the country to meet all its energy needs. However, this assumes that the biomass energy resources are secured through effective response to climate change threats, specifically decreased water flows and increased fire hazards.

The impact of climate change on water consequently on energy security and food security (reduced irrigation, destruction of livestock, less potential for rain-fed agriculture), as well potentially severe impacts on women and youth in rural areas through reduced opportunities for livelihoods and increased hardship, means that the response to climate change needs to be both integrated and highly strategic.



a) 1990 land cover map

b) 2015 land cover map

Figure 4 Land cover maps for Swaziland for the years 1990 and 2015, highlighting the amount of change that has taken place in the country, especially the loss of natural resources (woodlands and shrubland)

Source: UNDP, 2016

Annex 2: Current National Policies, Strategies, Legal Framework for Enabling Environment for RE

National Development Strategy (NDS) 1997

The development of government policies, frameworks and legislations for the energy sector in Swaziland is inclined towards the vision of the National Development Strategy, 1997, declaring 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"*, also known as *"Vision 2022"*. As expressed in the NDS, the energy sector can play the central role towards achieving socio-economic development.

The 25-year National Development Strategy (NDS) highlights energy as a key sector for achieving socio-economic development through three central strategic objectives. These are:

- ✓ Research and development,
- ✓ Energy efficiency, and
- ✓ Energy access.

Identifying options for domestic electricity generation and electricity access and increasing the domestic use of RE technologies are some of the fundamentals for achieving the above development goals

Poverty Reduction Strategy and Action Plan (PRSAP) 2007

The implementation of the NDS was supplemented by the Poverty Reduction Strategy and Action Plan, 2007 (PRSAP), which became another key strategic document to support development in the Kingdom of Swaziland. The PRSAP's goal for sustainable energy is to ensure that all people, including the poor, have access to affordable, safe, sustainable, secure and environmentally friendly sources of energy.

Draft National Energy Policy (2017)

The updated National Energy Policy has been formulated in the context of the existing National Development Plan, other existing economic, social and environmental policies, the current regional energy policies, the regional power supply and demand forecasts and the energy sector's linkages with other sectors.

The Ministry of Natural Resources and Energy (MNRE) in collaboration with key stakeholders has implemented some of the essential energy sector reforms such as liberalization of the Electricity Supply Industry (ESI) through promulgation of three electricity legislative Acts in 2007, including:

- **Electricity Act, 2007:** Allowed participation of private sector in the business of generation, transmission and distribution of electricity. It also established the Rural Electrification Access Fund.
- **Swaziland Electricity Company Act, 2007:** Transformed the Swaziland Electricity Board into the Swaziland Electricity Company (SEC) to become the State Utility engaged in the business of generation, transmission and distribution of electricity in the country.
- **Energy Regulatory Authority Act, 2007:** Established the Swaziland Energy Regulatory Authority (SERA) with a core mandate to exercise control over the Swaziland electricity supply industry and regulate the generation, transmission, distribution, supply, use, import and export of electricity in Swaziland. It is also responsible for the regulation of electricity tariffs and quality of supply and services.
- **Establishment and Management of the Rural Electrification Access Fund Regulations, 2017 in terms of section 67 of the Electricity Act. The Fund shall provide –**
 - Financing to achieve equitable regional access to electricity in order to maximize the economic, social and environmental benefits to rural electrification programme;
 - Financing for installation of RE systems and mini-grids in rural areas within the Kingdom of Swaziland;
 - Financing of programmes to improve the quality of supply of electricity lines in rural areas, in particular those with long distribution electricity lines;
 - Financing of studies to assess the national impact of the rural electrification programme;
 - For capacity building in the areas of energy access, RE, demand side management and energy efficiency in respect of projects undertaken through the Fund.

In as much as transmission and most of the distribution networks are owned and operated by the SEC, the existing legislation allows prospective electricity generating companies to be involved in electricity trading using the existing infrastructure, however wheeling charges shall apply, accordingly. Further, in 2016, the GoS approved the Swaziland Independent Power Producer Policy (SIPPP) which is a framework that aims to address the regulatory, economic, and technical challenges faced by existing and prospective independent power producers (including RE IPPs). The SIPPP provides the much-needed policy guidance to facilitate the growth and development of the power sector in Swaziland. The SIPPP considers the inclusion of small scale power generation projects as part of the overall planning process, taking cognizance of not only the generation capacity but demand-side management.

National Energy Policy Implementation Strategy (NEPIS)

The National Energy Policy Implementation Strategy (NEPIS) serves as the implementation arm for the National Energy Policy 2017. Where the NEP 2017 sets the goals for the energy sector, the NEPIS provides further implementation details, targets and information about implementation partners. The NEPIS 2017-time horizon is partly in line with the NEP 2017 and partly shorter. NEPIS 2017 provides detailed actions for the first year and semi-detailed target for year 2-5. Hereafter it is planned that

there NEPIS 2017 will be fully revised and updated implementation plans with adjusted budgets for the remainder of the NEP 2017-time horizon will be issued.

The NEPIS 2017 is intended to be updated on an annual basis and revised after five years.

NEPIS 2017 is an umbrella implementation strategy for the energy sector. Some energy sub-sectors have separate policies and implementation plans. These sub-sectors are:

- ✓ The petroleum sector
- ✓ The independent power producers sub-sector and
- ✓ The energy efficiency sector.

The NEPIS 2017 will refer to these sub-sector policies for implementation details and in these cases, limit its focus to monitoring of progress.

Draft Energy Efficiency Policy

This policy document provides a detailed framework to advance the country's agenda on EE and EC, considered to be a valuable energy resource and effective measures to mitigate the adverse impacts on the environment resulting from the growing energy demand. The policy also provides the much-needed guidance to influence enactment and review of legislation, development of strategies and programmes to advance the country's agenda on EE. Having recognized that EE represents an economically attractive option, this policy puts forward recommendations that focus on management of the energy demand through EE interventions within the residential, commercial, industrial and transport sectors.

Kingdom of Swaziland Energy for All (SE4ALL) Country Action

The UN Secretary General launched a global Initiative to achieve Sustainable Energy for All by the year 2030. The key objectives under this goal are: (1) ensuring universal access to modern energy services; (2) doubling the rate of improvements in energy efficiency; and (3) doubling the share of RE in the global energy mix.

The Kingdom of Swaziland is one of the Sub-Saharan countries which embraced the UN Initiative. This report presents the SE4ALL Rapid Assessment, Gap Analysis and Country Action Plan of Swaziland. It includes a situation analysis, with baseline data on sustainable energy production, distribution and utilization, and covered an assessment of national initiatives on (1) universal access to electricity; clean fuels and devices for cooking/heating; and mechanical power; (2) improvements in energy efficiency;

and (3) increasing the share of RE in the national energy mix, The assessment and analysis also covered the energy sector strengths and weaknesses in specific areas relevant to the sector such as policy, planning, institutions, finance, monitoring (data and accountability), capacity and partnerships.

International Renewable Energy Agency (IRENA) Swaziland Renewables Readiness Assessment

The International Renewable Energy Agency (IRENA) has a mandate to increase RE deployment across the world. The Renewables Readiness Assessment (RRA) process stems from the Africa High-level Consultative Forum held in 2011, which highlighted the need for technical support for African countries to identify their RE readiness. The RRA involves a holistic evaluation of a country's conditions and identifies the actions needed to overcome barriers to RE deployment. It has three purposes. Firstly, it identifies where action is needed to improve readiness. Secondly, it identifies partners and organizations who can help deliver it. Finally, it facilitates focused discussions with donors and other partners aiming to secure agreement on the actions outlined. The Swaziland RRA confirmed that RE resources can help reduce Swaziland's dependence on imported electricity. It indicated that bagasse cogeneration could meet about half of electricity demand in a sustainable way, while the unexploited solar potential presents "interesting prospects for greening both the centralized and decentralized energy infrastructure". The assessment also emphasizes Swaziland's role as a key link in the Africa Clean Energy Corridor, IRENA's initiative to meet East and Southern Africa's growing power needs sustainably and with a high share of renewables.

Key findings of the RRA include:

- While the costs of RE technologies, they still require high capital expenditure. Local financial institutions still perceive them as high-risk, which limits domestic appetite for RE investments. New (mainly foreign) potential investors face obstacles to securing bankable PPAs.
- Despite the high grid coverage enjoyed by the country, an important section of the population is still too poor to afford to be connected. The inhabitants could benefit from decentralized RE solutions, however local financial institutions are still averse to provide financing for the uptake of these systems for rural inhabitants due to a lack of awareness of the solar business and mistaken beliefs that the rural population would not be able to repay its debt. In addition, there is a lack of technical capacity in installing, operating and maintaining these systems.

The RRA states that creating an enabling environment for RE IPPs is crucial if Swaziland is to significantly increase renewables in its electricity mix. This is because the RE provisions in the Electricity Act and the Energy Policy are not sufficient to attract private sector investment. The enabling environment can be further developed through the design and adoption of tailor made policies and measures in the framework of a RE IPP policy. This process would include a consultation on the development of a standardized PPA to increase the bankability of RE power projects is needed. This would attract scalable investment, limit elaborate and tedious negotiations and give potential investors clear expectations on their investment

Public Private Partnership (PPP) Policy

A Public Private Partnership (PPP) policy has been established in Swaziland. This policy is an initiative by the government to work hand-in-hand with the private sector on national development programmes. The government intends to implement the development strategies in collaboration with the private sector – the government can source large amounts of funds, while the private sector has the technology and efficient implementation capacity. With transparency, the PPP can result in rapid development services delivery in the country, including interventions in the energy sector.

Swaziland Independent Power Producer (SIPP) Policy

The Swaziland Independent Power Producer (SIPP) Policy provides a framework that addresses barriers to the development of energy generation and the growth of IPP, in order to enable a successful transition of Swaziland's energy matrix towards sustainable energy sources and to open the market to the private sector in a controlled way. The overall national goal is defined as:

“Ensuring that the development goals of the country as set out in the Vision of the NDS are met, through the establishment of an enabling environment to promote the establishment of sustainable renewable energy and IPP generation sources for the benefit of all the citizens of the country.”

A total of 28 policy issues, recommendation and positions have been set in the SIPP Policy, concerning the following key themes:

- a) Institutional and Regulatory Framework;
- b) Power Sector Planning;
- c) Capacity Procurement;
- d) Funding and Bankability;
- e) Taxes and Incentives;

- f) Regional Integration;
- g) Rural Electrification and Mini-grids;
- h) Embedded Generation.

These SIPP Policy recommendations shall now start to be implemented, in a gradual manner so as not to lead to a large increase in the electricity tariff. All rules, codes, standards and other templates necessary for licensing energy investments shall be prepared in the immediate future, in order to facilitate new IPPs.

The Draft NEP recommends that the SIPP in a gradual manner; in line with a strategic action plan to be developed for liberalizing the electricity market. Key follow-up activities are to (i) develop a strategic action plan for the liberalization of the electricity market and (ii) prepare rules, codes, standards and other templates necessary for licensing energy investments.

In terms of this strategic plan for the SIPP, the NEP further recommends a timetable for Electricity Market Liberalization (EML).

The NEP recommends the following actions:

Immediate term actions (2017 - 2018):

- Implement accounts unbundling into generation and transmission / distribution of electricity.

Short term actions (2019 – 2022):

- Undertake study to identify and eliminate deficiencies in the electricity market;
- Undertake study to eliminate cross-subsiding between regulated and non-regulated electricity services;
- Undertake study of public ownership options for SEC.

Annex 3: Regional Policies, Strategies, Legal Framework for Enabling Environment for RE

Africa Clean Energy Corridor

Swaziland forms a key link in the Africa Clean Energy Corridor, IRENA's initiative to meet East and Southern Africa's growing power needs sustainably and with a high share of renewables. Swaziland is party to the RE zoning methodology from the Africa Clean Energy Corridor framework. This methodology aims to identify cost-effective, high potential and high-density RE zones for the development of utility-scale power plants. It uses a multi-criteria geospatial and economic analysis. RE zoning would allow the government to strategically allocate and promote identified zones for the commercial development of utility-scale solar PV power plants. This activity would fit in with the Public Private Partnership policy vision to promote the use of state-owned land to provide private investment opportunities.¹⁴

SADC

Swaziland is one of the 15 member States (MS) under the auspices of the Southern African Development Community (SADC) that have adopted the SADC Protocol on Energy of 1996. Subsequently, SADC has enacted several strategic instruments for the successful and harmonized development of the energy sector. These include the SADC Energy Cooperation Policy and Strategy in 1996, SADC Energy Action Plan in 1997, SADC Energy Activity Plan in 2000, SADC Regional Energy Access Strategy and Action Plan in 2010, Regional Infrastructure Development Master Plan (RIDMP) and its Energy Sector Plan in 2012, Regional Indicative Strategic Development Plan (RISDP 2015) and the SADC Renewable Energy and Energy Efficiency Strategy and Action Plan (REEESAP) 2016-2030. Furthermore, SADC has set up an Energy Thematic Group (ETG) which consists of representatives of the SADC Secretariat, SADC energy subsidiary organizations, International Cooperating Partners (ICPs) and a knowledge partner, the Southern African Research and Documentation Centre (SARDC). The lead ICP for the energy sector is Austria. SARDC is tasked with raising awareness among stakeholders about key regional energy issues. The region plans to commission more than 7,000 megawatts (MW) of new generation capacity in 2017, a development that is expected to strengthen energy security. With regard to RE, SADC aims to achieve a RE mix in the regional grid of at least 32% by 2020 and 35% by 2030. According to the African Development Bank (AfDB), southern Africa is a potential "gold mine" for RE due to the abundant solar and wind resources that are now hugely sought after by international investors in their quest for clean energy.

¹⁴ IRENA Swaziland Renewables Readiness Assessment, 2015

These policies, plans and strategies have set out objectives for SADC and its MS to support development of the energy sector and its subsectors of biomass, petroleum and gas, electricity, coal, RE, and energy efficiency and conservation.

Southern African Power Pool (SAPP)

In 1995, 12 continental SADC member countries signed an intergovernmental Memorandum of Understanding that led to the creation of the Southern African Power Pool (SAPP). SAPP is a regional body that coordinates the planning, generation, transmission and marketing of electricity in southern Africa on behalf of member state utilities. It aims to create a common market for electricity that will provide economically reliable power to consumers in each SAPP member country. Another aim is to optimize the use of available energy resources in the region and support cooperation between countries during emergencies. The Regional Energy Protocol, signed in 1996, advanced this initiative. It acknowledges the need for a coordinated approach to energy strategy formulation and planning in the SADC region.

SADC Regional Infrastructure Development Master Plan (RIDMP)

With respect to investment in new energy projects, the region needs about US\$114 billion to US\$233 billion between 2012 and 2027 to develop additional electricity generation capacity, according to the Energy Sector Plan of the SADC Regional Infrastructure Development Master Plan.

SADC Renewable Energy and Energy Efficiency Strategy and Action Plan (REEESAP) 2016-2030

The REEESAP, which spans the period 2016-2030, aims to provide a framework for SADC member states to develop RE strategies, leading to the greater uptake of RE resources as well as mobilization of financial resources in the sector. This will be achieved by a variety of measures, including establishing RE agencies in all 15 SADC member states that will have specific mandate for off-grid systems, as well as developing and adopting guidelines to meet the SADC target of cost-reflective tariffs by 2019 while ensuring that the poor are not prejudiced. Other proposed measures include raising awareness on the value and benefits of RE and introducing sustainable energy issues in school curricula and tertiary education. The REEESAP also proposes to create a special purpose regional investment fund for RE and energy efficiency projects of less than 10 megawatts (MW). The fund is expected, among other things, to support packaging of bankable projects. The adoption of the REEESAP will not only change the landscape of RE development in SADC, but is also critical to

encouraging the region to adopt innovative ways of using less energy to support development initiatives.

Distinct from most energy sector policies or strategies, the REESAP recognizes the value of a fully integrated approach to energy planning. It identifies the Water-Energy-Food nexus as a key cross-cutting issue and emphasizes the need to ensure policy coherence between interconnected Sustainable Development Goals (SDGs) and sectors. It identifies a number of other cross-sectoral issues, which are highly relevant for Swaziland, some of which are given below:

- **Formalize a dialogue among climate change, water and energy, at technical and ministerial level** (like the joint workshop of the Ministers of Energy and Water, held in Gaborone, in June 2016).
- **Conduct energy planning that incorporates industrialization and social development strategies** (for the latter to avoid environmental impacts, such as deforestation, erosion and indoor air pollution).
- **Create an enabling mechanism to facilitate access to public and private land for RE developers** (in some countries, dedicated land Commissions are created to fast track land acquisition for infrastructure projects of national importance) and anchor the issue of biofuels in policies that will avoid conflict and create synergies with food security, learning from the ongoing example of ethanol being produced from sugar cane molasses.
- **Mainstream gender in the energy sector**, and enhance energy access for women and other vulnerable groups, especially in rural and peri-urban areas, through targeted programmes,
- **Promote the productive use of mini-grids and other decentralized energy systems** to improve energy access, affordability and income generation.

SADC Centre for Renewable Energy and Energy Efficiency (SACREEE)

The SADC region continues to show its commitment to regional coordination and cooperation in the Energy Sector through establishment of the SADC Centre for Renewable Energy and Energy Efficiency (SACREEE), based in Namibia. SACREEE envisions to *“increase access to modern energy services and energy security by promoting the adoption of renewable energy, energy efficient technologies and energy services in SADC Member States, thereby supporting the region’s economic and social development”*. The vision shall be achieved by promoting market-based adoption of RE and energy efficiency technologies and energy services in SADC Member States thereby supporting the region’s sustainable development objectives through: resource mobilization; policy; quality assurance; capacity building and knowledge management; communication; and promoting investment in RE, energy efficiency projects and programmes¹⁵. It is envisaged that SACREEE will oversee the implementation of the REESAP in MS. The development of the PARES programme is one way to

¹⁵ SACREEE Project Document 2015

demonstrate Swaziland's commitment to ensure fruition of the SADC REEESAP in the local energy industry.

Regional Electricity Regulators Association of Southern Africa (RERA)

The Namibia based Regional Electricity Regulators Association of Southern Africa (RERA) is a formal association of independent electricity regulators also under the auspices of SADC. Swaziland, through Swaziland Energy Regulatory Authority (SERA), is a participating member in RERA with the aim to improve regulation and governance in the Swaziland power sector. Swaziland joined RERA with a view to benefit from regional best practices, benchmarking information and shared experiences in addressing common power sector challenges, including RE and EE.

SADC NEXUS Dialogue Project “Fostering Water, Energy and Food Security Nexus Dialogue and Multi-Sector Investment in the SADC Region”

This is a project supported by the European Commission as part of the global ‘Nexus Dialogues Programme’. The Nexus Dialogues Programme (Phase I) aims at helping regional organisations and their member states applying a nexus approach in the formulation of multi-sector policy recommendations, strategies, action plans and investment programmes.

The overall objective of the project is to support the transformation required to meet increasing water, energy and food security demand in a context of climate change in the SADC Region through the development of a truly integrated nexus approach. The specific objective of the project is to create an enabling environment that will drive cross-sectoral engagement and implementation of nexus investment projects that contribute to enhancing water, food and energy security in SADC region. The SADC Nexus Dialogue Project is a strategic fit in the implementation of SADC Regional Indicative Strategic Action Plan (RSAP IV) and the Roadmap and Strategy for industrialisation.

The two expected results of the project are:

- Establishing a SADC Regional WEF Nexus Operational Framework; and
- Developing a prioritised list of Nexus Investment Projects