RENEWABLE ENERGY AND ENERGY EFFICIENCY STRATEGY & ACTION PLAN

REEESAP 2016-2030

"Secure energy, empower lives, brighten the future"

A project funded by
The European Union

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an Atkins led consortium

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Abbreviations / Acronyms

AA	Action Agenda
ACEC	Africa Clean Energy Corridor
ADA	Austrian Development Agency
AEEP	Africa-EU Energy Partnership
AFD	Agence Française de développement
AfDB	African Development bank
BAU	Business as Usual
BREA	Botswana Renewable Energy Agency
CFL	Compact Fluorescent Lamp
CSP	Concentrating Solar Power
CNELEC	Conselho Nacional de Electricidade
COMESA	Common Market for Eastern and Southern Africa
COP21	Conference of the Parties (2015 Paris Climate Conference)
CSO	Civil Society Organisations
DBSA	Development Bank of Southern Africa
DFI	Development Finance Institution
DRC	Democratic Republic of Congo
DSM	Demand Side Management
EAC	East African Community
EACREEE	East African Centre for Renewable Energy and Energy Efficiency
EAPP	Eastern Africa Power Pool
ECOWAS	Economic Community of West African States
ECREEE	ECOWAS Centre for Renewable Energy and Energy Efficiency
EE	Energy Efficiency
EEP	The Energy and Environment Partnership
ETG	Energy Thematic Group
EUD	European Union Delegation
FIT	Feed-in-Tariff
FUNAE	Fundo Nacional de Energia
GDP	Gross Domestic Product
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (*GIZ*) GmbH (German International Cooperation)
GTF	Global Tracking Framework under SE4ALL
GVEP	Global Village Energy Partnership
HCB	Hidroeléctrica de Cahora Bassa
HIVOS	Dutch Organization for Development
I&S	Infrastructure and Services (SADC Directorate)
ICP	International Cooperating Partner
ICS	Improved Cook Stoves
ICT	Information and Communication Technologies
IDC	Industrial Development Corporation of South Africa
IEA	International Energy Agency
IGMOU	Inter-Governmental Memorandum of Understanding
INDC	Intended Nationally Determined Contributions
IOC	Indian Ocean Commission
IP	Investment Prospectus
IPP	Independent Power Producer
IRENA	International Renewable Energy Agency
IRP	Integrated Resource Planning
kW / MW / GW	Kilowatts / Megawatts / Gigawatts
kWh	Kilowatt hours
LED	Light Emitting Diode
LPG	Liquefied Petroleum Gas
M&E	Monitoring & Evaluation
M/toe	Mega / tons of oil Equivalent
MEPS	Minimum Energy Performance Standards

MMEWR	Ministry of Minerals, Energy and Water Resources of Botswana
MoE	Ministry of Energy
MOTRACO	Mozambique Transmission Company
MS	Member States
NAP	National Action Plan
NDC	Nationally Determined Contributions
NKE	Non Key Expert
OMD	Omnicom Media Group (media Group) of South Africa
PNEE	Mauritius National Energy Efficiency Programme
PPA	Power Purchase Agreement
PPP	Public Private Partnership
PROBEC	Programme for Basic Energy and Conservation
PRU	Public Relations Unit at SADC
RAGA	Rapid Assessment and Gap Analysis
RCREEE	Regional Centre for Renewable Energy and Energy efficiency
RE	Renewable Energy
REEEP	Renewable Energy and Energy Efficiency Partnership
REA	Rural/Renewable Energy Agency
REASAP	Regional Energy Access Strategy and Action Plan
REC	Regional Economic Communities
REEESAP	Renewable Energy and Energy Efficiency Strategy and Action Plan
REI4P / REIPPPP	Renewable Energy Independent Power Producer Procurement Programme of South Africa
REN21	Renewable Energy Policy Network for the 21st Century
RERA	Regional Energy Regulators Association of Southern Africa
RIDMP	Regional Infrastructure Development Master Plan
RISDP	Regional Indicative Strategic Development Plan
SA	South Africa
SACREEE	The SADC Centre for Renewable Energy and Energy Efficiency
SADC	Southern African Development Community
SAPP	Southern African Power Pool
SARDC	Southern Africa Research and Documentation Centre
SDG7	Sustainable Development Goals (Goal 7 in energy)
SE4ALL	Sustainable Energy for All
SNV	SNV Netherlands Development Organisation
TAF	Technical Assistance Facility
TANESCO	Tanzania Electric Supply Company Limited
TFEC	Total Final Energy Consumption
TPES	Total Primary Energy Supply
UN	United Nations
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
US	United States of America
WB	World Bank

Glossary

Biofuels	A wide range of liquid and gaseous fuels derived from biomass. Biofuels – including liquid fuel ethanol and biodiesel, as well as biogas – can be combusted in vehicle engines as transport fuels and in stationary engines for motive power, heat and electricity generation. They also can be used for domestic heating and cooking (for example, as ethanol gels).
Biomass Energy / Bio Energy[1]	Energy derived from any form of biomass/organic material, including bio-heat, bio-power and biofuel. Bio-heat arises from the combustion of solid biomass (such as dry fuel wood) or other liquid or gaseous energy carriers. The heat can be used directly or used to produce bio-power by creating steam to drive engines or turbines that drive electricity generators. Alternatively, gaseous energy carriers such as bio-methane, landfill gas, or synthesis gas (produced from the thermal gasification of biomass) can be used to fuel a gas engine. Biofuels for transport are sometimes also included under the term bioenergy (see Biofuels).
Cooking/Heating and Cooling	These terms collectively mean use of energy sources for cooking, heating and cooling. The heating could mean space heating or water heating. Cooling generally means space cooling and other related technologies of cooling like refrigeration.
Concentrated Solar Power (CSP)	Concentrated solar power (also called concentrating solar power, concentrated solar thermal, and CSP) systems generate solar power by focussing sunbeams on mirrors/receivers converting the solar energy into heat that in turn is used to generate steam to drive a turbine that generates electrical power.
Cost Reflective Tariff	Tariff that takes into account the full cost of supplying energy or electricity to the consumer, including the generation, transportation and distribution costs. This is in context where some utilities in the SADC Region charge consumers lower for a unit of electricity than what it costs to produce it.
Energy Access	Access to modern energy services provided through electricity, clean cooking fuels, clean heating systems, and energy for productive use and community services[2].
Embedded Generation	Embedded Generation is generation of power in a small scale, normally connected to a distribution network, as opposed to a transmission network, and is located close to the place where the power is consumed. An example of embedded generation is a PV panel connected to the grid and installed in a household rooftop.
Energy Efficiency	Measures (practices, efficient devices & appliances, regulatory e.g. labelling and codes) undertaken to reduce the losses in generation, transmission and distribution networks on the supply side and to reduce the consumption of energy in demand sectors that include household, industry, commerce). EE in this case includes deployment of solar water heating systems and improved building designs.
Energy Intensity	According to the World Bank, energy intensity level of primary energy[3] is the ratio of energy supply to gross domestic product measured at purchasing power parity. Energy intensity is an indication of how much energy is used to produce one unit of economic output. A lower ratio indicates that less energy is used to produce one unit of output and hence being more efficient.
Energy Mix	The Energy Mix of a country/region is the specific combination of different energy sources it uses to meet its energy consumption needs- often a combination of non-renewable and renewable energy. Energy mix varies according to the energy resources available to a country/region either as national/regional resources or as imports.

[1] Definition from REN 21 SADC Report
[2] Based on SE4ALL--- http://www.worldbank.org/content/dam/Worldbank/document/Energy/se4all/SE4ALL-Energy-Access-Committee-Report-Corrigendum.pdf
[3] Includes all sources of energy

Feed in Tariff (FIT)	A feed-in tariff is a policy mechanism designed to accelerate investment in renewable energy technologies. It achieves this by offering long-term contracts to renewable energy producers, typically based on the cost of generation of each technology. Rather than pay an equal amount for energy, however generated, technologies such as wind power, for instance, are awarded a lower per-kWh price, while technologies such as solar PV and tidal power are offered a higher price, reflecting costs that are higher at the moment.
Hydropower	Hydropower is often referred to as water power. The simplest definition of hydropower would be the power that derives from the force of energy of the moving water using turbines and generators. Hydropower systems can be run-of-river (no significant dams or reservoirs) or use large dams and reservoirs. Hydropower refers to large hydroelectric power plants, and small and micro hydro systems. In REEESAP all hydropower has been considered as RE. Furthermore, small hydro and lower sizes have been defined as below: Small hydro: 1 -20MW Mini hydro: 100kw-1MW Micro hydro: 5kW-100kW Pico hydro: <5kW
Integrated Resource Plan (IRP)	A public planning process and framework within which the costs and benefits of both demand and supply side resources are evaluated to develop the least total cost mix of utility resource options. IRP includes a means for considering environmental damages caused by electricity supply and transmission and, for identifying cost-effective energy efficiency and renewable energy alternatives
Independent Power Producers (IPP)	IPP is a private entity, which generates and supplies power to the state utilities or directly to the end users. IPP is not a state utility but can be part of a Public Private Partnership entity together with a state utility.
Intended Nationally Determined Contributions (INDC)	In preparation for the International Climate Agreement at the UNFCCC Conference of the Parties (COP21) in December 2015 in Paris, countries (Parties) around the world publicised what post-2020 climate actions they intended to take, known as their **Intended Nationally Determined Contributions** (INDCs). The pledges in INDCs will largely determine whether the goals of reduction in global temperature rise can be achieved. Developing countries/Parties can benefit from global climate funding to implement their INDCs.
Invasive Species-Plants	An **invasive species** is a plant, that is not native to a specific location (an introduced **species**), and which has a tendency to spread to a degree believed to cause damage to the ecosystem with impacts e.g. on water availability, livestock grazing areas, arable; land. Removing the plant species is creating a feedstock that can be used to generate energy- e.g. as charcoal, or combustion in heat or electricity plants.

Executive Summary

This Renewable Energy and Energy Efficiency Strategy and Action Plan (REEESAP) presents a SADC-wide long-term vision on achieving sufficient, reliable, least cost, sustainable, clean modern energy services for SADC by 2030 through acceleration of scaling up of renewable energy (RE) and energy efficiency (EE) uptake.

Access to adequate modern sources of energy is known to result in improved economic development and poverty alleviation which are the pillars of SADC Agenda, and is a precondition for achieving development goals that extend beyond the energy sector, such as poverty eradication, access to clean water, improved public health and education, women's empowerment and increase food production. This is even more relevant at a time when the region is facing energy deficit, particularly electricity since 2007.

The REEESAP was developed through a consultative process involving the 15 SADC MS, SADC Secretariat and ICP agencies through a combination of literature review and direct meetings with the relevant stakeholders in the MS countries. Further guidance was provided by the stakeholders through Formulation and Validation workshops.

The REEESAP is a regional framework from which SADC MS will develop their own RE/EE Strategies and Action Plans and will thus kick-start national processes to accelerate energy transitions in the region, including development of national action plans".

The key strategic objectives for this REEESAP are to:
1. achieve **energy security** by closing the current supply/demand deficit largely in the power sector and enabling future economic growth and industrialization;
2. increase availability, **accessibility and affordability of modern energy services** particularly to the poor that largely depend on inefficient traditional forms of energy in order to enhance their socio-economic status and hence alleviate poverty;
3. **offset the risk associated with energy imports** in the form of large import bills and uncertainty of supply aggravated by the impact of currency fluctuations;
4. **mobilize financial resources for investment for both** RE/EE projects and manufacturing of RE/EE equipment in the SADC Region, the latter contributing to industrialization agenda of SADC; and
5. achieve low carbon development paths and climate resilient energy systems in MS and hence the Region.

Action plans to achieve these objectives are framed along the following strategic interventions[4]:
1. Strengthen national and regional institutions to adopt and implement RE/EE projects;
2. Create policies, strategies, plans and other frameworks to ensure an enabling environment for RE/EE investments;
3. Have appropriate regulation and standardization frameworks for RE/EE projects and investments;
4. Attract private sector participation in investments for RE and EE;
5. Build capacity to design, develop, build, implement and maintain RE/EE projects
6. Attract financing for RE/EE projects;
7. Develop projects, technologies and transfer know how to meet demand targets;
8. Promote adoption of RE/EE through information, advocacy and awareness; and
9. Consider cross-sectoral and cross cutting issues when implementing RE/EE projects

Key to ***strengthening national and regional institutions*** is the staffing of SADC agencies, launching of SACREEE and ensuring that all MS have established their national energy regulators. Institutions to cater for RE/EE particularly off-grid systems and attracting private sector participation are considered important. A SADC-COMESA-EAC tripartite platform to share RE/EE experiences is also required.

The creation of ***National frameworks*** starts with national action plans that will domesticate the REEESAP at MS level to meet the RISDP target of MS starting implementing REEESAP by 2019. In addition, accompanying frameworks such as current Integrated Resource Plans (IRP) or similar planning frameworks with clear set targets, independent power producer (IPP) procurement frameworks to attract private sector investment and cost reflective tariffs for both grid and off grid systems are important.

[4]These are defined in the TORs of the project

Important ***regulation and standardization*** frameworks are the quality standards for RE/EE, harmonized grid codes, standardised Power Purchase Agreements, regulation of grid losses and ensuring energy auditing standards and building standards/codes.

MS are to ***attract private sector participation*** in investments for RE and EE through transparent investment regimes and exposition of investment opportunities through prior project preparation, predictable sector and grid network expansion and market assessment.

Foreseen ***capacity development*** will entail creating skills for IRP development, formulation of IPP frameworks, RE resource assessment, project development[5], accessing project financing, technology development and energy auditing.

Attracting financing for RE/EE projects will be a combination of mobilizing national and regional financing institutions and banks, creating special funding/schemes/facilities for those projects that cannot easily access project financing and exposing the various sources of financing to potential project developers and governments.

MS and SADC should be ***developing projects and technologies and transferring know-how*** to meet future energy demand targets both for grid and off-grid/mini-grid scales. This will also entail mapping resources and required network infrastructure and piloting projects for other RE technologies that are not widely used. Manufacture of RE/EE technologies will also facilitate this objective.

Promoting adoption of RE/EE through ***information, advocacy and awareness*** will require information collection, analysis and dissemination using technology information systems and training those that can disseminate information on the opportunities and benefits of RE/EE uptake.

To achieve development goals that extend beyond the energy sector, such as poverty eradication, access to clean water, improved public health and education, women's empowerment and increased food production, ***a cross-sectoral and cross cutting*** approach when planning and implementing RE/EE projects is required. This will require institutionalizing the coordination on the cross-sectoral planning with relevant sectors such as water, land and cross cutting planning with gender and climate change mainstreaming.

The current REEESAP has mainly focused on Action timeframes for the next 5 years[6] with opportunity to revise the action plans every 3 to 5 years. An Implementation framework is included that specifies guiding principles, institutional roles and resource mobilization for implementation of REEESAP. An M&E framework has been provided that will track progress towards the energy sector performance on the strategic objectives and milestones on achievement of the stipulated actions under each strategic intervention.

Guidelines as reference to guide MS in the development of their National Action Plans based on the REEESAP and a Communication and Visibility Plan have been developed separately.

[5] Including capacity to design, develop, build, implement and maintain RE/EE projects
[6] Although some are ongoing actions

1. Introduction

1.1. Background

Since the adoption of the Protocol on Energy in 1996, Southern African Development Community (SADC) has enacted several strategic instruments for the energy sector. These include the SADC Energy Cooperation Policy and Strategy in 1996, the SADC Energy Action Plan in 1997, the SADC Energy Activity Plan in 2000, the SADC Regional Energy Access Strategy and Action Plan in 2010, the Regional Infrastructure Development Master Plan and its Energy Sector Plan in 2012, and most recently the revised Regional Indicative Strategic Development Plan (RISDP 2015). These policies, plans and strategies have set out objectives for SADC and its Member States (MS) for development of the energy sector and its subsectors of wood fuel, petroleum and gas, electricity, coal, **renewable energy, and energy efficiency and conservation**.

In the past, there has been significant focus on the fossil fuel-based power sector, with limited attention paid to renewable energy and energy efficiency (RE/EE) in the SADC Region. There is however emerging interest towards RE/EE, as the revised Regional Indicative Strategic Development Plan (RISDP-2015-2020) provides for the establishment of a SADC Centre for Renewable Energy and Energy Efficiency (SACREEE) as well as the need for a "**Renewable Energy and Energy Efficiency Strategy and Action Plan (REEESAP)**. There have been some efforts in the past in establishing a SADC RE & EE strategy, including a Renewable Energy Strategy and Action Plan (RESAP) document drawn up with the support of Finnish Government in 2012, though never validated. Reviving the development of a SADC REEESAP, therefore, has remained a necessary step.

The current REEESAP development has been given an impetus by the decision of the 34th Meeting of the SADC Ministers (Decision 18) responsible for Energy in 2015 held in Johannesburg, South Africa, that instructed continued work on the formulation of a SADC "Renewable Energy and Energy Efficiency Strategy and Action Plan" for the years 2015 to 2030. Subsequently, the SADC Directorate of Infrastructure and Services (I&S) requested support from the European Union (EU) Delegation in Gaborone to formulate the REEESAP. The EU granted the support through the EU Technical Assistance Facility (TAF) for the SE4ALL - Eastern and Southern Africa. A team of consultants led by Atkins of the United Kingdom (which is the lead partner of a consortium that executes the TAF) were responsible for the development of the REEESAP.

The project to develop REEESAP commenced on the 25th of April 2016 in Gaborone with a kick-off meeting with the EU Delegation to Botswana and representatives of the Energy Division of the Directorate of Infrastructure and Services at SADC Secretariat. As part of the development process of REEESAP, field visits were undertaken to seven (7) SADC MS namely Botswana, Mozambique, Mauritius, Namibia, South Africa, Zambia and Zimbabwe to consult with stakeholders and solicit inputs for the development of the REEESAP. Information for the rest of the SADC Member States was obtained through literature review and some direct communication with the MS concerned. Participation by MS at the First and Validation workshops provided an opportunity for all MS to make inputs to the final version of the REEESAP.

1.2. Rationale for REEESAP

The REEESAP is a regional framework from which SADC MS will develop their own RE/EE Strategies and Action Plans leading to the acceleration of efforts to promote RE and EE in the MS, and hence contributing to energy security and energy access in SADC Region. Energy security and adequate access to modern sources of energy are known to result in improved economic development and poverty alleviation which are the pillars of SADC Agenda stipulated in the SADC Treaty and the revised Regional Indicative Development Strategic Plans (RISDP – 2003 & 2015). Apart from contributing to energy security and access, REEESAP is expected to mobilize significant finance from local and international investors in the short to medium term (3-5 years) thereby increasing the rate of implementation of RE/EE projects and also progressing industrialization related to manufacturing of RE/EE equipment. It is therefore important that SADC and MS set RE and EE targets that will signal to investors the extent of RE/EE investment required.

Renewable Energy (RE) and Energy Efficiency (EE) are considered to be promising sources that can contribute positively to the region's energy mix in a financially and environmentally sustainable manner considering that:

1. there are RE resources in the Region in the form of hydro, solar, wind, biomass and geothermal[7] energies;
2. the prices of RE technologies such as solar and wind are falling significantly and are beginning to be competitive with those of conventional sources;
3. the region has some examples of successful deployment of RE models e.g. South Africa that is mobilizing large private sector financing;
4. the model of competitive bidding for RE through Independent Power Producers (IPP) procurement is leading to record low prices of RE generated electricity (e.g. in SA and Zambia[8]);
5. there is a concerted effort to establish feasibility and affordability of other emerging RE technologies such as CSP[9], Ocean (tidal and wave) Energy[10] , geothermal and biomass based power generation[11];
6. EE offers the cheapest way of investment to generate additional capacity to meet the ever increasing electricity demand and offer solar thermal applications to meet energy demand in sectors such as households, social institutions (hospitals, local government and schools) as well as industry;
7. given the scarcity of traditional fuels and their polluting effects, both RE and EE provide a solution towards cleaner and sustainable energy services for improved healthy environment and poverty alleviation.
8. both RE and EE are the key means of reducing greenhouse gas emissions in the energy sector and hence will contribute to low carbon development in the Region, hence contributing to mitigating global climate change. Planning for a sustainable energy supply mix also requires taking into consideration climate resilience of the energy systems for sustainability of energy supply; and
9. because of the uncertainty posed by climate change particularly for hydropower generation, other RE sources and EE offer alternatives for a more sustainable and resilient energy system.

The process of developing REEESAP has created an opportunity for a coordinated MS consultative process in which the strategies for promotion of RE and EE in the SADC Region can be developed and consolidated.

1.3. Conceptual Framework of REEESAP

The conceptual framework presents how the REEESAP was developed, its content and the future use (Figure 1-1). SADC-REEESAP was considered within the framework of the overall Southern African Development Community (SADC) Development Agenda of regional economic integration and poverty eradication with the principles of balance, equity and mutual benefits among the SADC Member States. Consistency has also been maintained in the development of REEESAP with other relevant SADC energy instruments and Agency Plans and roles as provided in the box below.

SADC Instruments and their relevance to REEESAP

- **SADC Treaty 1992** - regional economic integration and poverty reduction
- **Energy Protocol 1996** - cross sectoral issues with water, agriculture, forestry, demand sectors. The Protocol is due for revision as indicated in RISDP 2015-2020.
- **Energy Sector Cooperation Policy and Strategy** - sustainable, coordinated management, protection and efficient utilization of energy resources
- **Action Plan 1997** - **Activity Plan 2000-2005-**enabling environment & harmonization of policy/legal and regulatory frameworks
- **REASAP 2010** - energy access, harness resources and progressive increase in access
- **RIDMP 2012** - infrastructure for energy security, access, resource utilization and financial and environmental sustainability. Demand forecasting for various scenarios of 3%, 5% and 8% economic growth rates[12].
- **RISDP 2015-2020** - strategic direction stipulating targets for energy access
- **SACREEE Project Document** - Promote markets for RE/EE technologies and services
- **SAPP Plans** - regional electricity planning and trading; project development and implementation
- **RERA** instruments - electricity regulatory framework
- **Energy Ministers Decisions** - inform on direction being pursued

[7] Geothermal potential is known to exist in some SADC countries but exploitation has not yet occurred
[8] From 6 USc/kWh from Solar
[9] CSP with modified carrier fluid and storage
[10] Combining with harbour designs
[11] e.g. using invasive species
[12] SADC Industrialization Strategy and Roadmap assumes 6% per capita GDP growth rate 2015-2020 and 8% from 2021 to 2063

Apart from the SADC energy instruments, the development of REEESAP has been inspired by various national policies and strategies, initiatives of other Regional Economic Communities, and global initiatives such as SE4ALL, IRENA, SDG7, AEEP and REN 21. Below are some global initiatives that have been considered in the development of REEESAP. These are examples only and there are many such initiatives that MS can harness in their efforts to develop and implement their own RE/EE Strategies and Action Plans.

- **SE4ALL** - Action Agendas and Investment Prospectus assist participating countries to set RE/EE and energy access targets and reforms to improve the RE in energy mix, rate of EE and energy access in view of the global target of doubling RE in the energy mix, and doubling the rate of EE and universal access to modern energy services
- **International Renewable Energy Agency (IRENA)** is also a Centre of excellence for RE under SE4ALL. The Agency also supports participating members to conduct RE resource assessments, RE Rapid Assessment and develop RE-Roadmaps hence availing technical resources towards improved adoption of RE
- The **African Development Bank** (**AfDB)** has also prepared targets for RE and Energy Access for 2025 that MS can align with to benefit from financing resources the Bank will be deploying to achieve those targets.
- **Sustainable Development Goal** on energy (**SDG7**) of ensuring access to affordable, reliable, sustainable and modern energy for all- inspired formulation of the Vision adopted for the REEESAP.
- **Africa-EU Energy Partnership** (**AEEP**) - has some targets to improve RE and energy access in Africa and avails technical and financial resources towards those targets
- **REN 21** - the global RE network generates planning data that can guide decision making on future RE/EE investments.

The REEESAP also considered COMESA and Indian Ocean Commission (IOC) RE/EE initiatives to ensure synergy and coordinated actions for MS that belong to these Regional Economic Communities (REC).

The process of REEESAP development started with a situational or baseline analysis of the energy sector with emphasis on the activities and practices on RE and EE. This led to identification of targets and the gaps that the SADC Region and its MS should be addressing through REEESAP.

The Vision and Mission for REEESAP is presented further on in the report, followed by the definition of the strategic objectives. The objectives are centred on energy security, energy access, offsetting the risk of energy imports, mobilizing finance for RE/EE investments and climate change sustainability. The objectives are also in line with the objectives provided in SADC RIDMP (2012), as the energy sector broad objectives are similar.

The Scope presents what is being covered by the REEESAP on the RE and EE subsectors. RE scope covers electricity - grid and off-grid, cooking/heating and cooling and biofuels. Heating and cooling are for both space heating and cooling, and water heating. EE covers supply and demand side options largely for the electricity sector but also for technology, fuel substitution in cooking/heating/cooling and transport fuels, and buildings.

The strategic interventions to achieve the objectives fall within the following areas[13]:
- institutional strengthening
- policy/strategy/legal framework
- regulatory and standardization
- private sector participation
- capacity development
- financial intermediation
- projects and technology development and transfer
- information, advocacy and awareness
- cross sectoral (e.g. water crisis, food crisis, industrialization etc.) and cross-cutting issues (e.g. gender, climate change etc.)

The strategic interventions are translated into Action Plans depending on the issues and gaps identified for these topics. MS will then be informed by these regional Action Plans when developing their own national

[13] In line with the TORs

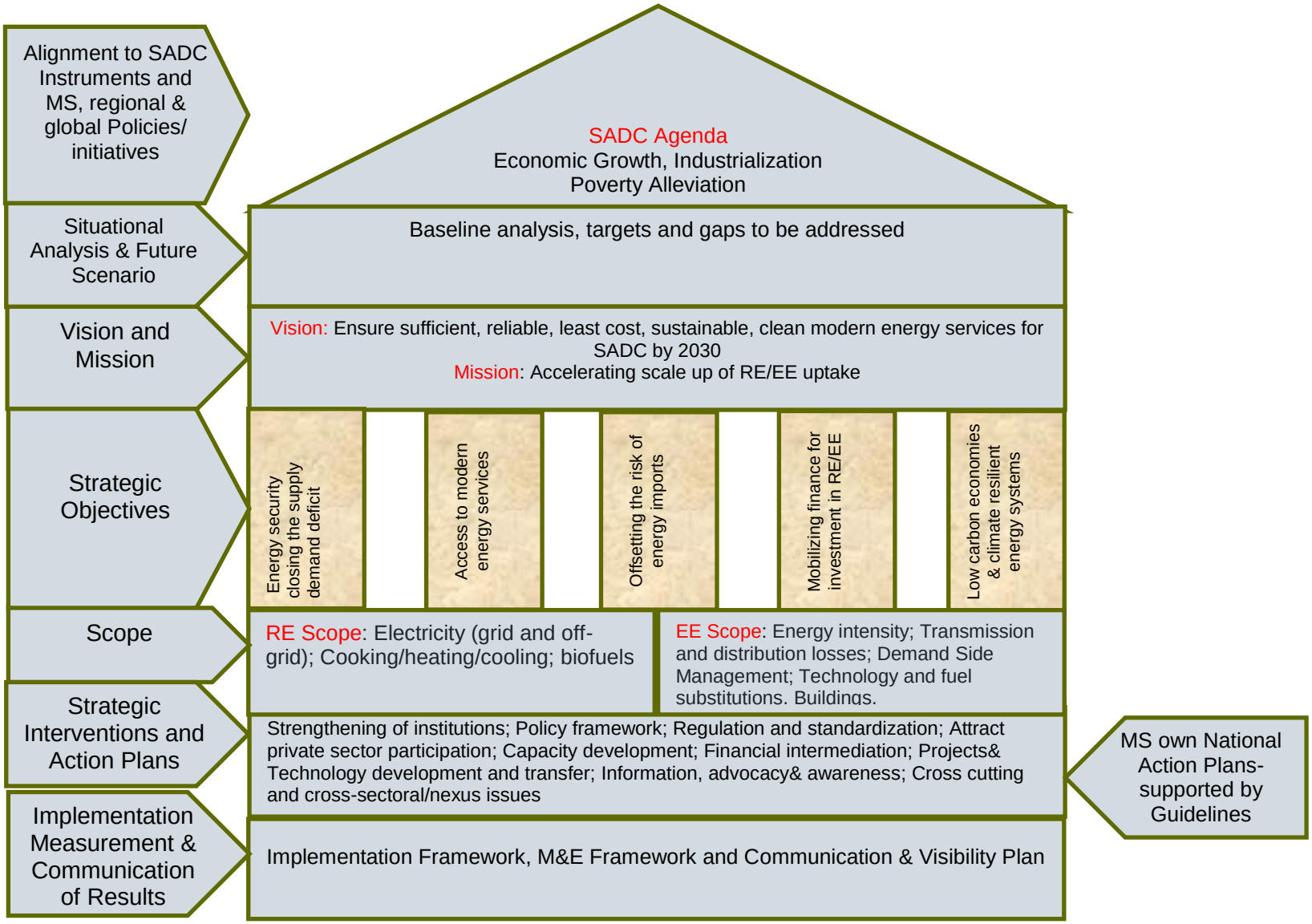
Action Plans. Guidelines have been provided in a separate document to support MS when developing their own National Action Plans.

An implementation framework presenting guiding principles, Institutional roles and resource mobilization for implementation of REEESAP is provided.

The Monitoring and Evaluation (M&E) framework has been developed to track achievement of the strategic objectives and implementation of the Action Plans.

A communication and visibility plan accompanies the REEESAP to support its dissemination to various stakeholders.

Figure 1-1 REEESAP Conceptual Framework



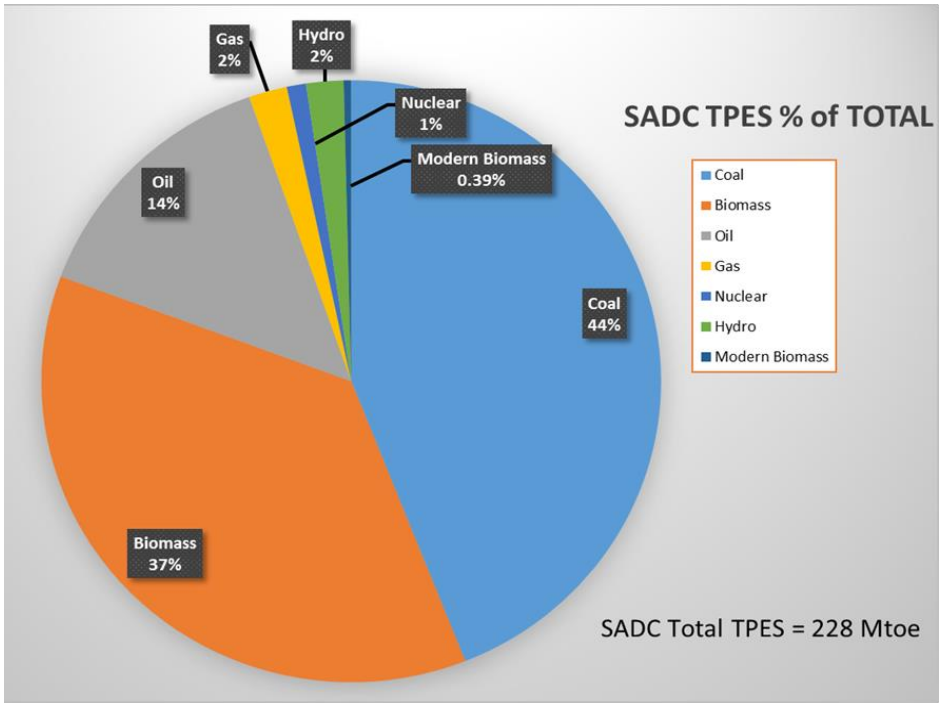
2. Baseline Status

The baseline status presented below has been prepared with the best available data at the time of preparing REEESAP. Efforts were made to collect first hand data during the consultation visits to the MS, through follow-up communication; however, in many instances data were obtained from secondary sources.

2.1. Energy Sector Overview

Africa as a whole has one of the lowest energy supplies and consumptions in the world. For example, in 2013, the Total Primary Energy Supply (TPES) for the world was approximately 13,500 Mtoe while TPES for the whole of Africa was only close to 750[14] Mtoe (approximately 5.5% of the World TPES), even though the population of Africa accounted for approximately 15% of the world total. The latest available[15] data shows that the TPES for SADC Region was approximately 228 Mtoe (2008 figure from IEA, 2011, as quoted by IRENA), with per capita annual consumption of 0.88 toe. Coal had the highest share (44%), followed by traditional biomass (36.66%) and oil (14%), as shown in Figure 2-1. The low energy consumption in Africa calls for concerted efforts to boost energy use particularly of clean modern energy for economic growth and poverty reduction, without adversely affecting the environment. The endeavour to bring in RE and EE will also assist in diversifying the energy mix to meet the demand for such modern energy sources.

Figure 2-1 SADC TPES - Share of Fuels



Source: IEA quoted in IRENA RRAs, 2008 data

2.2. Electricity Sector

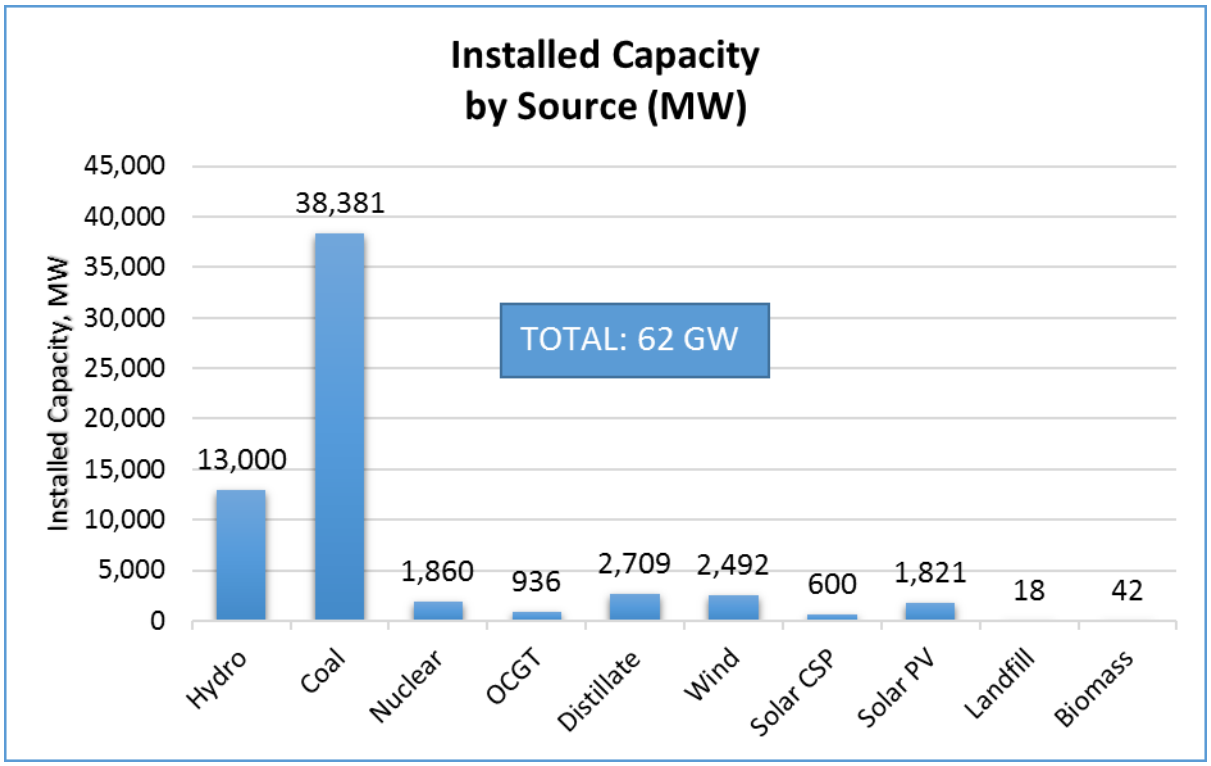
After enjoying surplus electricity until 2007, the SADC Region as a whole now has a deficit in electricity supply that is set to continue until 2020/2022, according to the Southern African Power Pool (SAPP)[16]. This shortfall is attributed to an increase in demand due to the rise in economic activities and population growth in almost all of the SADC countries. Many countries in the region such as South Africa, Botswana, Zambia, Zimbabwe and Namibia have implemented temporary rationing of the electricity supply as a result of the

[14] Key World Energy Statistics 2015, IEA
[15] Data available to the expert team at the time of writing this document
[16] Malawi, Tanzania and Angola are still not connected to the SAPP grid.

shortfall, although the situation is slowly improving. The shortfall has given rise to loss of output of many important economic activities, including the mining in South Africa.

The installed electricity capacity in the SADC Region[17] as of 2015 was 61,859 (MW)[18] with the largest contributor being coal (as seen in Figure 2-2)[19]. Even though the installed capacity is higher, the available and operating capacities were 52,589 and 46,910 MW respectively[20]. For the same period (as of 2015) the demand (including reserves) was 55,157 MW resulting in a shortfall of over 8,000 MW for the participating Member States.

Figure 2-2 Installed Capacity by Source in SADC Region (2015)



Source: SAPP Annual Report 2015

The SADC Island States have a total installed capacity of less than 1,500 MW.

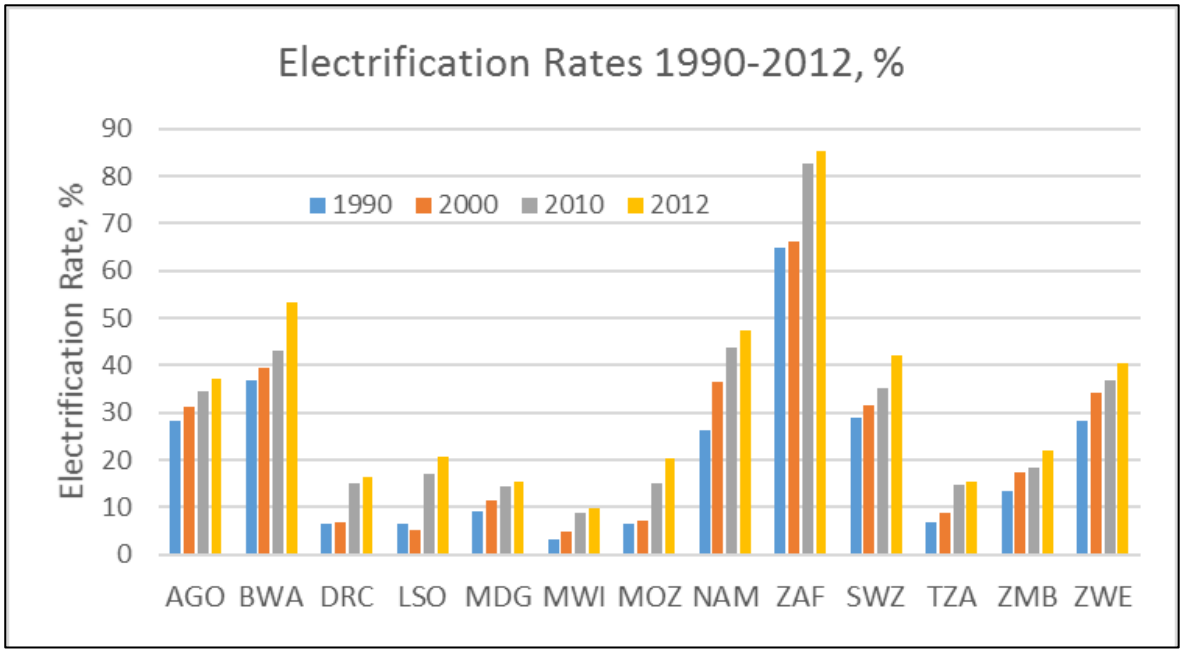
2.2.1. Electricity Access & Rural Electrification

Access to electricity in SADC stands at 42%[21] with less than 10% access in rural areas of most of the Member States. National electrification access rates vary significantly among SADC MS, with Mauritius and the Seychelles being either fully or very close to fully electrified (RERA, 2015). On the other hand, Malawi has the lowest national electrification rate, which is less than 10 percent. In rural areas the electrification rate is even lower, close to only 2%. Other MS with low levels of national electrification rates include the Democratic Republic of Congo (DRC) and Madagascar, both with the rates below 20 percent. In the revised RISDP (2015-2020), MS were expected to reach 100% access to electricity by 2012. Some of the Member States have made good progress in improving the rate of electrification over the years.

Figure 2-3 shows that the historical electrification rates for all SADC Member States on the mainland have improved. As can be seen in the figure, some countries such as South Africa, Botswana and Namibia have made good progress in improving the electrification rates.

[17] Excludes Island States
[18] SAPP Annual Report 2015; SAPP also presented as current figure
[19] Does not include Mauritius, Madagascar and Seychelles
[20] March 2015
[21] SADC RE & EE Status Report, 2015 (REN21)

Figure 2-3 Electrification Rates 1990-2012; Source: World Bank Data



Every MS in the SADC Region (except Mauritius and Seychelles with or near 100% electrification rates) has a rural electrification plan, and some countries have a dedicated agency for rural electrification. These countries also have various targets for rural and national electrification and electricity access. In many countries, NGOs such as SNV and Practical Action have been active in promoting rural electrification. Going forward, rural electrification can still play an important role in increasing the electricity access rates in many countries, particularly those with low electrification rates. It is important to mention that updated statistics on energy access rates are missing in most countries and this calls for further action for MS to conduct baseline studies to update the figures. This will also capture the increasing role of micro and pico-systems in improving electrification access. There are challenges related to what is considered to be energy access and MS need to agree on what definitions to use in order to compare performances with regard to the energy access goal.

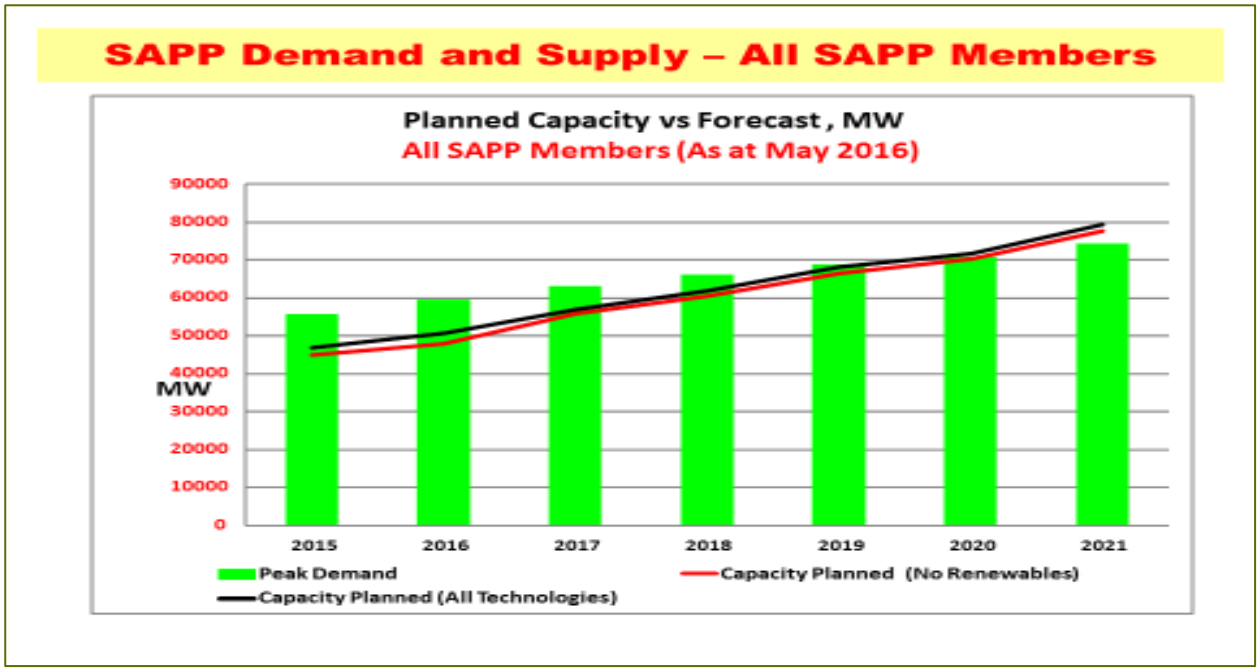
2.2.2. Future Electricity Supply and Demand

Forecast of power and energy demand by SAPP suggests that there is a steady growth in demand for electricity in the Member States with utilities participating in SAPP. The trend in capacity addition in order to meet the expected demand is mixed. A total of 1,999 MW was added into the SAPP grid in 2014, which was the highest figure in the recent years though it was less than the capacity addition in 2009. The encouraging aspect was that over 80% of the new capacity addition in 2014 came from renewable energy, though all of this was in South Africa only.

According to an assessment by SAPP (2015), there is a power shortfall of approximately 8GW. The power shortfall is expected to continue until 2020, as shown in

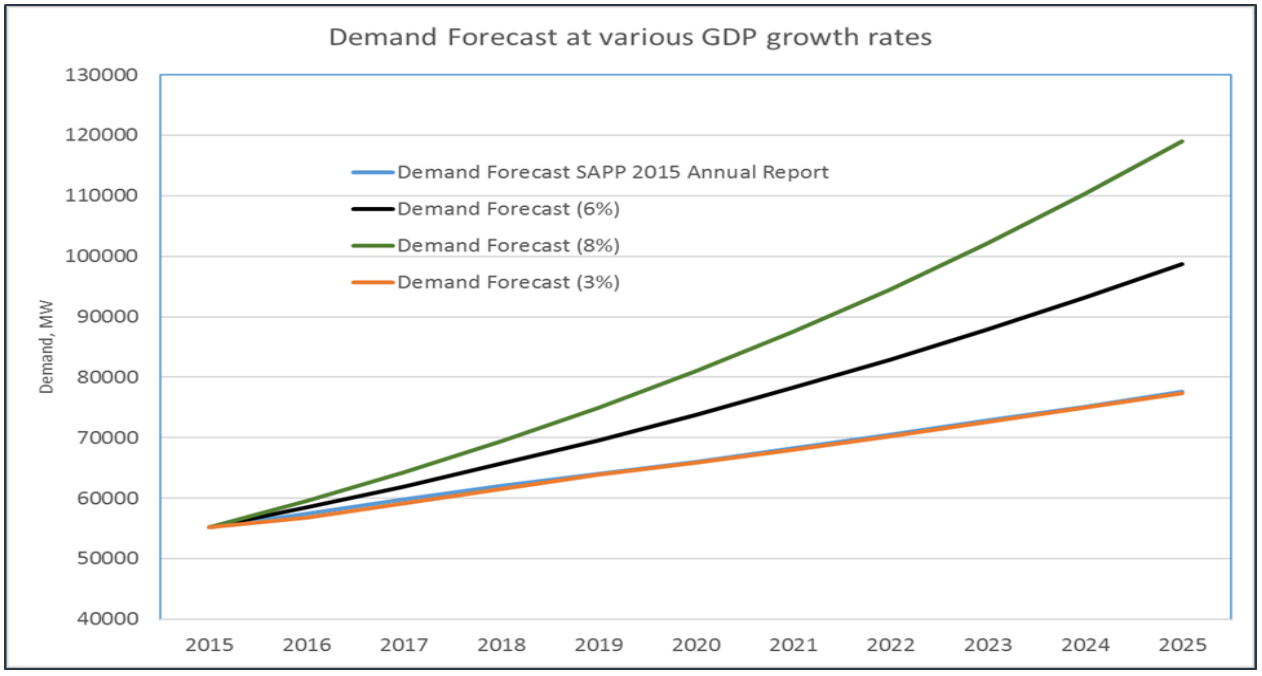
Figure 2-4.

Figure 2-4 SAPP Demand versus Supply (Source: SAPP)



In this analysis, the demand growth is expected to be approximately 3% per annum, though the growth in 2014 was more than 6%. According to the SADC Industrialisation Strategy and Roadmap, the annual per capita GDP growth rate is expected to be 6% until 2020, and 8% after 2020. Figure 2-5 shows three different scenarios of energy demand growth of 3%, 6% and 8% (assuming a linear relationship between per capita income and per capita energy demand). The demand forecast used by SAPP (from Annual Report 2015) is also plotted alongside which shows that the SAPP forecast is very close to 3% growth scenario.

Figure 2-5 Demand Growth Scenarios



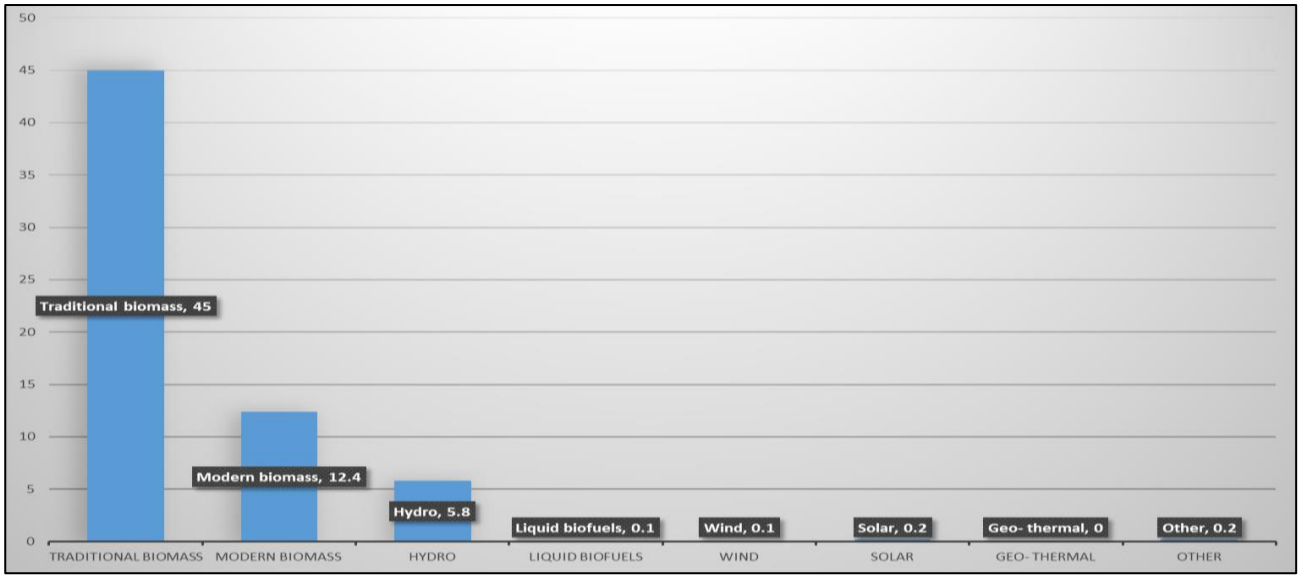
It is then very much conceivable that if the planned capacities over the years remain the same as shown in Figure 2-5, the power shortfall will grow and will not be bridged by the year 2020 as predicted and the shortfall is likely to continue for much longer.

2.3. Renewable Energy Sector

Traditional biomass accounts for more than 45% of the final energy consumption (TFEC) in the SADC Region (rises to 57% if the modern biomass is included), as shown in

Figure 2-6. The prominence of use of traditional biomass in SADC is in line with the rest of Sub-Saharan Africa. The biomass fuels mostly include wood, charcoal and animal waste and are used primarily for cooking and heating in the domestic sectors, particularly in rural areas of the region and in small scale industries.

Figure 2-6 Share of RE by Source in TFEC in the SADC Region (2012)



Source: REN21 SADC Status Report

2.3.1. Electricity: on grid and off-grid

The current total installed capacity of renewable energy in the SADC grids is just over 14 GW (as shown in Table 2-1), which is 24%[22] of the total installed capacity in 2014. The share of renewables in the electricity mix is overwhelmingly dominated by large hydropower systems though solid biomass; solar and wind power are increasing.

Table 2-1 RE Installed Capacity (MW) in MS by Source, 2014

	Hydropower[23]	Solar PV	Onshore wind	Biomass/ Waste	Biogas	Total
Angola	878	0	0	0	0	878
Botswana	0	1	0	0	0	1
DRC	2416	0	0	0	0	2416
Lesotho	77[24]	0.3	0	0	0	77.3
Madagascar	165	3	1	0	0	169
Malawi	351	1	0	17	0	369

[22] Basing on SAPP data, this figure is estimated to have reached 29% in 2015.
[23] Includes large, medium, small and pumped storage
[24] Figures revised during Validation workshop

Mauritius	61	18	1	271	0	351
Mozambique	2186	1	0	0	0	2187
Namibia	332	5	0	0	0	337
Seychelles	0	0	6	0	0	6
South Africa	2276	922	570	242	13	4023
Swaziland	63	0	0	75	0	138
Tanzania	573	11	0	62	0	646
Zambia	2257	2	0	43	0	2302
Zimbabwe[25]	771	5	0	97	0	873
SADC	12323	969	578	807	13	14690

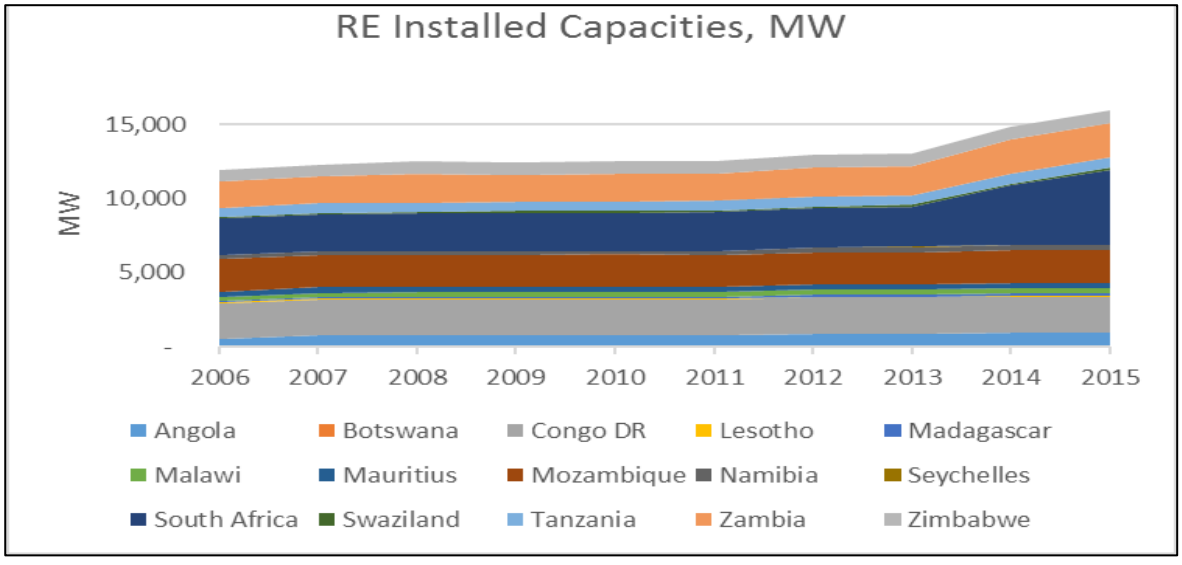
Source: REN21 SADC Status Report, 2015

Geothermal energy has not been seriously investigated in the SADC Region – only Tanzania has identified some potential. Other countries next to the Rift Valley – namely DRC, Malawi, Zimbabwe and Mozambique – have planned to harness their geothermal potential but there are no specific targets. Some work on resource assessment for geothermal energy is taking place in Zambia.

The share of renewable energy in the energy mix has been steadily increasing in the region, as shown in Figure 2-7. Capacity addition of RE has been faster after 2013 due to the increase in RE generation in South Africa as a result of the Renewable Energy Independent Power Producer Procurement Programme (REI4P) being implemented by that country since 2011. Renewable energy mix in SADC was targeted to reach 33% and 39% in 2020 and 2030 respectively as per the RIDMP (2012).

Off-grid situation is not documented in most MS and hence the current status is not well known although some programmes are being implemented.

Figure 2-7 Growth in RE Installed Capacity in SADC (Source: IRENA RE Statistics)

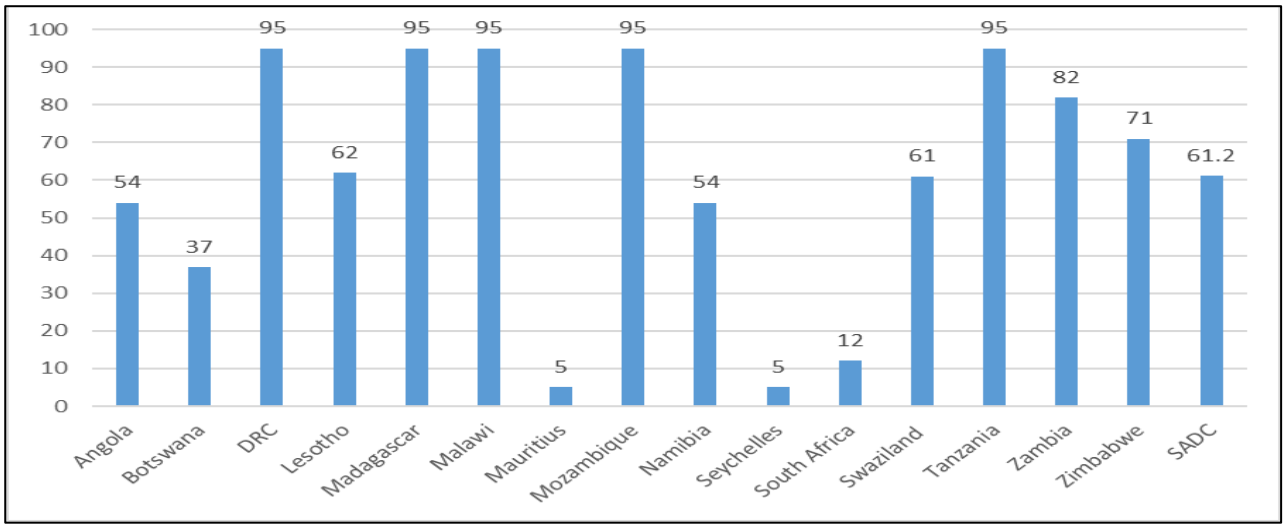


[25] Figures revised in validation workshop by Zimbabwe delegation

2.3.2. Cooking fuels

As shown in Figure 2-8, the proportion of population using solid fuels varies considerably among SADC Member States. The overwhelming majority of the population in some Member States use solid fuels for cooking, with the average SADC figure being 61.2%.

Figure 2-8 Percentage of population using solid fuels for cooking



Source: REN21 SADC RE/EE Status Report 2015

2.3.3. Biofuels

Many countries in the SADC Region have been trying to promote biofuels for several years now, though the initiatives lag behind other RE activities. Activities in biofuels have mostly focussed on production of ethanol and biodiesel for transport vehicles. Member States such as Malawi, South Africa, Zimbabwe, Swaziland and Mauritius have been producing ethanol from sugar cane molasses (by-product of sugar production) and are now accelerating this process and also exploring production of ethanol directly from sugar cane. Other countries such as Angola, Tanzania, Mozambique and Zambia are stepping up efforts in this area.

Zimbabwe, which is implementing a mandatory E10 blending ratio has also developed a Biofuels Policy but has not gone through the approval process yet. Zambia also has established blending ratios. In Malawi, Liquid Fuels & Gas (Production & Supply) Regulations (2009) stipulates a mandatory blending of ethanol with Petrol (E20 – 80% Petrol, 20% Ethanol) though there is no specific biofuels policy.

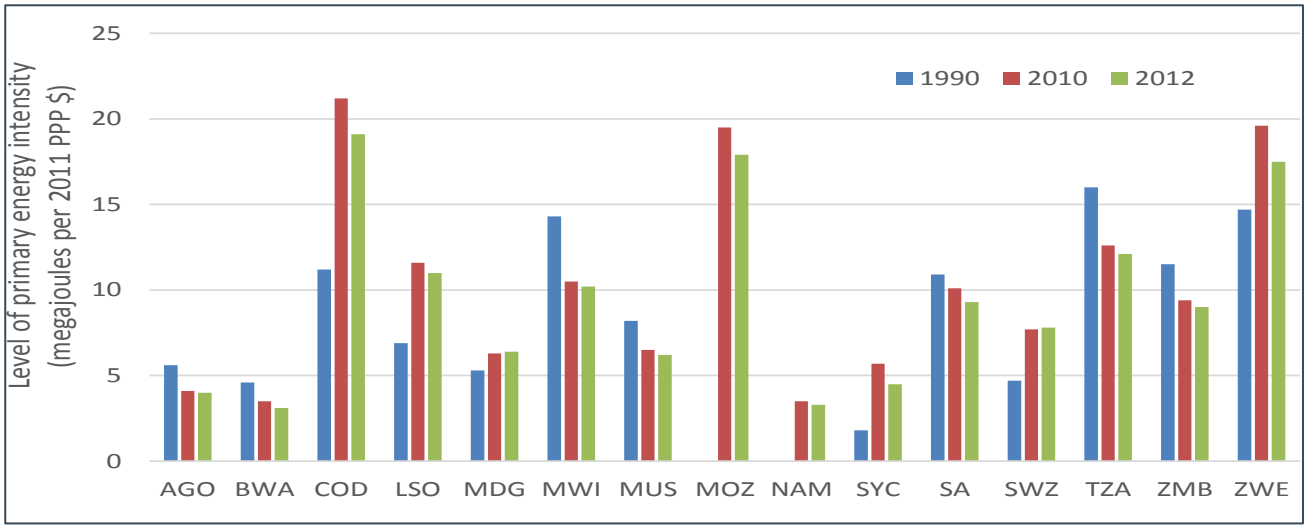
2.4. Energy Efficiency

Availability and reliability of data on the use of energy in the SADC Region are limited. This leads to difficulties in the characterisation of energy use and, consequently, in the identification of energy efficiency measures. The Energy Intensity is used as an indicator to monitor energy efficiency in a sector, country or a region. Energy intensity can however be affected by a number of factors not necessarily linked to pure efficiency such as fluctuations in the volume and sectoral structure of GDP but it can provide a quick overview of the status and evolution of energy efficiency.

Figure 2-9 shows the progress of the energy intensity for each SADC Member State. As a general rule, the intensity was reduced during the 20-year span (1990-2010). The reduction can be attributed to technological improvements across all sectors of the economy. Figures for 2012 have also improved, in comparison to 2010, indicating a continuation of the improvement in overall energy efficiency in the Member States.

Some SADC MS such as DRC, Lesotho, Madagascar, Malawi, Mozambique, Swaziland and Zimbabwe, however, had higher energy intensity in recent years compared to 1990 and this can be attributed to economic crises or inaccurate data, or both. In fact, these figures have been sourced from the SE4ALL Global Tracking Framework report, which warns that energy intensity values have been compiled from three (3) different sources: International Energy Agency (IEA), World Bank (WB) and the United Nations (UN). Therefore, the methodological approaches used by these institutions could justify this unexpected picture. This underlines the importance of having reliable data when deriving such indicators for decision making.

Figure 2-9 Levels of Primary Energy Intensity of SADC Member States



Source: SE4ALL, Global Tracking Framework, Full Report, 2015

2.4.1. Demand Side Management Measures

The following sub-sections provide an overview of the demand-side management activities implemented or under implementation in the region. These measures have been implemented by the governments and utilities to reduce the use of existing energy facilities, defer the addition of new generation capacity and reduce peak loads. Although these mostly concern the electricity sector, some refer to other sectors such as cooking.

2.4.1.1. Awareness Raising

Awareness raising programmes have been used in the region for some time. The objective of these programmes is to inform consumers on how to use energy wisely and efficiently. Most of the programmes target behavioural practices and raising awareness for more efficient technologies already available in the market. One of the most effective methods of encouraging the use of more energy efficient equipment is the implementation of efficiency labels and **Minimum Energy Performance Standards (MEPS)**. South Africa initiated a mandatory labelling programme in 2012 for household appliances. The programme now targets the most energy intensive appliances in the residential sector, namely air conditioners, dishwashers, washing machines, electric ovens, refrigerators and freezers, electric water heaters and lighting equipment. Mauritius also initiated a voluntary labelling programme in 2014 for household appliances, but it will become mandatory by 2017.

Other SADC Member States have not yet implemented these types of programmes but look favourably upon the adoption of a regional labelling programme for electric appliances. Some consumers in the region look for efficiency labels when buying electric equipment even though the labels are not enforced in their country. Quantification of achievable savings needs to be determined to encourage the consumers and the MS to adopt such measures.

Mauritius is implementing a national energy efficiency programme (in short PNEE, in French) targeting the industrial sector. The programme objective is to promote the emergence of the market for Energy Efficiency in Mauritius by demonstrating the benefits of energy services and technologies. For this, the PNEE will subsidise approximately a hundred energy audits in companies between 2015 and 2016 and will be linked to a credit line offered by the French Development Agency (AFD) to Mauritian banks. The status shows that in the SADC Region private companies are still not investing much in energy audits probably because they have not appreciated the benefits that can accrue from the energy savings. The majority of the Small and Medium Enterprises with opportunities for energy savings do not have financial resources and capacity to invest in energy audits and energy efficiency technologies.

2.4.1.2. Leapfrogging to Efficient Lighting, Appliances and Equipment in SADC

A partnership between SAPP and United Nations Environment Programme (UNEP) is expected to develop a roadmap to achieve a permanent and sustainable transition to efficient lighting, appliances and equipment in

SADC. This initiative targets reducing the electricity consumption by 35 TWh and power demand by 5,000 MW[26], allowing for the electrification of 16 million households in the region and reducing its CO_2 emissions by 20 million tons per year in 2030. The scope of the roadmap is expected to include measures for efficient lighting[27], refrigerators, air conditioners, water heaters and distribution transformers.

2.4.1.3. More Efficient Technologies

Technologies that reduce energy use are available for almost all end-use applications in the residential, commercial and industrial sectors. These can be, for example, replacing incandescent light bulbs with CFL and LED bulbs or replacing air conditioners and refrigerators with higher-efficiency models. In an effort to reduce peak consumption, utilities in the region have been implementing exchange programmes where incandescent bulbs are replaced with CFL or LED bulbs. The Zambian Government banned the import of incandescent bulbs since January 2016. Other MS agreed to phase out the use of incandescent bulbs by December 2017 during the 35th SADC Meeting of Ministers responsible for Energy held in Gaborone, Botswana on 21 June 2016. In the same meeting, the ministers also agreed to gradually phase out of fluorescent lights due to concerns associated with their disposal and mercury poisoning.

In the cooking subsector, the improved cooking stoves can convert more than 20% of the energy in wood fuel into heat as opposed to the 10% by conventional stoves. These stoves can, therefore achieve savings of at least 50% in the quantity of fuel used for cooking. This is particularly important in urban and peri-urban areas where prices of charcoal are increasing.

A number of international and local organisations are promoting the uptake of more efficient cooking stoves in almost all of SADC[28]. These organisations include the World Bank, United Nations agencies, Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH – German International Development Agency (GIZ), Global Village Energy Partnership (GVEP), Netherlands Development Organisation (SNV), the Global Alliance for Clean Cook stoves and NGOs operating at local level. The majority of these initiatives have concentrated their efforts in increasing the affordability of the stoves and local manufacture. Grants, carbon credits and micro-credits have been used to increase the affordability of this technology.

Training of local manufacturers and the use of local materials are also the preferred approaches to promote the use of cleaner stoves. However, these initiatives tend to fail once the donors and implementing organisations stop promoting the projects. As a result, the quality of the cook stoves starts to decline, with it their efficiency and then the consumers in general tend to retreat to their previous appliances and cooking techniques.

The lack of quality and performance standards is usually considered as the main barrier preventing the widespread use of this technology. The SADC and its MS can embark on a regional effort to implement and enforce these standards. A regional or national programme to promote these stoves should also focus on how to make them more affordable and attract private sector participation. Previously nine (9) SADC MS[29] were involved in a GIZ[30] supported programme, the Programme for Basic Energy and Conservation (PROBEC)[31] that lasted from 2004 to 2010 to promote efficient use of energy devices, policy advice and research into biofuel, but the programme could not be sustained after the donor funding was terminated.

2.4.1.4. Fuel Switching

The use of wood fuel for cooking can cause deforestation and indoor pollution. Switching fuels raises other barriers that can be difficult to overcome. For instance, even if LPG[32] has economic, environmental and health benefits and could be potentially better than using clean cooking stoves (especially in urban areas), the consumers may find it unaffordable, particularly the gas stoves and the gas canisters. They can also find it difficult to adapt to the new cooking processes, and the social acceptance may be an issue e.g. due to perceived difference in the taste of food. LPG is already widely used in some MS such as Botswana where over 50% of rural and 70% of urban households are already cooking using LPG. The country has well established distribution channels and technical standards. Other MS would learn from such a success story.

[26] http://united4efficiency.org/southern-african-utilities-adopt-an-ambitious-regional-roadmap-to-switch-the-region-to-efficient-lighting-appliances-and-equipment/
[27] CFLs have been manufactured in Lesotho by Phillips. Utilities are however migrating to LEDs.
[28] Examples that are still active are EEP (www. http://eepafrica.org/) and SOLTRAIN (http://sessa.org.za/about-sessa/affiliates/soltrain/217-soltrain-about-the-southern-african-solar-thermal-training-demonstration-initiative)
[29] Lesotho, Malawi, Mozambique, Tanzania, South Africa, Zambia, Swaziland, Botswana and DRC
[30] Anchor funding with other ICPs involved
[31] http://www.pciaonline.org/projects/probec
[32] LPG is an accepted clean modern energy source in context of energy access and energy efficiency

2.4.1.5. Load Management

Utilities in the MS have been using different technologies to reduce peak demand by shifting power from periods with high electricity demand to those with lower demands. The reduction in peak demands is needed to avoid load shedding, to reduce higher costs of peak electricity generation, and to defer the construction of new power plants. The most common measures used in the region are water heater controllers that turn off appliances during peak times and solar water heaters that can replace electric water heaters. Other demand response measures and technologies are also used.

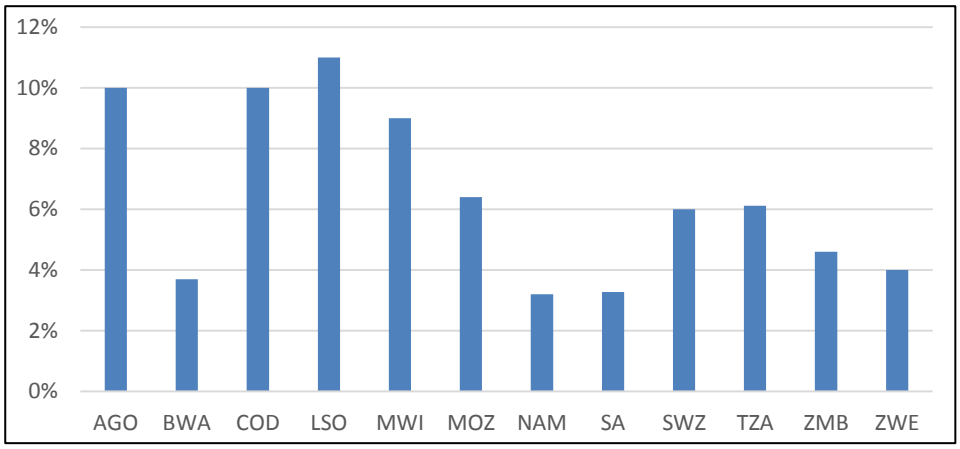
Although demand response has a significant potential to reduce peak loads, most countries lack the legal framework allowing the utility to compensate large consumers to reduce loads and to apply different tariffs according to the time of the day. Nevertheless, utilities and industries can agree on voluntary load reductions, especially during the periods of the year with highest energy consumption.

Another option to manage loads, which could soon be made possible through the introduction of smart-grids and electric vehicles, is the use of the batteries of electric cars to help regulate the grid. Batteries could be used to store energy during periods of lower demand (and high generation of intermittent renewables – solar and wind) and/or to inject electricity in the grid in times of high demand. This is an interesting technology that could be investigated for application in conjunction with RE generation as part of the REEESAP.

2.4.2. Grid Losses[33]

Grid losses in the region are considered to be high[34] and utilities have been implementing several programmes to reduce the losses, including investing in the modernisation of transmission lines, reducing congestion of certain lines, and installation of more efficient equipment with the objective to reduce transmission losses. These investments are, however, significant and utilities in the region struggle to finance them.Figure 2-10 presents the transmission losses for the SAPP utilities for the years 2013 and 2014. Some countries such as Angola, DRC, Lesotho and Malawi have high losses while others such as Botswana, Namibia and South Africa have been able to keep this figure below 4%. Distribution losses are higher but the extent of losses is not documented.

Figure 2-10 Transmission losses in SAPP utilities in 2013-2014



Source: SAPP Annual Report 2014

Losses not only occur in transmission, but also in distribution lines. The latter involves non-technical losses due to electricity theft and billing issues, among other issues. Utilities have been introducing modern meters (e.g. split meters) to avoid theft with good results, however the high cost of this equipment hinders its widespread application.

Prepayment meters are a way to improve revenue collection and help consumers manage their consumption, which is an efficiency measure in that regard.

[33] Note must be taken that losses are for both RE and fossil based electricity
[34] Looking at transmission losses only, the SADC average is 6%. Including distribution losses, the figure rises to 19%, which is well above the global average of 8%. Source: REN21 SADC Report, 2015.

2.4.3. Buildings

Buildings are responsible for more than a quarter of the final energy consumed worldwide[35]. This is expected to be also the case in the SADC Region; however, there is a generalised lack of understanding by the majority of the MS concerning their building stock and their energy consumption. This fact is further exacerbated by a general lack of building codes or a lack of reference to energy usage in the existing codes in the different MS.

A few ICP led activities have been trying to promote EE in the building sector, including the creation and adoption of building codes for specific MS. However, only the South African Bureau of Standards has been able to develop a series of mandatory and voluntary building codes to regulate the market. These codes set the minimum requirements for energy usage in new buildings but leave the choice of the technology to the developer with the objective to promote innovation and the use of alternative energies for electricity and heating loads.

Botswana and Namibia have also developed programmes aimed at promoting EE in the building sector[36]. Besides developing energy guidelines for new buildings, their programmes have also included the training to a number of auditors. It is foreseen that the guidelines developed in these two countries are incorporated in their national building codes.

2.5. Energy Sector Enabling Environment

As seen in the previous section, the region's electricity generation capacity has not been able to meet the demand, causing blackouts and brownouts across most of the Member States. Some governments in the region have been developing different strategies in order to invest in new sources of energy. Attracting investment through private sector participation in renewable energies is seen as a possible solution to meet future electricity demand. For this to happen, robust policy and institutional arrangements are crucial to attract private sector finance and to lay the foundations for a sustainable sector.

2.5.1. Policy Environment

The SADC instruments mentioned in Chapter 1 have set the tone for the policy environment at regional level and MS can derive their national policy frameworks from these regional instruments.

Table 2-2 summarises the status of the policy and regulatory frameworks for promoting the use of renewable energy and investment in energy efficiency in the SADC Member States. These include the enactment and approval of renewable energy and energy efficiency policies, strategies, action plans and regulatory frameworks.

[35] IEA, Energy Efficiency Investments and Trends 2016
[36] With support from DANIDA- Danish International Development Agency.

Table 2-2 Status of RE & EE Policy and Regulatory Framework

Member State	Energy Policy	Renewable Energy			Energy Efficiency			Rural Electrification Policy/Strategy
		Policy	Strategy	Action Plan	Policy	Strategy	Action Plan	
Angola	X	X	X					
Botswana	X[37]		D			D		
DRC	X							
Lesotho	X	x	D	D	X	D	D	D
Madagascar	X			X				
Malawi	X		X					X
Mauritius	R	D	D	D	D	D	D	
Mozambique	X	R	R					
Namibia	R	D						X[2]
Seychelles	X	X						
South Africa	X	X	X		X	X	D	X[38]
Swaziland	X		D	D				
Tanzania	X		D				D	X
Zambia	X	R						X[39]
Zimbabwe	X	D						

Note: X approved, R under revision, D under development

(Source: REN21, SE4ALL (Africa Hub), own consultation)

An analysis of the data reveals that only South Africa has put in place a comprehensive framework to encourage investments in both renewable energy and energy efficiency. Although the existing policies and regulations are still recent – the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP or REI4P) that started in 2011 has raised US$19 billion in private investment (in 92 projects, totaling 6,327 MW) by April 2015. The electricity prices of wind power have fallen by 46% and solar PV by 71%. The promotion activities in energy efficiency have, however, been scaled back in the recent years. However, it should be noted that the South African economy is very different from that of the rest of the MS and hence direct emulation of REIPPPP and other measures in place in South Africa may not be appropriate in many MS.

Botswana and Mauritius are currently preparing their strategies for both renewable energy and energy efficiency. Strategies and master plans are being developed with the objective to promote investment in sustainable energy. The experience of Mozambique and Tanzania is also worth highlighting, especially in the use of renewable energy to facilitate access to sustainable energy in rural areas. Innovative business models for decentralised systems are being used in these countries with good success and with the potential for replication in other countries. Additionally, the effort by Mozambique to set up a solar PV panel factory in 2013 is worth highlighting. The current production capacity is 5 MW/year, but could be expanded to 20 MW. It produced 0.5 MW in 2015 and is expected to produce 1.2MW in 2016 and 4.4 MW afterward. The factory manufactures four types of solar panels with various (particularly off-grid) applications including illumination of homes, schools and health clinics, shops and public lighting, and water pumping systems. The panels have now been certified to gain quality recognition[40].

[37] Not yet approved by the Parliament
[38] Household Electrification Strategy
[39] Rural Electrification Master Plan
[40] www.funae.co.mz

For the remaining SADC Member States, the renewable energy and energy efficiency policies and strategies are still limited. Some countries, such as Tanzania, have implemented specific regulations to attract IPPs but the lack of a comprehensive framework for the sector limits the effectiveness of these types of actions.

A common denominator for most energy policies in SADC is their limited inclusion of a gender approach. Linkages to other nexus areas such as water, food security, education and health are also lacking. SADC is however pursuing a holistic approach to the issues faced by these different sectors. The joint energy and water ministerial workshops are such an example that is facilitating the development of more comprehensive and inclusive regional strategies and actions.

2.5.2. Institutional Framework

2.5.2.1. SADC Institutions

The key SADC institution that is mandated to drive energy sector development are the Energy Division under Directorate of Infrastructure and Services at the SADC Secretariat (SADC) and is in charge of policy harmonisation and resource mobilisation. The Southern African Power Pool (SAPP) is in charge of power sector operation, largely in form of co-ordination of planning and project implementation[41], and electricity trading. The Regional Energy Regulatory Association (RERA) is in charge of regulatory harmonisation in the Region including for regional energy trading.

The low staffing levels in the Energy Division of the SADC Secretariat constrains its capacity to perform well in all the energy sub-sectors. The Division however is assisted by project officers under International Cooperating Partners (ICP) supported projects.

SAPP has a critical mass of staff but its role to coordinate both planning and directing project implementation and electricity trading would require additional staffing. The SAPP is however now supported by the newly created SAPP Project Advisory Unit based in Sandton, Johannesburg that supports project structuring. The SAPP PAU is supported by the World Bank.

RERA is an association of regulators and has been performing its functions with support of its committees but its expanded role in developing regional regulatory frameworks and capacity building indicates the requirement for additional in-house staffing. Its current position as an association would limit its authority to enforce regionally agreed regulatory decisions.

SADC energy sector projects are supported by the ICPs and the Energy Thematic Group (ETG) that comprises the SADC Secretariat Energy Division, major ICPs in the energy sector, SAPP and RERA. The ETG meets biannually to review the energy programme and identify areas for support. The ETG provides a platform for an efficient SADC/ICP dialogue, and gives an opportunity for pooling resources and implementing specific programmes in areas of common interest. Austria is currently the lead ICP for the ETG, although other ICPs in ETG have contributed to various energy sector projects at SADC and MS level.

The Tripartite Task Force, headed by the Secretaries General of the Common Market for Eastern and Southern Africa (COMESA) and the EAC, and the Executive Secretary of SADC is also an important institution that strives to harmonise Regional Economic Community (REC) programmes in the areas of trade and infrastructure development. The relevant committee in charge of infrastructure would be a candidate in the case of harmonized planning for RE/EE by the three RECs.

The actual implementation of energy projects is being done at the Member State levels.

2.5.2.2. Member States Institutions

The actors involved in the design, approval and implementation of the framework implemented above in each of the SADC Member States are presented in Table 2-3.

These include the ministries of energy, energy and electricity regulators, power utilities and rural electrification agencies (REA). REAs have been set-up in almost all SADC Member States to facilitate the countries' efforts to increase the electrification of rural areas and to promote the use of sustainable energy for cooking. The majority of power utilities in SADC are government owned companies and have often other

[41] the SAPP Co-ordination Centre (SAPP-CC) was appointed as project co-ordinator for selected projects such the ZIZABONA and the Central Transmission Corridor (CTC) project in Zimbabwe.

roles such as planning and electrification of rural areas. Energy regulators have taken the function of regulatory aspects of the sector.

Table 2-3 Energy sector institutional framework in SADC Member States

Member State	Ministry or Department of Energy	Regulator	Rural Electrification Agency	Utility
Angola	Ministério da Energia e Águas	Instituto Regulador do Sector Eléctrico de Angola	Agência Nacional para a Electrificação Rural	(i) Rede Nacional de Transporte de Electricidade, E.P., (RNT) (ii) Empresa Pública de Produção de Electricidade, E.P. (PRODEL) (iii) Empresa Nacional de Distribuição de Electricidade, E.P. (ENDE)
Botswana	Ministry of Minerals, Green Technology and Energy Security Department of Energy	Being developed	To be developed (DoE and BPC provide services)	Botswana Power Cooperation
DRC	Ministère des Ressources Hydraulique et Electricité	Autorité de Régulation (ARE)[42]	Agence Nationale des Services d'Electrification en milieu Rural (ANSER)	Societe National d' Electricite
Lesotho	Ministry of Energy & Meteorology	Lesotho Electricity and Water Authority (LEWA)	Rural Electrification Unit	Lesotho Electricity Company
Madagascar	Ministry of Energy and Mines	Office de Régulation de l'électricité	Agence de Développement de l'Electrification Rurale	Jirama
Malawi	Ministry of Natural Resources, Energy and Mining	Malawi Energy Regulatory Authority (MERA)	Malawi Rural Electrification Programme (MAREP) Unit Housed within Department of Energy	Electricity Supply Corporation of Malawi (ESCOM)
Mauritius	Ministry of Energy and Public Utilities (MEPU)	Utility Regulatory Authority		Central Electricity Board (CEB)
Mozambique	Ministério dos Recursos Minerais e Energia	Conselho Nacional de Electricidade (CNELEC) (advisor only but a new entity to regulate the energy market is under discussion)	Fundo de Energia (FUNAE)	Electricidade de Moçambique HCB MOTRACO
Namibia	Ministry of Mines and Energy	Electricity Control Board (ECB)	None, Rural Electrification is done by the Ministry of Mines and Energy	NamPower

[42] DRC is considered as one of the SADC MS that needs to create a regulator in the 34th SADC Ministers responsible for Energy Report.

Seychelles	Ministry of Environment, Natural Resources and Transport	Seychelles Energy Commission		Public Utilities Corporation
South Africa	Department of Energy (DoE)	National Energy Regulator	ESKOM, municipalities, off-grid service providers and the DOE	ESKOM
Swaziland	Ministry of Natural Resources and Energy	Swaziland Energy Regulatory Authority	Rural Electrification Unit housed in the Energy Department	Swaziland Electricity Company (SEC)
Tanzania	Ministry of Energy and Mines	Energy and Water Utilities Regulatory Authority (EWURA)	Rural Energy Agency (REA)	Tanzania Electricity Supply Commission (TANESCO)
Zambia	Ministry of Energy and Water Development	Energy Regulation Board	Rural Electrification Authority	Zambia Electricity Supply Corporation Ltd Copperbelt Energy Corporation Lunsemfwa Hydro Power Company
Zimbabwe	Ministry of Energy and Power Development	Zimbabwe Energy Regulatory Authority (ZERA)	Rural Electrification Agency (now Fund)	Zimbabwe Electricity Supply Authority (ZESA) and subsidiaries ZPC, ZETDC, Powertel and Zent Enterprises

Twelve (12) SADC Member States already have an energy or electricity[43] sector regulator to provide oversight and enable the operation of an efficient electricity market. The independence of these regulatory institutions is in some cases still limited with the key decisions (e.g. tariffs) being made by the ministries responsible for energy. Rural electrification agencies have also been set-up in almost all countries in an effort to increase access to electricity in rural areas but their role in promoting RE/EE needs to be redefined.

[43] 4 regulators are for electricity and 2 energy and water, the last 3 MS are in the process of creating their regulators

3. RE/EE Plans and Targets

The Energy Sector is one of the priority areas of intervention in the revised Regional Indicative Strategic Development Plan (RISDP) 2015-2020 for SADC. There are a number of policy targets identified in the revised RISDP, including:

- SADC Renewable Energy Strategy and Action Plan is implemented in all Member States by 2019
- SADC Protocol on Energy is revised by 2020
- Regional Energy sector-wide Regulatory Framework is developed by 2018
- Planned electricity generation and transmission expansion capacity is implemented by 2020
- Migration to Cost Reflective Tariff achieved by 2020[44]

3.1. Renewable Energy Plans and Targets

3.1.1. Electricity - grid and off-grid systems / energy access

3.1.1.1. Regional Targets

The key regional strategy on energy access is enshrined in the Regional Energy Access Strategy and Action Plan (REASAP, 2010). REASAP aims to halve the proportion of people without access to adequate, reliable, least cost, environmentally sustainable energy services within ten years for each end use (lighting and small power, heavy power and heat), and halve it again in successive five-year periods, until there is universal access for all end users.

Given that the target was set in 2010, the baseline figure in that year for energy access is critical in establishing numerical targets for the next 10 years and so on. Basing on the REASAP defined progression to increased energy access and the 2015 electricity access of 42%, targets would be set as 71% access by 2025 and 85.5% access by 2030. One key aspect of REASAP is the definition of energy access. REASAP argues that although the goal of universal electrification is desirable, for most SADC countries it will remain a challenge for a long time because of the massive investments required, which are beyond the reach of many MS. The focus should thus be on developing a “portfolio” of least-cost energy options to fulfil lighting, power and heating needs.

According to a modelling undertaken by IRENA[45], the share of renewable technologies in electricity production in the region could increase to as high as 46% in 2030. This is caveated by assumptions that the fossil fuel prices will rise and the prices of renewable energy technologies will fall.

RIDMP Energy Sector Plan (2012) outlines the following RE mix targets for SADC Region for the electricity sector (Table 3-1). The on grid targets were largely derived from the SAPP Pool Plan (2009) and the South African IRP (2010).

Table 3-1 RE and EE Targets for SADC

Technology / Usage	2020 (%)	2030 (%)
Renewable Energy mix in the grid	33	39
Off-grid share of renewable energy	5	7.5

Source: Regional Infrastructure Development Master Plan, 2012

The revision of SAPP Pool Plan is expected to be complete by the end of 2016. Similarly, South Africa is revising its IRP (expected to be ready by 2017) and other countries are also revising their IRPs or Master Plans which will determine the least cost target for RE in the electricity grid mix. The targets of electrification and RE in electricity mix need to be reviewed and revised as necessary when these Plans/IRPs/Master Plans are prepared.

[44] or 2019 as the mentioned in the 34th Ministers meeting report
[45] SOUTHERN AFRICAN POWER POOL: Planning and Prospects for Renewable Energy (2013)

The targets for off-grid electricity are not readily available and MS agreed to targets in Table 3-1 in a workshop (RIDMP 2012) as feasible targets for period 2020 and 2030. The baseline status of off-grid capacity is not known and it will require baseline studies to establish a regional target.

3.1.1.2. National Targets

Various SADC Member States have specific targets set for indicators such as share of RE in the energy mix and access to modern clean energy or electricity. These targets vary considerably among MS while some do not have any specific targets. Additionally, the targets are set for different time frames and hence will not be easy to amalgamate at SADC level. Some MS have adopted universal energy access by 2030 – which is in line with SE4ALL targets. Table 3-2 shows some of the targets for RE and energy access that have been obtained for the MS during the formulation of REEESAP.

Table 3-2 MS Targets on RE Share and Energy Access

Country	Renewable Energy Targets	Energy Access
Angola		60% (electricity) by 2025[46]
Botswana		90% (electricity) by 2030[47]
DRC[48]		60% electricity access by 2025
Lesotho		At least 50% electrification by 2020[49]
Madagascar	54% (share of final energy, 2020)	
Malawi	7% (share of energy, 2020)[50], 10% (share of energy, 2050)	30% electricity access by 2030[51]
Mauritius	35% (share of electricity by 2025)	
Mozambique[52]	24.4% of new RE installed capacity by 2030[53]	56% (electricity) by 2030; 30% (modern fuel for cooking) by 2030
Namibia	70% (of final energy being considered by 2030)[54]	50% (electricity) by 2020, 100% (modern energy services) access by 2030
Seychelles	15% (share of electricity, 2030)	
South Africa	42% (share of electricity, 2030)	
Swaziland[55]	50% (share of electricity, 2030)	Universal Access (100% Electricity) by 2030
Tanzania[56]	50% (electricity, including off grid 2030), >2.6% rate of EE improvement per year	>75% by 2030 (electricity access)
Zambia		66% (electrification rate by 2030)[57]
Zimbabwe		Universal by 2030

These targets are a combination of what MS provided and those sourced from secondary sources.

These targets are merely pointing out the current status of the targets and how they are not consistent across the MS and hence not possible to compare or combine to form a SADC level target. It is not clear how these targets are derived by the MS. Some are aspirational and may not have been based on an analysis of future demand projections and supply options, which is the correct way of setting targets. It is therefore imperative that such an approach to target setting be adopted by both SADC and MS to track progress on implementation of REEESAP going forward.

[46] SE4ALL RAGA, quoting Angola Energy 2025
[47] From Botswana delegation in First Workshop August 2016
[48] Emission Reduction Profile, DRC. UNEP
[49] From Lesotho Delegation in First Workshop August 2016
[50] Expression of Interest to SREP, World Bank
[51] From Malawi delegation in First Workshop August 2016
[52] EU Country Fiche
[53] Personal communication by the Mozambican Ministry of Energy and Mineral Resources
[54] From Namibia delegation in First Workshop August 2016
[55] From Swaziland delegation in First Workshop August 2016
[56] From SE4ALL Action Agenda
[57] Rural Electrification Master Plan

3.1.2. Cooking and Heating

There are no targets in SADC Region on improving the share of renewable energy in cooking and heating but targets set in RIDMP (2012) for penetration of cooking/heating devices as presented in Table 3-3 below were also endorsed as reasonable in a MS workshop back in 2011.

Table 3-3 Targets for penetration of efficient cooking and heating devices

Target	2020 (%)	2030 (%)
Cooking/heating efficient devices penetration	10	15

Source: RIDMP 2012

3.1.3. Biofuels

Several MS have established blending targets in the biofuels sector. For example, blending ratios have been established in some MS+ e.g. Botswana, Zambia – 10% for ethanol, 5% for bio-diesel in the diesel fuel. Zimbabwe has recently developed a Biofuels policy that specifies blending ratios and promotes increase in production of biofuels such as ethanol.

On a regional level, targets for biofuels have been set in the RIDMP (2012) as follows (Table 3-4) basing on those known blending ratios.

Table 3-4 Targets for biofuels blending in the SADC MS

Target	2020 (%)	2030 (%)
Ethanol share of total fuels	10	20
Biodiesel fuels share	5	10

Source: RIDMP 2012

3.2. EE Targets

3.2.1. Regional Targets

Targets for EE have been set for the electricity sector in SADC. RIDMP (2012) has targets of reaching savings of 5% by 2015, 10% by 2020 and 15% by 2030 of total electricity in the sectors that use electricity compared to the baseline demand.

SAPP has formulated an energy efficiency framework with the objective of reducing not only electricity consumption but also demand, especially during peak periods. The framework advises the setting up of a strategic policy framework document in each country i.e. the design and implementation of National Efficiency Action Plans. The framework includes targets for reducing demand across the SADC (see Table 3-5).

Table 3-5 SAPP Implementation Targets and Achievement (reduction in demand)

	2009	2010	2011	2012	2013	2014	2015	2020
Target (MW)	1,000	1,800	2,900	4,200	4,500	4,500	4,500	6,700
Achieved (MW)					2,305		4,564	

Source: SAPP Energy Efficiency Framework, 2013

The SAPP Energy Efficiency Framework of 2013 indicates that savings of 2,305 MW and 4,564 MW were achieved in 2013 and 2015 respectively through Demand Side Management (DSM) measures against targets of 4,500MW each year. SAPP indicated that of the 2015 savings, 700 MW were from commercial lighting and the rest from residential lighting programmes (Table 3-5).

RIDMP (2012) had EE targets for electricity grid and for charcoal production, as shown in Table 3-6 derived through workshop stakeholder deliberations.

Table 3-6 EE Targets for electricity grid use and charcoal production

Target	2020 (%)	2030 (%)
Energy efficiency savings achieved of grid use	10	15
Efficient charcoal production share	5	5

Source: RIDMP 2012

3.2.2. Targets for Utility DSM Measures

The framework implementation status for demand-side management was assessed in 2013 for the different SAPP utilities. A summary of the measures being implemented in each MS, under the SAPP framework, is summarised in Table 3-7. The actual targets to be achieved through these measures is not precisely determined but is embodied in the expected savings mentioned above in Table 3-5.

Table 3-7 Implementation Status of DSM Measures

SAPP Utility	Pre-paid meters	CFL/LED	Awareness raising	Power Factor	Grid improvement
BPC	√	√			
CEC	√		√	√	√
EDM	√	√		√	
ENE	√	√			
ESCOM	√	√	√		√
ESKOM	√	√			
LEC	√		√	√	√
NamPower		√	√		√
SEC	√	√	√	√	√
SNEL	√				
TANESCO	√	√	√	√	√
ZESA	√	√			√
ZESCO	√	√	√	√	

Source: SAPP Energy Efficiency Framework, 2013

The installation of pre-paid meters has been used as a DSM measure by the majority of the SAPP utilities. These can help utilities tackle meter faults and illegal connections, and improve revenue collection. Promotion and distribution of CFL have also been used by the majority of utilities in an effort to reduce demand. However, the financial sustainability of distributing efficient light bulbs needs to be carefully assessed and planned. For example, in Tanzania, TANESCO was not able to raise the required investment for a CFL replacement programme as donors were not convinced of the sustainability of the programme.

Other measures implemented by the utilities included power factor correction measures, correcting conductor sizes and grid improvement by improving distribution transformer losses.

3.3. Relevant Global Initiatives and Targets

Many MS within SADC have signed up to various international targets and goals in terms of energy access, share of renewable energy in the energy mix, energy efficiency and other climate change targets such as Nationally Determined Contributions (NDCs) that aim at reducing GHG emissions. Some of these are described below and can potentially provide sources of finance in the implementation of REEESAP.

3.3.1. Sustainable Energy for All (SE4ALL)

SE4ALL specifies targets related to the share of RE in the energy mix, improving energy efficiency and universal energy access. Every country that has ratified SE4ALL is expected to undertake a process to

produce several documents that define the targets (to achieve by 2030) and the measures to achieve those targets. The main documents to be produced under the SE4ALL framework are:

- Rapid Assessment and Gap Analysis (RAGA)
- Action Agenda (AA)
- Investment Prospectus (IP)

At the time of writing this document, only Tanzania had completed the process of developing all these documents and hence has official SE4ALL targets. Many other MS are in the process of formulating their targets under SE4ALL and their targets can be included in their MS RE/EE strategies and Action Plans at the time of domesticating REEESAP.

The latest status related to SE4ALL for SADC MS are given in **Table 3-8**.

Table 3-8 SE4ALL Statuses

Country	SE4ALL Status
Angola	RAGA complete
Botswana	RAGA complete
Democratic Republic of Congo	RAGA complete
Lesotho	RAGA complete
Madagascar	Not a partner country
Malawi	RAGA complete, AA/IP being finalised
Mauritius	Not listed as partner country
Mozambique	RAGA complete
Namibia	RAGA complete
Seychelles	Not listed as partner country
South Africa	RAGA complete
Swaziland	RAGA complete, AA/IP finalised
Tanzania	AA and IP completed
Zambia	RAGA being finalised, AA/IP under development
Zimbabwe	RAGA Complete, AA/IP being finalised

3.3.2. AfDB's New Deal on Energy

The African Development Bank (AfDB) has set a goal to help the continent achieve universal electricity access by 2025 under the New Deal on Energy Initiative. To achieve this goal, the AfDB has stipulated the following four (4) targets with a strong focus on encouraging clean and renewable energy solutions:

- increase on-grid generation to add 160 GW of new capacity by 2025;
- increase on-grid transmission and grid connections that will create 130 million new connections by 2025, which is 160% more than today;
- increase off-grid generation to add 75 million connections by 2025, 20 times the current level; and
- increase access to clean cooking energy for around 130 million households.

The AfDB Group will be investing $12 billion of its own resources in the energy sector from 2016 to 2020; this is in addition to an expected leverage of about $50 billion.

3.3.3. Africa-EU Energy Partnership (AEEP) Declaration

The first High Level Meeting of the AEEP consisting of African Ministers responsible for the energy sector and European Union (EU) Ministers responsible for Africa-EU energy relations published a declaration in 2010 pledging to work towards attaining the following targets in the RE, EE and energy access, in the timeframe up to 2020.

- **Energy Access:** bring access to modern and sustainable energy services to at least an additional 100 million Africans, focusing on sustainable models

- **Energy Security:** doubling the capacity of cross border electricity interconnections, both within Africa and between Africa and Europe, thus increasing trade in electricity
- **Renewable Energy and Energy Efficiency:** Africa and the EU will take joint action to increase both energy efficiency and the use of renewable energy in Africa by:
  - building 10 000 MW of new hydropower facilities taking into consideration social and environmental standards
  - building at least 5 000 MW of wind power capacity
  - building 500 MW of all forms of solar energy capacity
  - tripling the capacity of other renewables, such as geothermal, and modern biomass
  - improving energy efficiency in Africa in all sectors, starting with the electricity sector

3.3.4. Intended Nationally Determined Contributions (INDC)

In preparation for the International Climate Agreement at the UNFCCC Conference of the Parties (COP21) in December 2015 in Paris, countries around the world publicised what post-2020 climate actions they intended to take, known as their Intended Nationally Determined Contributions (INDCs). The pledges in INDCs will largely determine whether the goals of reduction in global temperature rise to below 2°C can be achieved. Every SADC MS have submitted their INDCs to the UNFCCC indicating their pledges in reducing greenhouse gas emissions. Use of renewable energy and energy efficiency is highlighted in MS INDCs including targets they wish to achieve by 2030 under the UNFCCC. Submissions for Madagascar, Mauritius, Namibia, Seychelles and Swaziland were ratified at time of concluding REEESAP formulation[58] .

3.3.5. Power Africa Initiative

Power Africa, a US$7 billion initiative launched by US President Barack Obama in 2013, offers the combined resources of 12 US government agencies, the World Bank Group, the African Development Bank, the Government of Sweden[59], partner African governments, and many other Power Africa public and private sector partners. Power Africa employs a transaction- and partnership-driven model, focused on removing the barriers to power project development across sub-Saharan Africa. The transaction-centred approach directly addresses the constraints to project development and supports projects to bankability and financial closure.

This initiative aims at doubling electricity access in Sub-Saharan Africa, including a “Beyond the Grid” initiative with a focus on off-grid and small-scale energy. Power Africa’s goals are to add 60 million new electricity connections and generate 30 GW of new generating capacity by 2030.

In addition to meeting this major financial target, Power Africa is also partnering with governments to ensure that the regulatory environment is conducive for investments and that projects will have sound, sustainable development impacts. MS have an opportunity to tap into this resource.

3.3.6. Africa Clean Energy Corridor

Africa Clean Energy Corridor (ACEC) is an IRENA coordinated regional initiative promoting accelerated development of RE potential and cross-border trade of renewable power within the Eastern Africa Power Pool (EAPP) and SAPP. The initiative assesses cost-effective RE resources; encourages the incorporation of higher shares of RE in generation expansion plans; promotes more coordinated planning of generation and transmission; builds an enabling environment for RE investment; builds regional capacity to plan, construct, operate, and govern power systems with more RE; and raises awareness on the overall benefits of the ACEC.

The assessment of cost-effective RE resources or RE Zoning has identified the existence of an abundant yet uneven high quality wind, solar PV, and CSP resources, which demonstrates the importance of regional collaboration and grid interconnection. Additionally, many countries with sufficient RE potential can develop zones that are cost-effective and have low environmental impact. This is also true for proximity to load centers and transmission considerations. Many of the solar and wind zones are suitable for the development of multiple RE technologies, which may improve transmission capacity utility, minimize land use, and increase return on investment.

58 The word “intended” was used because countries were communicating proposed climate actions ahead of the Paris Agreement being finalized. However, as countries formally join the Paris Agreement and look forward to implementation of these climate actions – the “intended” is dropped and an INDC is converted into a Nationally Determined Contribution (NDC).
59 Government of Sweden’s involvement in Power Africa is limited to Renewable Energy and Energy Efficiency projects.

4. Issues, Barriers and Gaps

4.1. RE/EE and Cross Cutting/sectoral Issues

A number of RE and EE issues, barriers and gaps that have been identified during the development of REEESAP and are to be addressed to achieve the strategic objectives are presented in the following sections.

4.1.1. Renewable Energy Issues

The immediate priority of the SADC Member States is to meet their electricity demand which currently outstrips supply and even more so when considering unmet demand. High peak demand is causing utilities to rely on expensive generation and, frequently, resorting to load shedding to maintain grid stability.

If the region's energy demand grows at the same rates as the annual GDP per capita of 6% (until 2020) and 8% (after 2020) as stipulated in the SADC Industrialization Strategy, the already planned electricity development strategy will not be sufficient to meet the demand in the medium to long term unless new additional generation capacity is added to the regional energy mix. RE could be instrumental in adding further capacity to the grid due to continued decrease in RE costs and the short lead time required to plan and build an RE power plant as opposed to conventional generation.

Hydropower: The major RE source that is being exploited at the moment is hydropower, which in 2014 contributed about 20% to the SAPP electricity generation mix. There is still an untapped large hydropower resource - both large and small hydro projects - estimated to be approximately 150 GW[60], hence the harnessed capacity is only about 8% of the potential resource. Deployment of large hydropower apart from being environmentally unfriendly has lately become unreliable due to unpredictable rainfall and hydrological flows. Small hydro projects may be limited to offset the large hydropower capacity but have prospects to serve communities in remote areas for both power and water if problems of siltation are managed.

Other renewable energy sources: Apart from hydropower, the region has also significant solar, wind, bioenergy and geothermal potential that have not been fully exploited in most of the MS and yet could make significant contribution to sustainable energy supply in the region. Exploitation of these abundant renewable energy resources however will require large investments in RE technologies, transmission infrastructure and interconnections and such investments are not easily available through public financing. The challenge is how to attract significant private sector financing that most MS have not managed to achieve to date.

A moderate investment layout can be achieved through deployment of mini-grids and there is growing interest to finance Green Mini Grids. Currently, both the governments and private sector investors largely focus on grid connected RE projects.

Mini grids are however hindered by lack of well-established rural electrification plans and policies. For instance, it is not often clear where the network expansion will be carried out and whether mini-grids could be connected to the network when the grid reaches the mini-grids.

Solar water heaters (SWH) can be an important substitute for grid electricity for water heating but the current performance of the technology is not sustainable in many countries that started SWH programmes. This is attributed to factors such as poor components and maintenance infrastructure in the countries.

Wider uptake of renewable energy has been limited by the high costs of the technologies in the past but the costs have started to fall. The fact that most RE technologies have to be imported, however, increases costs of supply and hence limits access for certain segments of society particularly women and other disadvantaged groups. This is particularly significant in rural and peri-urban areas that experience low electrification rates and low access to cleaner cooking solutions.

Traditional Biomass: The majority of SADC population is dependent on traditional biomass for cooking and water/space heating which has resulted in overexploitation of the natural forest resources and unhealthy indoor environment particularly for women and children. Most of the population still uses cook stoves that are extremely inefficient. Though efficient cook stoves that can increase the fuel efficiency by 50% exist, the

[60] RIDMP Water Sector Strategy 2012

large majority of the population is still not aware of the benefits of this technology or lack the purchasing power to afford them.

Charcoal Production: Charcoal is particularly used to supply cooking fuel to urban and peri-urban areas of some MS, but has been a major contributor to deforestation and forest degradation. Greater efficiency in fuel wood gathering and combustion, and charcoal production together with sustainable forestry management in response to the growing energy demand is a critical issue. This has to be part of energy planning and natural resources and environmental management systems of nearly half of the SADC countries on the mainland that still depend on traditional biomass for up to 95% of the population.

4.1.2. Energy Efficiency Issues

The SADC Region has vast opportunities for saving energy both on supply and demand side and the efforts being made are not sufficient to realize large benefits in the form of offset investments in new plant capacity and improvement in supply situation.

There is lack of sufficient data to establish energy savings through the use of more efficient technologies, switch in fuels, change of habits and processes hence the potential energy savings are not established. Energy efficiency in industry and commercial sectors is hampered by a combination of lack of awareness of and capacity to establish the potential energy savings and difficulties in accessing financing to implement the measures.

Utilities have been promoting energy efficiency measures and load shifting with the objective to reduce peak consumption. There is, however a lack of monitoring and verification of the savings achieved by different measures to determine the actual savings that have been achieved in the case of some utilities.

On the supply side, the potential for reducing grid losses is significant in power sector networks particularly for the distribution network. However, the utilities need to quantify the losses and mobilize resources to implement the required measures to reduce those losses.

The importance of transitioning towards clean and efficient cooking, water and space heating and cooling systems is being appreciated but up-scaling is limited due to a number of factors including lack of clear policy measures, quality of products and services provided. There is also limited awareness on the benefits of energy efficiency and lack of standards to guide choices of energy efficient appliances among the majority of energy consumers in the region.

4.1.3. Energy Access

There is poor access to clean energy in the region, particularly in rural areas. In the case of electricity access, eight of the SADC countries have rural access to electricity that is less than 30%. The contribution being made through off grid systems including for cooking and heating are not well known.

4.1.4. Cross Cutting and Cross Sectoral Issues

Global fuel prices: Oil prices are at their lowest now, but throughout history they have been erratic. SADC has not been spared from impacts of the volatile oil prices that have adversely affected the global economies. The insecurity of depending on imported oil has triggered interest in local production of biofuels as substitute or extenders for fossil fuels. This will assist in meeting the local demand but also, foreign countries see the potential to produce their biofuels in Africa with the perspective that land and labour resources are abundant and underutilized. The approach to biofuels has however remained uncertain pending resolutions on which land and feedstocks to allocate to biofuels production.

Land issue: This is a critical issue with regard to installation of RE and the required grid extension to evacuate power to demand centres. Acquisition of land has delayed implementation of projects in many MS.

Climate Change: There is a general lack of attention provided to mainstreaming climate change into development plans by SADC Member States. Effects of climate change is increasingly becoming evident as indicated by some extreme weather events in the form of droughts, floods, and extreme temperatures that are likely to affect both energy supply and demand in the SADC Region. Climate change is expected to affect hydropower availability as the region is projected to become drier. In addition, the SADC electricity base is dominated by coal, which is indicated as the main contributor to greenhouse gas emissions. Low carbon development path would call for cleaner technologies.

Direct Foreign Investment: The SADC Region has been experiencing low inflows of investment finance that has also affected allocations to investments in the deployment of renewable energy and energy efficiency. This is exacerbated by the fact that most SADC countries are considered to be high risk investment destinations by international investors.

Gender mainstreaming: Little attention is paid to gender mainstreaming in the development of energy policies and strategies of the MS, yet there are gender targets at country levels that have barely been translated to the energy sector.

Tourism and Agriculture: Deforestation and associated impacts such as soil erosion and loss of biodiversity can have a negative impact on the tourism and agriculture sector revenues.

4.2. Barriers and Gaps in RE and EE in the SADC Region

The barriers and gaps to deployment of RE and EE technologies are many. Given below are some of the key gaps identified in this study that will need to be addressed in order to increase RE and EE adoption.

4.2.1. Socio-economic Barriers

- Endemic and widespread poverty in the region, with 40% of the region's population living in extreme poverty affects affordability of RE and EE technologies;
- High unemployment rates[61] which also affect affordability of RE/EE technologies;
- Inadequate and poorly maintained energy infrastructure such as grid networks, and generation equipment preventing easy tapping of RE resources;
- Weak entrepreneurial skills to propagate uptake of RE/EE technologies through business models; and
- Relatively weak and small markets for RE/EE technologies at individual MS level.

4.2.2. Institutional, Policy, Legal and Regulatory, Financial Frameworks

4.2.2.1. Institutional Gaps

At regional level, the SADC implementing agencies that include SADC Energy Division, RERA and SAPP remain largely under staffed limiting the extent to which they can support the upscale of RE/EE uptake. The operationalization of SACREEE, which is intended to be dedicated to promoting RE/EE needs to be accelerated.

Not all MS of SADC have energy regulators and in that regard such MS may not present an impartial and conducive environment for private sector investment.

There are no appropriate institutional arrangements for implementation of RE/EE programmes and there is no clear mandate given for off-grid systems at both MS and SADC level.

Although there is a desire to attract private sector to participate in RE/EE investments, most MS do not have well equipped, experienced and dedicated institutions to engage with potential private sector investors.

The local industry for RE/EE is weak and often coordinated through poorly supported associations in most MS. Business councils do not exist in most MS but even where they exist, they may not be fully informed of the opportunities in RE/EE. Therefore formation of building councils is desirable to implement EE and energy conservation in buildings.

MS of SADC are also members of other regional economic communities namely COMESA, EAC and IOC but there are no apparent collective coordinated energy sector planning and policy frameworks among these Regional Economic Communities.

4.2.2.2. Policy/Legal Gaps

There are disparities among SADC MS in the status of their RE/EE policy and planning frameworks. Many MS do not have dedicated RE/EE policies and strategies and action plans, and in case an MS has the RE/EE policies and strategies, the instruments may not be current and harmonized with REEESAP.

[61] 20-32% for MS on the mainland that have provided data for 2013.

On planning, Integrated Resource Plans (IRP) or Energy Master plans that guide future targets for RE/EE in MS and at SAPP level are either not fully developed or under revision and hence it is not clear what RE/EE supply projects are planned to 2030. The demand forecasting is also underestimated considering that they do not include unmet demand and expected growth in Industrialization.

To deal with the private sector, MS will need IPP Frameworks and so far, only South Africa is known to have an effective framework and the others are working on developing or improving their frameworks. These IPP frameworks need to be accompanied by a “one stop shops” providing all information and services required by potential investors.

All SADC MS have set a target for cost reflective tariffs by 2020 and require concerted effort from RERA and its members to ensure harmonized approach and timely achievement of the desired tariffs. It is also not clear how these cost reflective tariffs will take into consideration cost of energy production and related inefficiencies and how the tariffs will entice consumers to adopt energy efficiency.

The single buyer model prevalent in the SADC MS has limited the extent of market for power trading and hence for independent power producers. Large consumers could be buying directly from RE producers; however, this is still not resolved in the existing policy frameworks.

There are no well-formalized tariffs for mini-grids, consumer-owned generation and other off-grid systems, although there are isolated examples of municipalities and distribution authorities in the region that have been granted tariffs to implement embedded generation.

There are also no clear frameworks guiding introduction of efficient cooking/heating and cooling systems which could be the major reason programmes in these end uses have not been sustainable or up-scaled.

4.2.2.3. Regulatory Gaps

RE and EE technologies have been discredited in the past due to poor quality and lack of quality standards for various equipment. Quality of service standards are also lacking in the MS.

To simplify power trade and contracts for private sector participation, grid codes and Power Purchase Agreements (PPAs) should be harmonized and standardized. However, this has not taken place at the SADC level although efforts are being made in this regard.

As mentioned above the utility transmission and distribution losses are not well monitored and yet they contribute to utility inefficiencies and hence lower revenues. On the demand side the measures that have been implemented lack monitoring and verification systems to confirm the savings.

EE specific measures in the form of regional Minimum Efficiency Performance Standards (MEPS) together with labelling and standards for appliances for cooking/heating and cooling are still to be developed in the region apart from South Africa. Similarly, building codes are not harmonized across the region, although, there are plans to harmonise them in some of the island MS.

In terms of regulations, some MS have introduced regulatory frameworks to ban incandescent bulbs (ICs). Some MS are considering phasing out[62] of ICs although the implications on trade agreements are not well assessed. Many consumers however already understand the benefits of more efficient lighting such as CFL and LED. The qualities of some of these lighting products in some cases are inferior as a result of a lack of quality assurance of the equipment that enters the market.

On the demand sectors, energy audits are crucial to establish energy saving potential but there is a lack of an established framework for accredited energy service companies to operate in this space. There are currently no established routines for accreditation of such companies and energy auditors, no education and licensing of accredited auditors, and no conditions for capital loans and harmonised subsidy levels for specific measures and tailored bank guarantees.

Similarly, there are no well-established standards that MS can adopt to improve their buildings energy efficiency. Some MS have implemented projects on building energy efficiency and conservation but these have not culminated in building codes. Some MS have mandatory building standards, but voluntary standards can also act as incentives for building owners to implement energy efficiency measures.

[62] Zambia is banning ICs as from January 2017.

4.2.2.4. Investments and Financing Gaps

The financial sector in most MS is not well developed to support Public Private Partnerships (PPP) and IPP frameworks. There is limited small supplier and end user financing schemes in the MS to support uptake of RE/EE technologies.

Local industry players have difficulty accessing financing for RE/EE project preparation and implementation of small projects, technology development and utilization. Additionally, small RE projects of the order of 5 MW and below have high relative transaction costs and hence are not attractive to financiers including Development Finance Institutions (DFIs).

Many public utilities in the SADC Region run a deficit and hence face difficulties in obtaining finance for investment in public projects.

As already indicated above, transparent and clear guidelines in the form of IPP frameworks needed to attract private sector investment are lacking in most MS.

What is also lacking are clear policies in terms of how off-grid/mini-grid investments will be accommodated when the national grid reaches such areas currently far from the grid. Such predictable network expansion and policies can act as an incentive for investors to plan their projects.

In relation to private sector investments, another opportunity exists to manufacture RE/EE technologies at a regional level contributing to the industrialization dimension of the region but so far little effort has been made to encourage investment in this area.

As of 2016, there is limited participation of both national and regional commercial and development banks in RE and EE, limiting availability of counterpart funding for the local industry players.

4.2.2.5. Projects, Technology Development and Transfer Gaps

In order to meet demand for sustainable energy, supply for energy security and access to clean modern energy services, the planned projects and grid networks and corresponding investment requirements need to be determined and supply targets set to meet expected demand. For SADC potential capacity required to meet the SE4ALL target of doubling RE in the energy mix by 2030 has not been mapped to indicate whether the target can be met using current technologies or will require deployment of future technologies. The focus required should have a balance of on-grid and off-grid/mini-grid alternatives to meet future demand.

The assessment of RE resources vis-à-vis the required network has also not been comprehensively conducted in most MS in the context of meeting SE4ALL target. Network expansion plans are required in addition to capacity to guide investment in RE projects.

Many past programmes on cooking/heating/cooling have failed soon after donor funding is withdrawn because they were not anchored on strong policy frameworks. The business sector has also not fully participated in this energy subsector due to a number of issues such as lack of purchasing capacity by the general population and lack of incentives to produce and supply this type of equipment in the MS.

To meet RE/EE demand, local production and supply would be required but the implication of either local production versus imports requires full analysis.

4.2.3. Capacity Development, Information and Awareness Gaps

4.2.3.1. Capacity gaps

The following are some of the skills and capacity gaps that need to be bridged in order to achieve the objectives of REEESAP:

- capacity to prepare IRPs or energy sector Master Plans and related economic analysis, and demand forecasting modelling;
- capacity in RE resource assessment;
- capacity in development and execution of IPP frameworks;
- capacity of national development and commercial banks to assess RE/EE project risks, to support project preparation and structuring, and to design appropriate funding packages that can augment other sources of financing for these projects;

- the project developers have limited skills for project development/preparation and for accessing various financing opportunities offered through initiatives such as Power Africa, ElectriFI, EEP, Global Climate Fund, carbon financing and AEEP;
- Few utilities have fully fledged system planning units hence not all are able to assess grid capacity and conduct stability analysis in-house to determine how much RE can be connected to the grid networks and how much more investment and planning is required to accommodate the aspired RE capacities in the MS;
- capacity for reengineering of RE technologies to support technology development or adaptation of existing technologies to the local environment; and
- limited local technical capacity to undertake energy audits that can meet requirements of financing institutions and accreditation is not demanded for service providers.

4.2.3.2. Information, advocacy and awareness gaps

There is inadequate processed information to assist planning and project implementation including lack of adequate and verifiable data that can guide investments in RE/EE projects. Data relating to verification of RE resource potential and characterization, socio-cultural factors and those that determine energy choices and energy utilization patterns are not readily available or not regularly analysed by MS.

Compartmentalized planning in the energy sector without realizing the demands of other SADC strategies e.g. SAPP Pool Planning based on MS IRPs is not capturing unmet demand and expected growth in industrialization. There is also lack of clear targets in many MS for RE/EE.

Weak information and awareness base as potential economic, social and environmental benefits of RE and EE are not well appreciated leading to poor access to information needed to influence positive decision making on RE/EE. There is also poor documentation and dissemination of research results from best practice.

There is also lack of awareness by the population of the benefits of RE/EE equipment. Interventions in this area are sporadic and planned without a long term strategy.

4.2.4. Crosscutting and Cross-sectoral Gaps

Energy planning in most MS does not adequately address the energy needs for poverty alleviation. Providing energy services for localised productive uses, food production, water, health and education can significantly contribute to poverty reduction but more emphasis is being placed on alleviating energy insecurity at larger scale, particularly in ensuring that power generation is able to meet the current demand neglecting the energy needs of the poor.

As of 2016, there are limited efforts by the MS to introduce low carbon development policies/strategies and strategies in national development plans including for the energy sector.

There is lack of gender sensitive policies/strategies to address the energy needs of both women and men. Whilst efforts to mainstream gender in energy policies and programmes are on-going in the region, there are no programmes systematically targeting women. This aspect of planning is vague and hampered by the lack of data to inform policy/strategy formulation in that regard.

There is a lack of an integrated approach to development planning that ensures that energy development and deployment builds on synergies with other sectors such as land use, food security, water and forestry and social development. The MS recognise the important link of energy and water but the 2016 joint workshop for Ministers of Energy and Water is not a regular event. It is, therefore, apparent that planning for RE, EE and access is frequently done in isolation with limited consultations with other sectors.

The issue of biofuels and food security is still topical. Although MS have set blending targets for biofuels, the issue of type of feedstocks to be used has not yet been resolved. Largely, generating biofuels from food crops is not supported by the biofuels policies in the region, although there are thriving examples of ethanol being produced from sugar cane molasses in some MS.

5. Vision, Mission, Strategies and Action Plans

5.1. Vision and Mission of REEESAP

The **Vision** of REEESAP is adapted from the one contained in the SADC Protocol on Energy[63] and is "***to ensure the availability of sufficient, reliable, least-cost/affordable, sustainable, clean and modern energy services for SADC by 2030*** that will assist in the attainment of economic efficiency, industrialization and the eradication of poverty whilst ensuring the environmentally sustainable use of energy resource.

The Mission of REEESAP is to accelerate the scaling up of uptake of **RE energy sources[64] and services[65]** and implementation of the various **energy efficiency** measures.

5.2. Strategic Objectives

The key strategic objectives for this REEESAP are as follows:

1. achieve **energy security** by closing the current supply/demand deficit largely in the power sector and enabling future economic growth and industrialization;
2. increased **access to modern energy services** particularly by the poor that largely depend on inefficient traditional forms of energy in order to enhance their socio-economic status and hence alleviate poverty;
3. **offsetting the risk associated with energy imports** in form of large import bills and uncertainty of supply aggravated by the impact of currency fluctuations;
4. **mobilizing financial resources for investment for both** RE/EE projects and manufacturing of RE/EE equipment in the SADC Region, the latter contributing to industrialization agenda of SADC; and
5. achieving **low carbon development paths** and **climate resilient energy systems**.

5.3. Strategic Interventions and Action Plans

In order to meet the strategic objectives, SADC and its Member States need to:

1. strengthen national and regional institutions to adopt and implement RE/EE projects;
2. create policies, strategies, plans and other frameworks to ensure an enabling environment for RE/EE investments;
3. have appropriate regulation and standardization frameworks for RE/EE projects and investments;
4. attract private sector participation in investments for RE and EE;
5. build capacity to design, develop, build, implement and maintain RE/EE projects;
6. attract financing for RE/EE projects;
7. develop projects, technologies and transfer know how to meet demand targets;
8. promote adoption of RE/EE through information, advocacy and awareness, and;
9. mainstream cross-sectoral and cross cutting issues when implementing RE/EE projects.

5.3.1. Strengthening of National and Regional Institutions

Most of the SADC agencies in charge of energy require additional staff. RERA in particular can benefit from additional professional staff at its secretariat to support the various initiatives being advanced by the agency. This agency could be more effective if it becomes an authority to give appropriate support to transboundary energy trading and national regulatory bodies of the Member States. Three countries are still in the process of creating their national energy regulators and would require assistance of RERA. The mandate and independence of the regulators would also require a body with authority for oversight.

The operationalization of SACREEE is advanced and the launch of the organization is now foreseen to be in mid-2017**.** It is therefore imperative that SACREEE be operationalised and capacitated in order to facilitate the implementation of REEESAP. There are also a number of programmes that are already going on in the region that SACREEE on behalf of SADC would be coordinating e.g. participation in EEP, ACEC,

[63] "to ensure the availability of sufficient, reliable, least-cost energy services that will assist in the attainment of economic efficiency and the eradication of poverty whilst ensuring the environmentally sustainable use of energy resources".
[64] investment
[65] consumption

Renewable Energy and Energy Efficiency Partnership (REEEP), SE4ALL on promotion of project development and implementation support.

The institutional setting for adoption and implementation of RE and EE is scattered among institutions with grid electricity being coordinated by utilities at MS level and by SAPP at regional level for power pooling and optimization of energy resources at regional level. A similar coordinated arrangement is required for off-grid systems. Although, MS have created Rural Electrification Agencies/Rural Energy Agencies and in some cases Renewable Energy Agencies (REAs) they are not coordinated at regional level to ensure experience exchange, economies of scale and synergies in their mandate to achieving clean energy access through off-grid systems.

Each MS need to set up IPP/PPP units that can prepare and execute IPP frameworks in an effective, efficient and transparent fashion in order to instil confidence of the private sector to invest in the RE/EE market. MS can learn from the South Africa's experience and adapt their own institutional framework that will deal with private sector investors.

Umbrella bodies in the form of associations have formed naturally when corporations and investors have appetite to enter the market but they are generally weak or new. These structures should be nurtured and strengthened to be nuclei for mobilizing participation of local private sector including financial institutions in RE/EE implementation. As part of such umbrella bodies, building councils are necessary to promote adoption of RE and EE in the building sector in particular.

Preparation of REEESAP has involved consultations with COMESA and IOC and this should be a standard collective regional effort to ensure harmonization of planning and policy frameworks across the three RECs. There is an existing Tripartite Subcommittee on Infrastructure between SADC, EAC and COMESA that may be considered as a platform for such planning and exchange of experiences.

The strategic Action Plan for this intervention is given in Table 5-1.

Table 5-1 Strategic Action Plan - Strengthening of National and Regional Institutions

Strategic Intervention 1: Strengthening of National and Regional Institutions					
Actions		**Level of implementation- REC, MS**	**Leading Implementing Agency**	**Collaborating Institutions**	**Timeframe**
1.1	Each Member State to set up an independent energy regulator	MS	Ministry of Energy (MoE)	RERA	2017
1.2	Strengthen RERA Secretariat and explore its migration to an authority	REC	SADC	MS Regulators	2017
1.3	Sign IGMOU and launch SACREEE as the RE/EE SADC Regional Implementing Agency through existing channels of SADC to operationalize SACREEE	MS/REC	SADC Energy Division	MS MoEs, ADA	May/ June 2017May 2017
1.4	Establish REAs or units in each MS with a mandate particularly for off-grid systems and coordinated at the regional level	MS	MoEs	SACREEE	2019
1.5	Create IPP/PPP Units or equivalent units in governments to attract private sector investment in MS	MS	MoEs	Other MS units	2019
1.6	Support creation and strengthening of	MS	MoEs	SACREEE	2019

	an RE/EE Association in each MS with regional coordination			formation of federation of REAs	
1.7	Facilitate establishment of green building councils to promote RE/EE in the built environment	RE/MS	SACREEE	Property developers, national and regional development banks	2018
1.8	Create a coordinated institutional framework for planning with COMESA, EAC and IOC on framing of RE/EE policy framework	REC	Energy Divisions in each REC	REC Power Pools, Regulators	2018

5.3.2. Creation of National Frameworks for RE/EE

The disparities among SADC MS in the development of their own RE/EE strategies and action plans should be addressed through domestication of SADC strategies, in this case the REEESAP. MS will be provided with guidelines on how to develop their national action plans drawing from the SADC REEESAP. This will also be an opportunity for MS targets for RE/EE to be aligned with the SADC targets.

Since most MS are still developing or revising their IRPs, this process should consider scenarios of required supply to meet target per capita GDP growth rates for industrialization of 6% to 2020 and 8% to 2050 (and hence electricity demand growth at similar rates), also considering other cross sectoral implications such as water and climate change. The same IRPs to be developed will result in a more credible SAPP Pool Plan with supply plan to 2030. Distributed generation such as rooftop PV is gaining momentum and should be included in IRPs of countries similar to what other MS e.g. Mauritius and South Africa are already considering. The IRPs can be revised every 3 years in order to take into consideration changing circumstances.

An important element of policy and regulatory framework is the development of market reforms and investment framework that RERA is championing and promotion of regional power trading. When complete, RERA will undertake a pilot phase with selected MS, and the framework will be ready for adoption by all Member States. South Africa has a well-established IPP framework that is attracting significant investment for RE, from which other MS can learn. The IPP Unit proposed above would have the mandate to execute the IPP/PPP frameworks in the MS.

In order to meet the SADC target for cost reflective tariffs by 2019 and while ensuring that the poor are not prejudiced, a methodology and auditing framework should be established and adopted by the energy regulators in the MS and coordinated by RERA to ensure harmonization. Tariffs that reflect the actual cost of producing energy are required as a prerequisite for incentivising EE actions.

MS can also become aware of and adapt the Market Reforms and Investment framework being developed by RERA in deciding how they can introduce multi buyer models so that RE producers can have a flexible market regime.

To address the issue of tariffs for mini-grids, consumer owned generation and other off-grid systems, MS can create a regulatory framework learning from the experiences of those municipalities in South Africa and distribution authorities in Namibia that have been granted tariffs to implement embedded generation. Setting of tariffs and rules for mini-grids needs to be harmonized at the regional level, basing on the mini-grid framework that RERA is already undertaking. In that regard favourable policies are also required with regard to how mini-grids will be treated when the grid reaches those areas supplied by mini-grids. Some examples[66] in that regard is that the Electricity Acts will cater for connection of mini-grids to the main grid at that stage thereby assuring investors of sustainability of their role in the supply industry.

Introduction of clear policy frameworks are considered important to guide upscaling of and sustaining cooking/heating and cooling programmes in the MS. A favourable policy environment will encourage the business sector to participate hence creating sustainability.

[66] GNESD. 2014 Renewable energy-based rural electrification: The Mini-Grid Experience from India. New Delhi: Prepared by The Energy and Resources Institute (TERI) for the Global Network on Energy for Sustainable Development (GNESD). This publication and other GNESD publications can be downloaded from www.gnesd.org.

The strategic Action Plan for this intervention is given in Table 5-2.

Table 5-2 Strategic Action Plan - National Frameworks

Strategic Intervention 2: National Frameworks					
Actions		**Level of implementation- REC, MS**	**Leading Implementing Agency**	**Collaborating Institutions**	**Timeframe**
2.1	Domesticate regional renewable energy and energy efficiency policies/strategies to inform upscaling of RE/E and clean energy access basing on REEESAP.	MS	MoEs	SADC Energy Division/SACREEE/ETG	2019
2.2	Develop Integrated Resource Plans/ Energy Master Plans and SAPP Pool Plan[67] taking into consideration unmet demand and higher growth rates for industrialization and poverty reduction	MS/ REC	SAPP	SADC Energy Division; SACREEE, IRENA/ETG	2019
2.3	Adopt and implement IPP frameworks in MS for both grid and mini grids/off-grid projects and related network policies.	MS/REC	MoEs	SADC Energy Division; RERA, ETG MS, Energy Regulators	2019
2.4	Adopt multi-buyer model[68] in MS and across the region	MS/REC	MoEs	MS Energy Regulators/RERA	2022
2.5	Develop and adopt cost-reflective tariff methodology for both grid and mini grids and auditing guidelines[69]	MS	MoEs	MS Regulators and RERA, electricity utilities	2019
2.6	Set regulations (technical and economic) for rooftop PV/embedded generation	MS/Local authority level	MoEs	MS regulators, electricity utilities, RERA, SACREEE	2018
2.7	MS tailored policy frameworks for cooking/heating and cooling	MS	MoEs	SACREEE NFIs	2018

5.3.3. Regulation and Standardisation for RE/EE

Harmonized technical and quality of service standards for the various RE and EE technologies are required across the region to allow cross border trading and also accreditation of service providers. MS have some of these standards in place but these need to be reviewed and enforced.

MS should introduce specific regulations and standards relating to RE for grid codes, and norms to facilitate regional electricity trading. These codes will also help attract private sector investment.

An important component of the IPP frameworks that MS should include is adoption of Standardised PPAs that will facilitate negotiations with private investors for RE/EE projects. SA has experience in execution of standardized PPAs and other MS can learn from that experience and adapt for their own circumstances.

On the supply side, there is need for regulators to monitor and regulate utility transmission and distribution losses. A regionally coordinated effort in this regard will be useful to put a cap on allowable losses. This is an EE measure that can contribute to the reduction of demand on the power systems.

[67] Current demand forecast is for least cost planning and assuming 3-5 % growth rates
[68] This will require unbundling of public utilities
[69] Cost items such as taxes and subsidies, and externalities need to be considered while developing a cost reflective tariff

Utilities have been implementing a number of Demand Side Management (DSM) measures including: efficient residential and commercial lighting, time of use tariffs, deployment of solar water heaters and electric geyser ripple control. These measures have yielded considerable savings albeit not verifiable. Regulators should ensure that utilities employ the services of accredited Monitoring and Verification (M&V) companies to confirm the energy savings. The practice should be coordinated by RERA.

Regional MEPS together with labelling and standards for appliances for cooking/heating[70] and cooling will facilitate trading across the region. Similarly, in the case of buildings, the standards and codes can be harmonized across the Region by learning from successful MS experiences.

The creation of regional building codes is anticipated for the MS that belong to the IOC and that experience can be useful when implementing similar actions on the mainland. Minimum building standards can be developed for MS to adopt considering both mandatory and voluntary options. The latter is expected to act as an incentive for building owners to adopt EE in buildings.

In terms of regulations, some MS have introduced a policy to phase out incandescent bulbs. An assessment of impact of this policy on trade regimes and industrialization effort is required.

On the demand sectors where utilities are not involved, consumers can hire services of qualified energy auditors to map the applicable EE measures and identify the 'low hanging fruits' in this area. Apart from creating awareness of the benefits that can accrue from the savings, energy audits will be required to estimate potential savings.

The strategic Action Plan for this intervention is provided in Table 5-3.

Table 5-3 Strategic Action Plan - Regulation and Standardization

Strategic Intervention 3: Regulation and standardization					
Actions		**Level of implementation SADC/REC, MS**	**Leading Implementing Agency**	**Collaborating Institutions**	**Timeframe**
3.1	Develop and adopt RE/EE technical and quality of service standards	MS	MoEs	MS Regulators, MS Standards Bureaus	2019
3.2	Review/develop and adopt grid codes at national level and harmonize at regional level	MS/REC	MoEs/RERA	MS Regulators	2019
3.3	Develop and adopt standardized PPAs	MS	MoEs	RERA/MS IPP/PPP Units, electricity utilities	2019
3.4	Prepare regional guidelines to minimize and set limits for transmission and distribution losses	MS	MoEs	SAPP/RERA/ MS Regulators, electricity utilities	2018
3.5	Establish Minimum Energy Performance Standards (MEPS), appliance labelling[71] in MS coordinated at regional level	MS	MS Bureau of Standards	MS Regulators;	2020
3.6	Establish minimum building codes/standards in MS coordinated at regional level	MS	MS Bureau of Standards	Ministers in charge of Built Environment, regulators, MoEs	2020
3.7	Establish Measurement and Verification system for savings from DSM	MS	MS utilities	MS regulators	2018

[70] Also focussing on solar water heaters
[71] RE/EE systems, Cooking, heating including SWhs and cooling

3.8	Assess impact of the policy to phase out Incandescent bulbs on trade regimes and industrialization effort	MS	MoEs	SAPP, RERA	2018
3.9	Establish standardized performance contracts for energy audits.	MS	MS Bureau of Standards	SADC/SACREEE	2019

5.3.4. Attracting Private Sector Participation in RE/EE Investments

The involvement of independent power producers (IPPs) and their share of planned capacity delivered are increasing particularly in South Africa. Other countries such as Zambia have also started to involve IPPs but the rest of the MS are still lagging behind in terms of attracting private sector investment in RE and EE.

It has become apparent that transparency and clear guidelines in the national and regional IPP frameworks are needed to attract private sector investment in the same manner as South Africa has managed to achieve. It is encouraging that some SADC MS are seeking to learn from the South African experience, notwithstanding the differences in the structure of the economy and levels of advancement in the financial sector.

SADC MS can standardize aspects of IPP frameworks such as government guarantees, licensing and contracts for IPP/PPP to deal with private sector investors particularly for the competitive bidding approach. The MS will also have to develop transparent frameworks for Feed–in-Tariffs (FIT) that can be applied in the countries alongside the competitive bidding to cater for small and medium projects with a view to further simplifying the process.

In relation to private sector investments, another opportunity exists to manufacture RE/EE technologies for the regional market contributing to the industrialization drive. Appetite for investment in this venture should be explored.

Bankability of projects has remained the cornerstone for securing project finance making project preparation critical. This requires capacity coupled with financing and clear project definition to reach the desired standards of project preparation.

The strategic Action Plan for this intervention is given in Table 5-4.

Table 5-4 Strategic Action Plan - Private Sector Participation

Strategic Intervention 4: Attracting private sector participation					
Actions		**Level of implementation- REC, MS**	**Implementing Agency coordinating**	**Collaborating Institutions**	**Timeframe**
4.1	Analyse applicability of IPP framework across SADC MS	REC	RERA	MoEs/IPP/PPP Units, SAPP	2018
4.2	Adopt standardized IPP frameworks and model contracts with regard to government guarantees, licensing, application of competitive bidding and FIT	MS/REC	MS IPP/PPP Units;	MS Regulators, utilities RERA, Development banks	2019
4.3	Undertake market assessment and investments potential study for RE/EE technologies and cooking/heating/cooling appliances	REC	SADC	SAPP/RERA/SACREEE	2018

4.4	Create/facilitate an early stage financing of project development by local entrepreneurs in order to unlock investment	REC/MS	SACREEE	SADC, National and regional development banks.	2018
4.5	Educate potential private sector investors on RE/EE opportunities/risks in the Region	REC	SACREEE	SADC, National and regional development banks.	On-going

5.3.5. Capacity Development

There is need to undertake a capacity needs assessment at both national and regional levels in order to identify training requirements for the various stakeholders needed to scale up RE and EE as outlined below:

IRP development: exchange of experience among Member States and contracting Centres of Excellence to provide training to MS government, regulators and utilities in this area.

Assessment of IPP/PPP projects: Government will require capacity to prepare IPP frameworks (with specific guarantees, licensing, contracts), negotiate with private sector and ensure that contracts deliver desired results. National development and commercial banks should be capacitated to understand the technologies in order to assess the project risks, support project preparation and structuring, and be able to design appropriate funding packages that can augment other sources of financing for RE/EE projects.

Project development: project developers should continuously be trained on the job to write proposals that can qualify for funding from the various financing opportunities offered through initiatives such as Power Africa, Electrifi, EEP, Global Climate Fund and AEEP.

Grid capacity and stability analysis: This training is required to assist utilities to determine investment and planning required to accommodate RE capacities in the grid. IRENA is providing similar capacity support to its members and SADC can approach IRENA to develop and implement a training programme for the region.

RE Resource assessment: governments, developers and R&D institutions should be trained in understanding and quantifying the RE resources in their countries. The knowledge will help them understand the RE potential and to plan for their optimum utilisation and integration into the grids.

Development of RE technologies and EE auditing: training in this area could be provided by existing national and regional training centres specializing in RE and EE technology aspects for re-engineering of wind turbines and solar PV; for energy auditing as well as replicating initiatives such as SOLTRAIN. MS can encourage energy service companies to go through accreditation in order to be registered to conduct energy audits.

The strategic Action Plan for this intervention is given in

Table 5-5.

Table 5-5 Strategic Action Plan - Capacity Development

Strategic Intervention 5: Capacity development					
Actions		**Level of implementation-REC, MS**	**Implementing Agency Coordinating**	**Collaborating Institutions**	**Timeframe**
5.1	Develop Capacity for Integrated Resource planning including setting of targets and climate change implications in supply and demand modelling	MS/REC	SAPP	MS electricity regulator & utilities, RERA	Dec, 2017
5.2	Develop skills in RE resource assessment	MS/RE	SACREEE	MS Centres of excellence	2018
5.3	Conduct training for developing and implementing IPP frameworks in MS	MS	MoEs	MS Regulators, RERA	2018
5.4	Train Government officers, commercial & development banks in project assessment, to support project structuring and prepare counterpart funding packages for RE/EE projects	MS/REC	SADC	SAPP, individual MS	2017
5.5	Develop Capacity for IPPs and Government Officers on accessing various sources of funding for project development and implementation	MS	SACREEE	SAPP; national and regional development banks, ICPs	On-going
5.6	Train MS utilities on conducting grid capacity assessment and stability analysis	MS	MS Utilities	SAPP/ IRENA/IPPs	2017 On-going
5.7	Develop skills for RE/EE technology development	REC/MS	SACREEE/MoEs	SADC and MS Centres of excellence	On-going
5.8	Develop Capacity for Energy Management and accreditation for quality energy auditors	MS/REC	MoEs	MS Centres of excellence	On-going

5.3.6. Financial Intermediation

Commercial and development financing institutions have set high thresholds of the size of projects they support (due to proportionately high transaction costs for small projects) which leaves small projects, particularly those below 10 MW of RE/EE without adequate access to financing. Project developers have to rely on equity to develop and implement such small projects and should have capacity to access some of the financing opportunities offered in initiatives such as AEEP and EEP. It is also important that IPP frameworks target such small projects in the same way as South Africa has allocated in its competitive bidding[72]. In other MS such as Namibia, such small projects (<5MW) qualify for Feed in Tariffs and hence can attract investments. Alternatively, both MS and SADC can create special purpose investment funds for such small projects involving both national and regional development banks. There are some regional banks providing project development support but such funds need to be assured and sustainable.

Both national and regional financial institutions have a niche to provide counterpart funding to local industry players. The banks should create and manage national/domestic and regional investment funds for RE/EE projects, strengthen project preparation and advice on common guarantee instruments and project structuring by building capacity to provide such a service.

At a lower level, innovative micro-credit mechanisms/revolving funds should be created to upscale adoption of sustainable energy equipment such as ICS and solar lanterns by the poor and other disadvantaged

[72] South Africa had such a window in its IPP framework

groups. Although the population has started to understand the benefits of these more efficient technologies, their high cost is an impediment for households with low purchasing power.

It must be noted that there are many initiatives that aim to support RE/EE in the region. SACREEE can provide support to project developers and MS to match with potential funders for their requirements. The opportunity of accessing financing initiatives that can combine grants, equity and debt facilities should be explored and an organization such as SACREEE can advise project developers in the region how to benefit from such financing arrangements.

To benefit from such initiatives and any possible national, regional and international investment funds, utilities should demonstrate their creditworthiness and be convincing that they can honour PPAs that are signed in the context of IPP/PPP frameworks.

The strategic Action Plan for this intervention is shown in Table 5-6.

Table 5-6 Strategic Action Plan - Financial Intermediation

Strategic Intervention 6: Financial intermediation					
Actions		**Level of implementation- REC, MS**	**Implementing Agency coordinating**	**Collaborating Institutions**	**Timeframe**
6.1	Facilitate creation of a special purpose investment fund for RE/EE projects of <10MW and to support project structuring and packaging bankable projects <20MW	MS/REC	SADC Secretariat,	National and regional development banks, SACREEE	2019
6.2	Mobilise national and regional development banks to create investment packages and counterpart funding for implementation of RE/EE projects.	MS/REC	SADC Secretariat,	National and Regional Development banks e.g. DFIs, SACREEE	2018
6.3	Develop guidelines for common guarantee instruments	REC	SADC Secretariat,	National and Regional Development banks e.g. DFIs, SACREEE	2017
6.4	Facilitate creation of an innovative micro credit financing for cooking/heating/cooling RE and EE projects and off-grid electrification	MS/REC	SACREEE & its NFIs	National small scale development/financing agencies,	2017/2018
6.5	Compile and disseminate various financing facilities available in the region for RE/EE projects development and implementation	REC	SACREEE	SADC ETG/ICPs	2017 +and On- going updates
6.6	Conduct utility worthiness to honour PPAs and improve efficiency through peer review mechanism.	REC	SADC	SAPP, RERA	2018+

5.3.7. Projects, Technology Development and Transfer

Both MS and SADC should set targets that are aligned to ensure that projects planned by MS can meet the SADC target similar to EU approach whereby MS are allocated share of the regional target they should meet depending on their resources and capacity. In that regard the MS and SADC should create a pipeline of on-grid and off-grid/mini-grids projects that will meet those targets. On-grid project pipelines including RE projects and EE measures can be compiled within the framework of SAPP Pool Plan using updated MS IRPs and their DSM programmes.

Mini grids are gaining popularity with many ICPs investing in particularly Green mini grids[73]. Green mini grids will serve the needs of communities too distant to be economically connected to the grid in the near to medium term, but densely populated enough to offer economies of scale in power delivery compared with individual home systems. The International Energy Agency has estimated that 40% of investment required to achieve universal electricity access by 2030 can most economically be achieved through mini-grids. Universal power access in Africa will require as many as 350,000 mini grids, so SADC MS should also tap into that market share.

The assessment being made e.g. by IRENA shows that it will be difficult for the majority of countries to meet the target of doubling RE in the energy mix by 2030 using current technologies. This calls for concerted effort to explore the additional potential that can be derived from the emerging technologies. Solar PV and on shore wind technologies have become competitive with conventional sources of energy but additional flagship projects such as CSP with storage, ocean energy, waste to energy, biomass (e.g. invasive species) and geothermal sources should be further explored so that MS with those resources can benefit. These types of projects can make significant contribution to future sustainable supply of SADC's energy mix. Regional efforts to pilot these technologies throughout the region with the requisite resources can bring their speedy deployment.

The assessment of RE resources should be matched with transmission and distribution adequacy. Such zoning of RE resources matching with transmission requirements should be done as part of RE resource assessment and grid capacity assessment. MS can benefit from initiatives by IRENA as part of REMap – roadmaps, although some MS are already investigating those zoning opportunities. On the Distribution side, such zoning approach will augment the efforts to introduce consumer owned generations such as rooftops and other embedded generation combining with deployment of smart grids particularly in urban settings such as municipalities. The lessons being learnt from some municipalities in SA and Distribution regions in Namibia can be disseminated for wider application in other MS.

For power transmission and distribution networks, the theoretical thresholds of how much RE can be connected to national grids without creating instability need to be reviewed. Rules of thumb are often used to establish the limit on the capacity of grids to absorb intermittent generation without the development of grid studies. Lessons can be learnt from initiatives by IRENA in the island states and can be replicated for selected countries on the mainland.

MS should also establish their grid network master plans that can inform future growth of the grid in order to assist project developers plan where and when they can undertake their investments.

For cooking/heating/cooling, the lessons learned from initiatives such as SOLTRAIN should be adapted and replicated for adoption by business communities with support of good policies.

The SADC Region was producing CFLs from a plant in Lesotho[74] owned by Phillips and with migration of utilities from CFLs to LEDs, the plant could be revived to use its economies of scope to start LED production. Another example is the PV panel factory in Mozambique which should be part of a regional strategy of manufacturing components regionally for RE/EE systems.

The strategic Action Plans for this intervention is given in Table 5-7.

Table 5-7 Strategic Action Plan - Projects, Technology Development and Transfer

Strategic Intervention 7: Projects, technology development and transfer					
Actions		**Level of implementation -REC, MS**	**Lead Implementing Agency**	**Collaborating Institutions**	**Timeframe**
7.1	Set RE and EE targets for MS aligned with SADC targets for 2030	MS/REC	MS Regulators	MS Utilities, SAPP/RERA/SE4ALL Hub	2018/19

[73] http://www.afdb.org/en/news-and-events/article/sefa-grants-us-1-million-to-promote-green-mini-grids-in-niger-15990/ http://solarnanogrids.org/powering-up-the-afd-dfid-green-mini-grids-support-facility-meeting/
[74] Plant closed down 2 years ago.

	considering the industrialization growth targets				
7.2	Create on-grid and off-grid/mini-grids project pipeline that will meet the stipulated targets including RE projects and EE programmes	MS/REC	MoEs/SAPP	Utilities/REAS/SACREEE/AfDB	2017> ongoing
7.3	Pilot regional flagship projects for CSP with storage, Ocean energy, biomass (invasive species), geothermal	Selected MS with particular resources	SAPP	SAPP/RERA/SACREEE	2020
7.4	Conduct optimum RE/grid network zoning and establish an updated network expansion plan including for rural electrification	MS	MoEs	MS Electricity Utilities/IRENA/SACREEE	2020
7.5	Pilot grid stability assessment	MS	MS Electricity Utilities	SAPP/IRENA	2018
7.6	Adopt targets for cooking and solar water heating for residential, institutional and commercial sectors	MS	MoEs	SACREEE, MS NFIs, REAS, ICPs	2018
7.7	Promote adoption of space heating/cooling technologies and models for residential, institutional and commercial sectors	MS	MoEs	SACREEE, MS NFIs, REAS, ICPs	
7.8	Promote LEDs manufacture in the region	REC	SAPP	SADC	2018

5.3.8. Information, advocacy and awareness Creation

Information, perceptions and awareness are key elements for successful RE and EE deployment.

On Information, there is need to ensure that planning is informed by adequate data that is reliable and up-to-date, and is monitored against clear targets. The promotion of a regularly updated economic and energy database supported by regular modelling of possible future scenarios will contribute to this effort. MS and SAPP can contribute to this as part of their IRP and SAPP Pool Plan development.

There is also a general perception among stakeholders that RE/EE technologies are riskier and less reliable than traditional energy sources. Addressing this issue should be a priority among the different SADC institutions. There is also a perception that countries are risk destinations for investment and that also need to be averted by good information on the opportunities that exist in the region.

Concerning awareness raising, it is important to inform project developers about financing opportunities offered through various global and regional initiatives such as Power Africa, ACEC, ElectriFI, EEP, Global Climate Fund, AEEP, and other mechanisms. It is vital that these funds reach projects, especially the ones that provide energy services to the poorer segments of society. These are often aware of the benefits of RE/EE technologies but do not have the purchasing power to acquire them.

Apart from knowledge on accessing financing from existing mechanism, consumers also need to know about the credible suppliers of equipment and services in their countries and region.

To ensure that information dissemination and awareness is created, appropriate skills for those tasked to share information are improved and that platforms such as educational institutions adopt curriculum that inform about RE/EE. Lessons can be learnt from the tertiary institutions that have set up Centres of Energy and provide educational programmes on RE/EE.

The strategic Action Plan for this intervention is given in Table 5-8.

Table 5-8 Strategic Action Plan - Advocacy and Awareness

Strategic Intervention 8: Advocacy and Awareness					
Actions		**Level of implementation-REC, MS**	**Lead Implementing Agency**	**Collaborating Institutions**	**Timeframe**
8.1	Establish and maintain Energy Databases and Information Systems	MS/REC	MoEs/SACREEE	MS Statistics Offices, SARDC, REN 21	2017/On-going
8.2	Create and maintain a SADC knowledge hub on RE and EE including coordination of collection and collation of planning data	REC	SACREEE	SACREEE, National Focal Institutions (NFIs); SARDC, REN21	2017+
8.3	Conduct awareness and advocacy campaigns on RE and EE value and benefits (with a focus on women)	MS/REC	SACREEE	MoEs, SACREEE, National Focal Institutions (NFIs); SARDC, REN21	2017+
8.4	Promote of the SADC Region as an attractive place to invest in RE and EE through promotional events and materials	MS/REC	SACREEE	SADC, SACREEE, National Focal Institutions (NFIs); SARDC	2017+
8.5	Disseminate information on sources of financing and their requirements.	REC	SACREEE	SADC, SACREEE, National Focal Institutions (NFIs); REAs	2017+
8.6	Creation of a register of credible and accredited service providers for RE/EE equipment, installations and maintenance-with recommendation to form associations of such service providers.	MS/REC	SACREEE	SADC, SACREEE, National Focal Institutions (NFIs); REAs	2017+
8.7	Train journalists on sustainable energy issues	MS/REC	SACREEE	SADC, SARDC, MISA	2017+
8.7	Introduce sustainable energy issues in school curricula and tertiary education	MS/REC	MoEs	MS Ministry of Education, SADC	2018+

5.3.9. Cross-Cutting and Cross- sectoral/Nexus

To achieve the link between energy and access to water, improving public health and education, women's empowerment and increased food security, initiatives such as the joint workshop of Ministers of Energy and Ministers of other relevant sectors such as Water are required to avoid isolated planning of RE, EE and access with other sectors.

Implementation of RE/EE should be supported by clear land acquisition legal framework to avoid delays in securing land for projects. In some countries dedicated land Commissions are created to fast track land acquisition for infrastructure projects that are of national importance.

The issue of biofuels and food security should be anchored on policies that will avoid conflict but create synergies with food security learning from the thriving examples of ethanol being produced from sugar cane molasses.

To address gender mainstreaming in the energy sector, targeted programmes should be implemented to address energy needs of women and men, especially in rural and peri-urban areas. This should be supported by collecting gender disaggregated data to inform the design of the programmes.

The strategic Action Plan for this intervention is shown in Table 5-9.

Table 5-9 Strategic Action Plan - Cross Sectoral Aspects

Strategic Intervention 9: Cross Sectoral /Nexus Aspects					
Actions		**Level of implementation**	**Lead Implementing Agency**	**Collaborating Institutions**	**Timeframe**
9.1	Ensure policy coherence between interconnected Sustainable Development Goals and sectors	MS/REC	SADC	SACREEE	2019
9.2	Formalise joint SADC Ministers' Meeting between Energy and other sectors	REC	SADC	MS ministries of energy and related sectors	By 2018
9.3	Formalize dialogue among climate change, water and energy at technical level	REC	SADC	MS ministries responsible for energy, water and meteorology	By 2017
9.4	Create enabling mechanism to facilitate access to public and private land for renewable energy developers.	MS	MoEs	MS Land Agencies /ministries	2018+
9.5	Promote the productive uses of mini grids and other decentralized energy systems for improving energy access, affordability and income generation	MS	SACREEE	SACREEE NFIs	2017+
9.6	Promote development of small hydropower projects that cater for power, irrigation and water supply and sanitation needs in MS that have potential	MS	SACREEE	SACREE/ NFIs	2017+
9.7	Promote creation of innovative financing mechanisms for targeted	MS	SADC	SACREEE and MS NFIs, national & regional Development	2019+

	programmes for cooking/heating and cooling to enhance energy access for women and other vulnerable groups			Banks	
9.8	Support MS to realize their climate change obligations and implement their Nationally Determined Contributions	MS	SADC	MS Ministries of Environment/UNFCCC Focal points	2017+
9.9	Develop an energy strategy mix to tackle the issues caused by rapid urban growth	MS	MoEs	SACREEE and MS NFIs, MS Ministries of Urban planning	2017

6. Implementation Framework

The implementation framework comprises of the principles that guide implementation of REEESAP, the institutional roles of key organizations and aspects of resource mobilization.

6.1. Guiding Implementation Principles

The implementation of REEESAP will be guided by the following principles that have been adapted from SADC policy directives, as presented in Table 6-1.

Table 6-1 REEESAP Guiding Principles

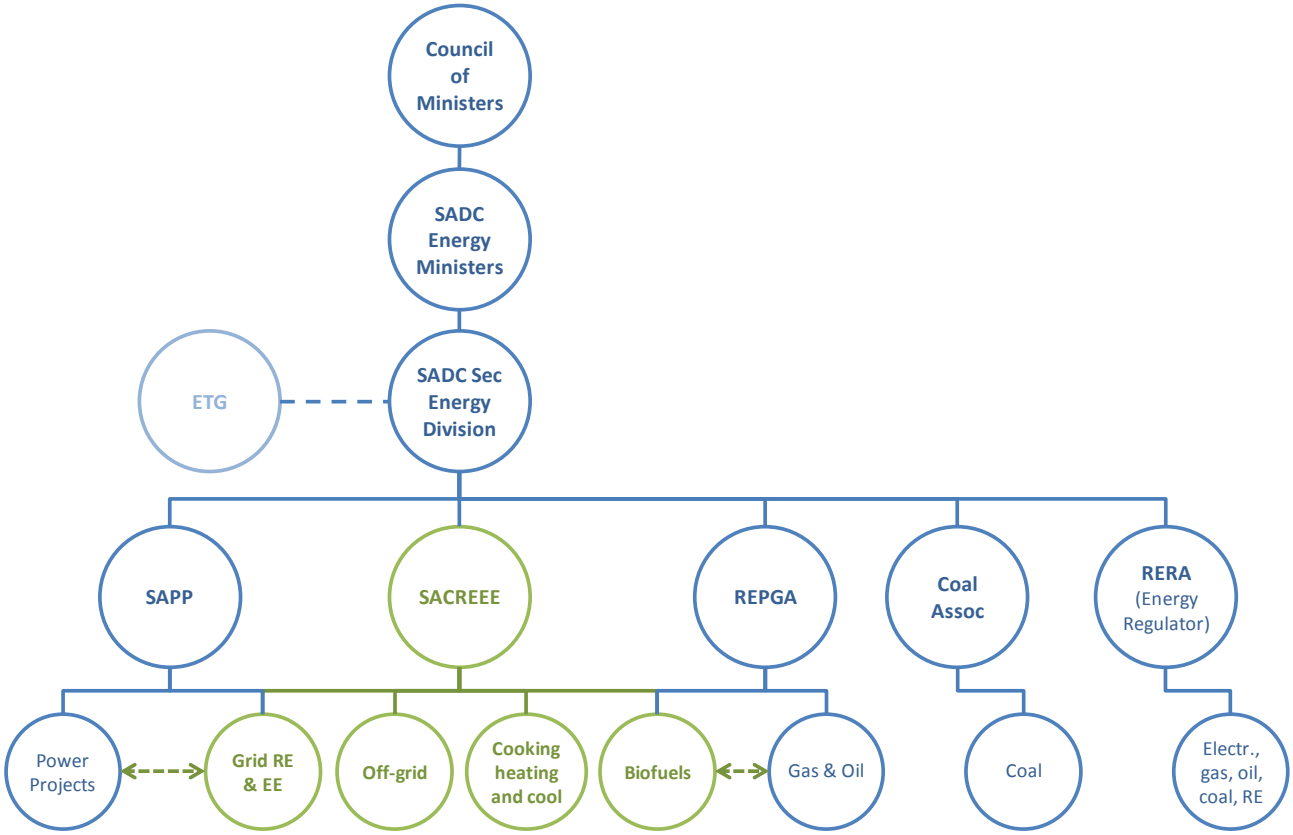
Responsibility	Member States have the responsibility to choose and implement those actions of REEESAP that are of priority to their countries.
Subsidiarity	REEESAP will be implemented at the most appropriate levels by relevant agencies in the Region and in Member States.
Additionality	Institutions other than the SADC Secretariat and its agencies can implement REEESAP interventions. These institutions can be public, private, civil society, academia and development partners.
Prioritization	REEESAP interventions are based on SADC development priorities and MS will have the liberty to prioritize the actions according to their development priorities.
Rationalization	REEESAP will promote coherency and alignment of national, regional and global initiatives, objectives and goals.
Coordination	REEESAP will promote cross sectoral and cross cutting planning with other sectors.
Flexibility	REEESAP is open to amendments and reviews in the course of its implementation to best respond to the changing circumstances.
Variable geometry	Certain Member States can move faster with the implementation of certain activities where they have comparative advantage or place high priority and have secured resources.
Best practices	REEESAP Strategic Action will be executed based on best practices and sharing of lessons learnt among MS and other regions.
Participatory	Relevant stakeholders are informed, consulted and involved throughout the implementation of REEESAP and development and implementation of MS Action Plans.
Sustainability	REEESAP promotes local ownership, awareness, capacity building and institutional development, and is anchored on participation of the MS.
Optimization	REEESAP will make the best use of available financial resources, prioritizing ‘high impact/ low cost’ solutions and match making actions with most appropriate funding mechanisms.

6.2. Institutional roles

The energy sector institutional framework is presented in Figure 6-1 below. The SADC Secretariat is key in implementing of SADC programmes and reporting to Ministers in charge of energy who in turn report to the Council of Ministers. SADC works with its agencies in the different energy subsectors: SAPP being responsible for power sector programmes and RERA coordinating regional regulatory frameworks. REPGA

which was to be created to coordinate oil and gas activities and a proposed coal association in the RIDMP (2012) do not yet exist. The major highlight is the creation of the SACREEE to support SADC Secretariat on the coordination of regional RE/EE programmes. The ETG is an important partner in the implementation of REEESAP as they provide financial and technical support directly to the SADC Secretariat programmes and bilaterally to MS.

Figure 6-1 Energy Sector Institutional Framework



Adapted from RIDMP 2012

The REEESAP has been developed by the Energy Division under the Directorate of Infrastructure and Services at the SADC Secretariat. The SADC Secretariat through the Energy Division with support of SACREEE has the responsibility to facilitate adoption of the REEESAP by the MS, including assisting MS in the development and implementation of their Action plans. Moreover, it will also support MS to secure resources to develop their Action Plans and also for implementation of their energy actions. At a technical level SACREEE can be overseeing the development of National Action Plans (NAPs) and arrange for peer reviews of MS NAPs to make them fit for funding and ensure harmonization where necessary.

In the institutional arrangement of implementing REEESAP, SACREEE has potential to participate in grid RE/EE projects cooperating with SAPP, and in the RE/EE related regulatory framework cooperating with RERA. The linkage of biofuels and oil and gas subsector can be another responsibility of SACREEE working with the SADC Secretariat and, the expected, REPGA.

SACREEE has other responsibilities to coordinate programmes on off-grid systems, cooking/heating/cooling as indicated in Figure 6-1. SACREEE in this case would link up with its National Focal Institutions through MS Ministries/Departments of Energy in identifying actions and responsible MS organizations to implement the actions.

Projects are largely implemented at MS level hence the SADC Secretariat together with SACREEE have the responsibility to ensure that MS start developing their National Action Plans as soon as the REEESAP is approved to meet the RISDP target of starting implementation of REEESAP in MS by 2019.

The REEESAP Actions that are to be implemented at regional level will be led by the SADC Secretariat with support of its agencies such as SACREEE, SAPP and RERA. Coordination with MS will also be required in

relation to actions that will be implemented in more than 1 country e.g. training, collection of baseline data and adoption of policy frameworks.

6.3. Resource mobilization

The success of REEESAP implementation will depend on availability of resources, particularly financial resources. These will be required to domesticate the REEESAP by MS and also to implement actions at regional and MS level.

As mentioned before, the development of NAPs by each MS will be a priority of REEESAP. The SADC Secretariat and SACREEE can assist in mobilization of ICP financial and technical support for MS to develop their NAPs. Either ICPs can support MS bilaterally or SADC Secretariat can have a coordinated funding strategy using ICP support. Support can also be provided from MS to MS through bilateral exchanges of know-how and technologies. In any case, MS should demonstrate their commitment and ownership by making contribution to development of their NAPs.

There is a mixture of financing instruments/sources that can be used to fund the implementation of REESESAP; therefore, it will be important to match funding sources and strategies with specific REEESAP actions. Particularly, actions that entail developing enabling environment (policies, institutions, capacity building, information systems and planning) are amenable to ICP grant funding. For projects type actions, both public and private sector funding can be deployed. Public funding will be a combination of government budgets, ICP grants and loan. Private sources will play an increasingly important role in financing clean energy projects when the investment environment is more attractive, secure and mature.

There are also various sources of financing that can be obtained by project developers with facilitation of both SADC and MS by providing the necessary support such as guarantees and letters of support. The role of multilateral development banks is also central, particularly in project development, preparation and implementation. In addition to applying their own financing mechanisms, these institutions facilitate large-scale regional sustainable energy projects, by catalyzing public and private funds and mobilizing additional concessional and innovative finance. Another source of funding for these projects is carbon finance – using different frameworks such as the UNFCCC's Clean Development Mechanism, Voluntary Carbon Markets and the Global Climate Fund.

Both MS and SADC can also create special purpose investment funds particularly for small projects (currently without adequate access to financing, due to their inherent high transaction costs) involving both national and regional development banks. Some regional banks are already providing project development support, but these funds need to be better understood by the potential target beneficiaries besides being sustainable in the long-run.

Procurement procedures particularly for RE projects have been innovative in how government guarantees and private sector investments can be deployed to reduce final costs of energy production. A combination of competitive bidding for large RE projects (>5MW) and Feed in Tariffs for small RE projects have attracted private sector investments in SADC MS and should be explored where applicable in future REEESAP Project implementation.

Also worth mentioning is the use of procurement tools to establish new markets for new technologies, especially in the EE and access to energy sectors. Governments could lead the negotiation/dialogue between buyers and manufacturers of these types of equipment in order to introduce and accelerate their adoption by the end-users. These innovative procurement tools would improve the confidence of manufacturers to enter and adapt their technologies to the new markets.

In summary, the SADC Secretariat will have the responsibility to coordinate resource mobilization particularly for REEESAP actions that will be implemented at regional level but also assist MS in securing the resources they need to domesticate the REEESAP in their countries. The actual amounts of financial resources required to implement REEESAP at both regional and MS level will be determined on a case by case basis as the identified actions will need to be explored further and are expected to be different among MS.

7. Monitoring and Evaluation Framework

Energy sector information has been one of the main issues governing planning and strategy development at the national and regional levels in SADC. Unreliable energy data affects negatively the capacity of governments and the SADC Secretariat to make informed decisions on the upscale of RE, EE and access to energy. This section provides a framework for the monitoring and evaluation of REEESAP implementation.

The implementation of REEESAP will be monitored and evaluated through the use of a system of indicators for the strategy and milestones for the action plan.

7.1. Objectives of REEESAP M&E System

It is important to establish a robust monitoring and evaluation (M&E) system for REEESAP in order to monitor the implementation of the strategy and action plan at national and regional levels. The M&E will aid the SADC Secretariat or SACREEE to track progress towards the achievement of SADC's goals and objectives for the sector, and identify any deviation or bottlenecks associated with the implementation.

Such system would provide a framework for frequent review and update of REEESAP implementation, help inform national and regional development planning and decision making, support sector policy development and programme design, help establish trends over time, and encourage policy dialogue within the MS and with ICPs. It would also aid the reporting of results of the implementation of the SE4ALL targets set by each MS.

In this regard, the M&E system is designed with the following key objectives in mind:

- develop institutional arrangements (such as need for additional resources, specific capacity development) that can support sustainable monitoring and evaluation processes;
- selection of a specific set of indicators and milestones to track REEESAP activity implementation and progress towards the achievement of set goals and objectives:
  - the sector performance indicators will inform policy makers and constituencies on whether interventions in the sector are yielding the intended development results;
  - the implementation milestones will advise implementers on the progress of the Action Plan execution;
- building a robust data platform related to the SADC energy sector to assist decision makers to evaluate the status of the sector and to plan future interventions;
- defining standardized procedures for data collection to ensure data quality;
- suggesting evaluation activities for assessing the implementation of REEESAP.

REEESAP's M&E system is designed to fit SADC context and needs. It builds on current monitoring and evaluation exercises already in place in SADC. It also links to the SE4ALL Global Tracking Framework (GTF), which proposes a holistic approach for tracking progress on all three SE4ALL goals, hence ensuring the provision of the most accurate data possible.

7.2. Monitoring System

The M&E system developed for the REEESAP is designed to be applied in the SADC context and is developed with support from the SADC Secretariat. The SADC Secretariat will be the entity responsible for ensuring that the M&E plan is applied correctly and that all the involved entities and stakeholders provide the necessary information and data in a timely and proper manner.

7.2.1. Regional Performance Measurement Indicators

A list of indicators has been selected based on the RISDP, RIDMP and REASAP targets (see Section 3). These will be relevant to assess the status of RE, EE and access to energy in the region, however, some of them may not be easily accessible in each MS. There will be a need to train MS in the collection and reporting of the indicators to ensure quality and reliability of the figures reported to the SADC Secretariat.

The proposed logical framework provides a strategic overview of the REEESAP Strategy aimed at informing policy makers on whether interventions in the sector are yielding the intended development results. The sector performance indicators are presented in the form of a table (see Table 7-1) and provide information about the key components of the REEESAP implementation in a clear, concise and systemic way. It contains the proposed indicators in relation to the targets, along with sources of data, means of verification and assumptions for each indicator. Baseline information is required, from which progress will be measured. However, baseline indicators are currently not available for most of these indicators with the only known baseline indicator being the RE on-grid mix that was 24% in 2014 (REN21, 2015). The existing targets included in the RIDMP (2012) also require updating hence SADC and its MS can set targets to measure progress against or benchmark their performance with other regions.

Table 7-1 Sector Performance Indicators

Results	Indicators	Description	Definitions	Sources and Means of Verification
Increase the use of RE	Renewable Energy mix in the grid	The RE mix in the grid measures the percentage of RE installed capacity in the total installed capacity in the grid each year. This yearly metric is developed to assess the penetration of RE in the energy system.	RE installed capacity divided by the total installed capacity connected to the grid in a given year. RE installed capacity may be from a power plant using a renewable resource, including: hydro, wind, solar, biomass, biofuels, geothermal and ocean energy.	Ministries of Energy in each MS
	Ethanol fuels share of total gasoline consumption	The share of ethanol of the total gasoline consumption measures the quantity of ethanol consumed in the total gasoline consumption in each year. This yearly metric is developed to assess the use of ethanol in relation to the total gasoline consumption.	Quantity of ethanol consumed divided by the total quantity of gasoline consumed in a given year. Ethanol is defined by each MS.	Ministries of Energy in each MS
	Biodiesel fuels share of total diesel consumption	The share of biodiesel of the total diesel consumption measures the quantity of biodiesel consumed in the total diesel consumption in each year. This yearly metric is developed to assess the use of biodiesel in relation to the total diesel consumption.	Quantity of biodiesel consumed divided by the total quantity of diesel consumed in a given year. Biodiesel is defined by each MS.	Ministries of Energy in each MS
Promote Energy Efficiency	Energy efficiency savings achieved of grid use	The savings achieved through EE measures in relation to the baseline year. This indicator measures the reduction in energy use by EE measures	Capacity or generation avoided compared to expected on grid electricity demand	SAPP and Ministries of Energy in each MS

		implemented to reduce grid electricity consumption.		
	Efficient charcoal production share	The percentage of charcoal produced using efficient methods. This indicator measures the quantity of charcoal being produced using methods that increase the charcoal yield per unit of wood used.	Quantity of charcoal produced using efficient methods divided by the total charcoal production in a given year. Efficient charcoal production methods are defined by each MS	Ministries of Energy in each MS
	Energy Intensity	The energy intensity indicates the quantity of primary energy required to produce a unit of GDP.	Rate of total primary energy supply to gross domestic product (GDP) at purchasing power parity (PPP).	Ministries of Energy in each MS
Access to sustainable and modern energy services	Electricity access percentage (%)	The electricity access percentage measures the percentage of the population with access to electricity in SADC	Access to an electricity service in terms of households in a given year. The electricity services may be of any kind: traditional, renewable, on-grid, off-grid.	Ministries of Energy in each MS
	Cooking / heating efficient devices penetration	The penetration of efficient cooking/space heating devices measures the percentage of households that use a modern solution for cooking.	Percentage of the population that is using a modern solution for cooking/space heating purposes as the main cooking device. Modern cooking solutions are defined as per the SE4ALL GTF.	Ministries of Energy in each MS
	Solar Water Heaters (SWHs) penetration	The penetration of SWHs measures the percentage of households that use a modern solution for cooking.	Percentage of the population that is using SWHs as the main water heating device.	Ministries of Energy in each MS
	Percentage of households using LPG as primary fuel for cooking	The percentage of households using LPG measures the share of households that use LPG as the primary fuel for cooking.	Definition: Access to LPG for cooking as percentage of total households.	Responsible entity: Ministry of Petroleum Sources of information: PHC, GLSS, Rural LPG Promotion Programme report and National Petroleum Authority

Globally there is an effort to monitor some of these indicators in the context of SE4ALL Global Tracking Framework. Of interest in this case is the measurement of the energy access indicators for electricity and cooking through the Multitier approach of the Global Tracking framework (GTF).

In accordance with the GTF, these indicators can be broken down in several Tiers, to have a richer analysis that monitors not only the access/no access feature, but also other attributes of electricity and cooking services. This type of approach will help SADC MS understand the quality of these services that is being provided to the population in order to make improvements in the future country strategies related to energy access promotion and development.

The proposed multi-tier approach splits both the levels of access to electricity and clean cooking in five different Tiers as indicated in Appendix B. The tier approach is a more compressive way to qualify energy access but will not be easy to determine considering that not all data can be found from the MS government institutions. Therefore, the use of the GTF, although recommended, may require comprehensive studies and surveys in each MS to derive the necessary indicators.

7.2.2. Milestones of the Action Plan

A list of milestones has been selected to assess the implementation status of the Action Plan of REEESAP, as shown in Table 7-2. The proposed milestones aim to inform the institutions implementing the measures to keep track of the progress REEESAP Action Plan.

It is envisaged that MS and SADC Agencies will be monitoring and reporting on the implementation of the strategic Action Plans presented and there is assumption that reliable data for analysis and financial support shall be available to generate the information to produce the indicators.

Table 7-2 Milestones of the Action Plan

Action Plans for Strategic Intervention	Milestones
1 Strengthening of national and regional institutions	• An IGMOU on SACREEE signed by each MS • An independent regulator in each MS established • An IPP/PPP unit capable to deal with the energy sector in each MS established • RE/EE Associations and building councils in each MS and at SADC level established • Annual meeting held on RE/EE policy between COMESA, EAC and IOC
2 National framework creation	• Development or reformulation of national policies and strategies in line with REEESAP in the 15 MS • Up to date MS IRPs and a revised SAPP Pool Plan • A methodology and guidelines to calculate cost-reflective tariff are developed and adopted • MS on-grid and mini grid procurement frameworks and regional RERA framework completed • MS Policy frameworks on cooking, heating and/or cooling are developed in each MS
3 Regulation and standardization	• Grid codes are developed and reviewed at MS level • RERA develops standardized PPAs that are applicable to MS • MEPS and associated labels are adopted at regional level • Building codes are adopted in MS and at regional level
4 Attracting private sector participation	• A study on the applicability of IPP framework in each MS • A standardised IPP framework and model contracts are adopted • Established MS electrification plans and policies to guide private sector investments • A market assessment on RE/EE technologies and cooking, heating and cooling appliances in each MS
5 Capacity development	• A regional programme on Integrated Resource Planning and Master Plan development • A regional training programme on RE/EE technology development for the tertiary education • A capacity programme for project structuring and packaging for banks and MS • A capacity development programme on Energy Management
6 Financial intermediation	• A fund targeting RE/EE projects of <10MW and to package projects <20MW is created • A regional micro credit facility is created • A database on various financing facilities available in the region for RE/EE projects is available online
7 Projects, technology development and transfer	• Targets of MS are aligned with SADC 2030 targets for on grid, off-grid / mini grids

	• Project pipelines of MS and SAPP Pool Plan to meet set targets • National targets are adopted for clean cooking/heating and cooling at MS level
8 Information, advocacy and awareness	• A SADC knowledge hub on RE and EE is created • A regional campaign on RE and EE value and benefits (with a focus on women) is implemented • An online platform on financial facilities for customer-owned generation and EE is created and updated annually • A register of accredited providers of RE and EE services is created and updated annually • Training workshop for media practitioners in the SADC region
9 Cross sectoral /Nexus	• Annual SADC Energy and other relevant sector Meetings • Guidelines for the development of multi-purpose small hydropower projects at the regional level • Nationally Determined Contributions are approved in each MS • A regional study on the promotion of sustainable energy mix in cities facing rapid urban growth

7.3. Evaluation Plan

The evaluation process consists of annual reviews of the progress made through the activities conducted and performance achieved towards the targets and objectives that are set under REEESAP.

The evaluation will ensure a broad and representative perspective on the achievements and challenges in the implementation of REEESAP strategies and action plan, and will allow assessing the adequacy of the adopted strategy to meet the targets as planned and take any corrective action if needed. The evaluation should include the provision of recommendations for future monitoring periods and it is also intended to inform the stakeholders participating in the implementation of REEESAP for follow-up actions required to further strengthen the performance and strategic activities.

In general terms, the purpose of the evaluation activities is twofold:

- To contribute to improving REEESAP effectiveness and delivery towards SADC goals by 2030;
- To contribute to overall alignment of strategic activities of REEESAP and ensure that it remains relevant to addressing MS level objectives whilst also aligned to the SADC objectives.

During the annual REEESAP evaluation, the SADC Secretariat will review the results achieved in the current monitoring period in comparison to the baseline and the previous year progress on actions using the agreed indicators and milestones. It will also help identify the actions needed for the following year.

7.4. Reporting Plan

Using the results of the evaluation phase, the SADC Secretariat will report on an annual basis on the progress and performance towards the implementation of REEESAP. The yearly progress will be presented in a performance assessment report. This report must clearly show the baseline scenario and the progress made against the targets and milestones set.

Appendices

Appendix A. List of Stakeholders consulted in the visited MS

List of Stakeholders Consulted - Botswana

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BIUST	Academia	Professor	Tunde Oladiran[76]		
Dept of Energy	Government	Policy, Planning and Research	Mareledi Gina Maswabi		
Dept of Energy	Government	Renewable Energy	T Modise		
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[75] Also Chair of SIAB
[76] Also chair of Renewable Energy Association

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CEB	Government	General Manager	Mr	Ahmad Iqbal	Dreepaul	iqbal.dreepaul@ceb.intnet.mu
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EEMO - Energy Efficiency Management Office	Government	Technical Officer	Mr	J.V.L.	Agathe	
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Omnicane	Private Sector	Project Development Manager	Mr	Pierre	SAGNIER	psagnier@omnicane.com
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		Programme				
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Appendix B. **Global Tracking Framework to Measure Access to Energy**

Multitier matrix for access to household electricity supply as per the Global Tracking Framework 2015

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

Multilevel matrix for access to cooking solutions (Global Tracking Framework 2015)

			Level 0	Level 1	Level 2	Level 3	Level 4	Level 5
Attributes	1. Indoor air quality	$PM_{2.5}$ ($\mu g/m^3$)		[To be specified by a competent agency such as WHO based on health risks]	[To be specified by a competent agency such as WHO based on health risks]	[To be specified by a competent agency such as WHO based on health risks]	< 35 (WHO IT-1)	< 10 (WHO guideline)
		Carbon monoxide (mg/m^3)					< 7 (WHO guideline)	< 7 (WHO guideline)
	2. Cookstove efficiency (Not to be applied if cooking solution is also used for space heating)			Primary solution meets tier 1 efficiency requirements [to be specified by a competent agency consistent with local cooking conditions]	Primary solution meets tier 2 efficiency requirements [to be specified by a competent agency consistent with local cooking conditions]	Primary solution meets tier 3 efficiency requirements [to be specified by a competent agency consistent with local cooking conditions]	Primary solution meets tier 4 efficiency requirements [to be specified by a competent agency consistent with local cooking conditions]	
	3. Convenience: • Fuel acquisition and preparation time (hrs/wk) • Stove preparation time (minutes/meal)				< 7 < 15	< 3 < 10	< 1.5 < 5	< 0.5 < 2
	3. Safety of primary	IWA safety tiers			Primary solution meets (provisional) ISO Tier 2	Primary solution meets (provisional) ISO Tier 3	Primary solution meets (provisional) ISO Tier 4	
		or Past accidents (Burns and unintended fires)					No accidents over the past year that required professional medical attention	
	4. Affordability						Levelized cost of cooking solution (including cookstove and fuel) < 5 percent of household income	
	6. Quality of primary fuel: variations in heat rate due to fuel quality that affects ease of cooking						No major effect	
	7. Availability of primary fuel						Primary fuel is readily available for at least 80 percent of the year	Primary fuel is readily available throughout the year

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