TECHNICAL MARKET REVIEW

Country Profile: Zambia

CTCN

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Review of potential for implementation of energy efficiency policies and strategies for lighting, refrigerators, air-conditioning, motors and transformers

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1 EXECUTIVE SUMMARY

This report reviews the potential for increasing the energy efficiency of products in Zambia by providing a technical market assessment of current conditions and policies. Five specific product categories have been examined: lighting, air-conditioning, refrigerators, motors and transformers. Research conducted by DNV GL during 2017 provides context and insight in relation to the barriers and opportunities, along with a set of recommendations to support Zambia in achieving its sustainability goals.

Situation analysis

According to the World Bank, under one fifth of households (19%) in Zambia have access to electricity, with rural electrification as low at 3%, with electricity used primarily for lighting, biomass is readily available for other end uses. The adoption of energy efficient technologies beyond lighting has consequently been low in Zambia to date, where the focus in the residential sector is on first expanding access to electricity. Opportunities for adoption of efficient products has been limited due to a range of reasons that include high levels of poverty and cultural factors, particularly in rural areas. The design and construction of efficient buildings has been impacted by the limited existence and enforcement of regulations, as well as an informal property market.

Underlying process

DNV GL conducted an initial desktop analysis before sending out data requests and scheduling meetings with key local entities involved in the energy sector within Zambia. Local contacts included the Ministries of Education, Science, Vocational Training and Early Education, as well as Copperbelt Energy Corporation (CEC), Zambia Electricity Supply Company (ZESCO) and other local stakeholders, such as contractors, suppliers and installers of technologies. Meetings and interviews were conducted by DNV GL during visits to Zambia, along with follow-up communications conducted via email and phone. Key findings are highlighted below.

National Designated Entity (NDE) prioritisation

Based on the interviews conducted, power sector challenges, such as electrification and the urgent need of system maintenance, mean that energy efficiency is a lower priority for the National Designated Entities (NDEs) in Zambia. More pressing are such basic issues as expanding access to electricity and improving food, water and housing conditions. Considering these priorities, little attention has been paid to the collection and maintenance of the kind of detailed data of interest to this study. Those with the authority to respond to the study team's requests for information cooperated in seeking support and feedback from other government entities (e.g., revenue authorities, trade organizations, utilities, statistics bureau, etc.), with varying success in terms of timeliness, comprehensiveness and data quality. Nonetheless, the information obtained by the study team has been employed to the fullest extent possible in presenting a picture of the status of and opportunity for energy efficiency technologies in Zambia.

Market context

Due to high levels of poverty in Zambia and the Southern African region in general, the equipment markets are extremely price sensitive, with few consumers able to afford the first cost of equipment at all, let alone the incrementally higher cost of most energy efficient product options. Energy efficient products typically come at a higher initial cost and any additional costs have large impacts on short-term cashflows. The concept of lower operating and maintenance costs, which can result in fairly attractive payback rates, is not widely promoted nor relevant due to limited capital for investment.

Africa constitutes less than 5% of all global electricity consumption. While there is significant growth potential, the expansion of the regional power sector, electrification and appliance and equipment markets are hampered by the number of independent countries with their own policies, regulations and economies, and by persistently high levels of poverty across much of the region. Research shows that appliance and equipment manufacturers are, therefore, understandably cautious in spending time and resources to invest in producing and shipping high efficiency products to the African market, which impacts availability to specific countries. In the absence of regional standards or harmonized policies to encourage energy efficiency, lower efficiency and lower cost units tend to dominate the markets in countries like Zambia, where first cost is the market driver.

Energy Policies

The goals for the energy sector within the Sixth National Development Plan (2011-2015) included increasing capacity by 1,000 MW and improving electrification to 15% for rural areas and 40% nationally. There are also plans for the following:

- Implement the Rural Electrification Master Plan (REMP)
- Build capacity in the engineering sector for energy efficiency
- Develop an Energy Efficiency Plan
- further develop the environmental technology industry in the country, with an incentive framework.

The Japanese government funded part of the National Energy Strategy (NES) (2009-2030) and the Rural Electrification Master Plan (REMP), which among other things, set targets for energy mixes of rural electrification that included grid extensions, mini grids, hydro and interconnections to the Southern Africa Power Pool (SAPP).

The Energy Regulatory Board of Zambia (ERB) was established to regulate the provision of energy services to the consumers, while implementation of the is driven by the REMP. Both are playing an important role in Zambia's energy sector.

Despite great enthusiasm and vigour in the energy sector, the government often focuses on fulfilling more basic needs of the population and improving the quality and availability of power in the energy sector. Departments responsible for trade, energy and economic indicators do not appear to devote resources to the capture and maintenance of detailed data on electric equipment at more than highly aggregated levels.

Summary of Market Assessment Results

Despite the limitations and context that it faces, Zambia has much to gain by adopting energy efficiency standards, regulations and technologies to ensure that, as it expands access to electricity, usage can be guided to be as efficient and affordable as possible. Ideally, such regulations and market levers would be harmonized with that of the larger Southern African region so as to have maximum impact on the technology market. The market research, data collection and analysis conducted by DNV GL during this study has been able to provide insight into the five product categories of primary energy-consuming appliances and equipment covered (lighting, air-conditioning, refrigerators, motors and transformers).

The projected energy savings for Zambia, when moving from the current state of technologies to Minimum Energy Performance Standards (MEPS) or to the Best Available Technologies (BAT) are shown in Table 1 and Figure 1 below. More detail on the underlying approach used to arrive at these can be found in the sections of the report related to each of the individual product categories. Section 2.6 presents more detail as to the assumptions used in the modelling process.

The overall savings potentially yielded by the adoption of MEPS are expected to increase from just under 1 000 GWh (2.9 t CO_2) per annum in 2025 to almost 2 000 GWh (6.0 t CO_2) per annum in 2030. BAT projected savings for 2025 is expected to be just under 1 700 GWh (5.0 t CO_2) per annum while savings yielded in 2030 are projected to be almost 4 000 GWh (11.7 t CO_2).

Table 1.1 Projected MEPS and BAT savings for Zambia.

	GWh savings (2025)	**GWh savings (2030)**	**MUSD savings (2025)**	**MUSD savings (2030)**	**GHG savings (2025)**	**GHG savings (2030)**
DNV GL Projected MEPS						
Lights	589.8	914.5	26.6	66.3	1.8	2.7
Aircon	12.3	37.8	1.3	6.5	0.0	0.1
Refrigeration	91.5	265.3	4.1	19.2	0.3	0.8
Motors	172.3	525.3	18.5	90.7	0.5	1.6
Transformers	101.1	240.8	10.8	41.6	0.3	0.7
Total	**967.0**	**1 983.7**	**61.3**	**224.3**	**2.9**	**6.0**
DNV GL Projected BAT						
Lights	1 042.2	1 629.4	46.9	118.1	3.1	4.9
Aircon	23.8	89.4	2.5	15.4	0.1	0.3
Refrigeration	126.6	335.3	5.7	24.3	0.4	1.0
Motors	267.1	1 169.1	28.6	201.8	0.8	3.5
Transformers	203.7	666.4	21.8	115.0	0.6	2.0
Total	**1 663.4**	**3 889.6**	**105.6**	**474.7**	**5.0**	**11.7**
U4E Targets						
Lights	597.9	701.6	12.6	14.7	2.0	2.3
Aircon	63.8	143.9	1.3	3.0	0.2	0.5
Refrigeration	121.8	288.0	2.6	6.0	0.4	1.0
Motors	174.1	402.3	8.7	20.1	0.6	1.3
Transformers	118.7	246.7	2.5	5.2	0.4	0.7
Total	**1 076.3**	**1 782.5**	**27.7**	**49.0**	**3.5**	**5.8**

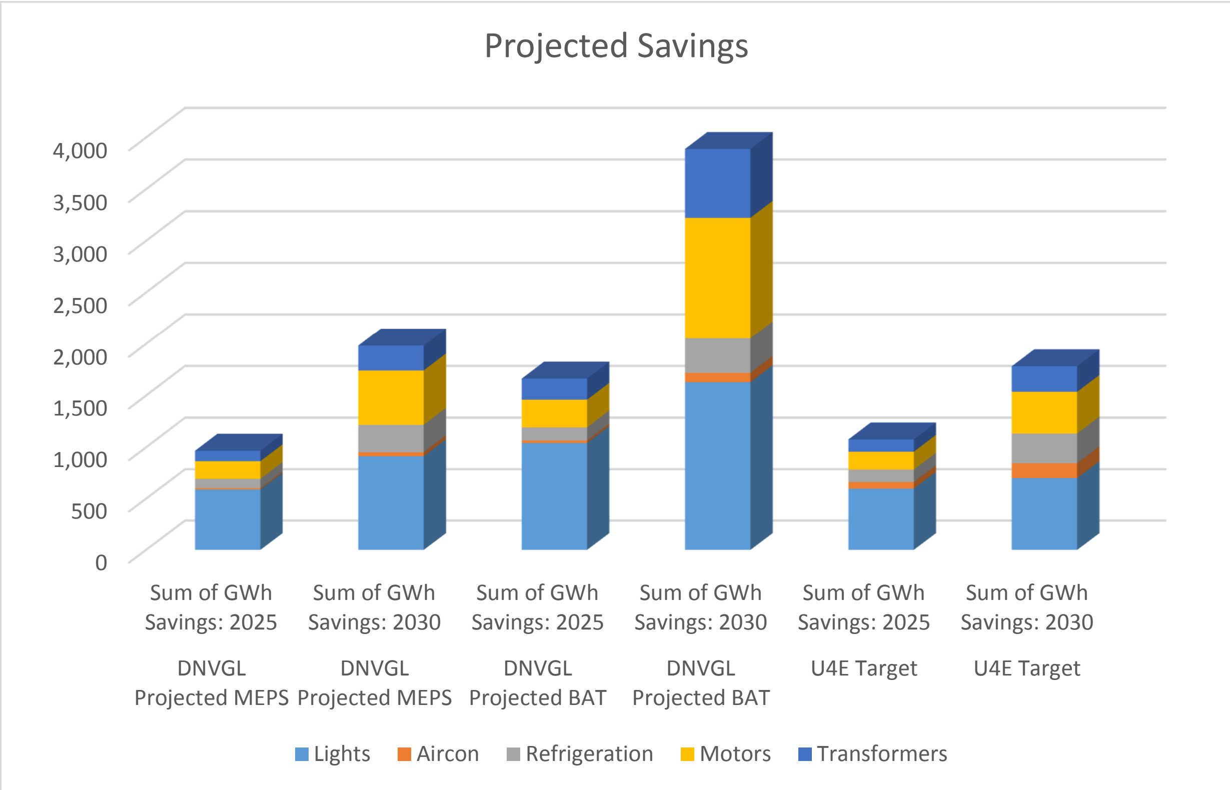

Figure 1-1 Projected annual energy savings for Zambia.

2 INTRODUCTION

2.1 General Information about Zambia

Zambia is a landlocked country bordered along Zimbabwe in the south divided by Victoria Falls, Congo DR to the north, Tanzania to the northeast, Malawi to the east and Mozambique to the southeast. Lusaka is the capital.

Size (km^2)	752,614
Population (Est, 2017)[1]	13,459,000

Zambia is a member of the United Nations, the Commonwealth of Nations and the Southern African Development Community (SADC).

54.4% of the population survives on less than the national poverty line [1]. Based on 2010 statistics, the international poverty line is US$1.90 a day. In 2016, the World Bank classified Zambia as a "lower-middle income" country because the annual gross national income (GNI) per capita levels is USD 1,046 to USD 4,125.

[2] [1] [3] [4] [5] [6] [7] [8] [9]

2.2 Climate and Topography

Zambia has a tropical climate, modified by the altitude of the country. Zambia has three distinct seasons, the hot, dry season runs from September to October, when temperatures range from 27 to 32 °C. The warm wet season is from November to April, while the cool dry season runs from May to August, when temperatures range from 16 to 27 °C. The maximum heat is experienced during November, while the maximum rainfall is received during December. Average annual rainfall is between 508 and 1,270mm, There are areas of semi-arid steppes along the Zambezi valley. more than 700 mm in the Southern parts, while more than 1,100 mm in the northern parts. Lake Kariba is one of the largest man-made lakes in the world and stretches along the Southern border of the province.

Northern Zambia is flat and has broad plains. The Barotse Floodplain is the most notable area, but floods from December to June, dominating the environment and inhabitants' lives. The plateau in Eastern Zambia rises from 900m to 1,200m, then reaches 1,800 m in the north. The northern plateaus are part of the Central Zambezian Miombo woodlands ecoregion. Eastern Zambia is diverse. The plateau is split by the Luangwa Valley, with hills and mountains located by the side of some sections. The area is home to the highest point in Zambia, Kongera (2.187m). In the watershed between the Congo and Zambezi basins are the Muchinga Mountains. The Luapula River, coming from the Congo River, is part of the border with the Democratic Republic of the Congo. It eventually enters Lake Mweru. The Kalungwishi River is the lake's other main tributary. The Congo basin's other major feature is Lake Tanganyika. It receives water from the Kalambo River, which is part of the border with Tanzania. The Kalambo falls are part of this river and are the second highest uninterrupted waterfalls in Africa.

[2] [1] [3] [4] [5] [6] [7] [8] [9]

2.3 Electricity Sector

The major fuel source of energy used in Zambia is wood, which is mainly consumed by households, with only 28% of the population having access to electricity and 11 million people without access to electricity in 2014 [10]. Electricity, petroleum and coal are mainly used in commerce and industry. The country's electricity is predominantly supplied by the national public utility, Zambia Electricity Supply Corporation (ZESCO). An estimated 6% share of the generation is supplied by Lunsemfwa Hydro Power Company, an independent power producer and Copperbelt Energy Cooperation, Zambia's independent transmission company. As per the IRENA document titled Southern Africa Power Pool: Planning and Prospects for Renewable Energy, 58% of consumed energy was imported. By 2030 this may drop to around 30%.

The Government of the Republic of Zambia (GRZ) identified the need to electrify rural areas to enhance development. Due to the challenges of electrifying rural areas, GRZ established the Rural Electrification Authority (REA) and the Rural Electrification Fund (REF) through the Rural Electrification Act No. 20 of 2003. During the period 2006 to 2015, a total of 3,524 households, comprising 2,803 households at schools, 358 at Rural Health Centers (RHC's), 42 at Chief Palaces and 321 at other public facilities were electrified. Further, 3,853 private households, comprising 813 households under the intensification programme in Chavuma, Mwansabombwe and Luangeni Projects, 430 households under the Mpanta Solar Mini-grid Projects as well as 2,610 households under the World Bank Increased Access to Electricity (IAES) Project were electrified. Amid these electrification schemes, rural electricity access rates are very low, with 4.4% for grid and 7.4% for solar. [9]

Zambia is known for ZESCO's major hydro facilities on the Zambezi River near the Victoria Falls. In 2016 the Electricity Supply Industry (ESI) in Zambia was dominated by hydro generation, which accounted for 94.1% of national installed capacity in 2015 and the balance of 5.9 percent was from diesel, HFO, and Solar Photovoltaic (PV) generation plants. The reliance on hydropower causes problems during times of drought and volatile water flow. Backup generation is usually from fuel-based sources which can prove prohibitively expensive. Zambia has abundant renewable and non-renewable energy resources, including industrial minerals such as coal, agricultural land to support biofuels, ample forest for biomass, abundant wind for wind energy, and long and intense hours of annual sunlight to support solar energy generation.

[11] [12] [10] [13] [14] [15] [16] [17] [18] [19] [20] [10] [21]

2.4 Power Industry Regulation

The Power Sector Regulatory environment is displayed below:

Organizations responsible for energy policies	Ministry of Energy and Water Development (MEWD)
Energy Regulator	Energy Regulatory Board of Zambia (ERB)

Energy policy publications

- Energy Regulation Act of 1995 (amended 2003)
- Rural Electrification Act 2003
- Draft Zambian Grid Code 2006
- The National Energy Policy (NEP) of 1994, revised in 2008
- Sixth National Development Plan (2011 – 2015)
- Rural Electrification Master Plan (REMP)
- National Energy Strategy (NES) (2009 – 2030)
- Power Rehabilitation Programme (PRP)

Main entities in the electricity market

- Zambian Electric Supply Corporation (ZESCO) Limited
- Copperbelt Energy Corporation (CEC)
- Lunsemfwa Hydro Power Company Limited (LHPC)

[11] [12] [10] [13] [14] [15] [16] [17] [18] [19] [20] [10] [21]

2.5 Global Partnerships and Energy Advancement Initiatives

Zambia joined various associations and global initiatives to promote and reduce barriers to the uptake of renewable energy. The country agreed to be part of the Renewable Readiness Assessment (RRA) roll-out project supported by the International Renewable Energy Agency (IRENA). The country is part of Power Africa's Beyond the Grid Initiative, launched in 2014 focused on unlocking investment and growth for off-grid and small-scale energy solutions on the African continent. [10]

Zambia is also a member of the Southern African Power Pool (SAPP), which began in 1996 as the first formal international power pool in Africa with a mission to provide reliable and economical electricity supply to consumers in SAPP member countries. ZESCO Limited acts as the operating SAPP member for Zambia.

To facilitate the development of a competitive electricity market in the Southern African Development Community (SADC), SAPP has the following main objectives:

- Provide a forum for the development of a world-class, robust, safe, efficient, reliable and stable interconnected electrical system in the southern African region.
- Coordinate and enforce common regional standards of quality of supply; measurement and monitoring of system performance.
- Harmonize relationships among member utilities.
- Facilitate the development of regional expertise through training programmes and research.

- Increase power accessibility in rural communities.
- Implement strategies in support of sustainable development priorities.

SAPP is governed by the following four agreements, to ensure fulfillment of their mission and objectives set out:

- Inter-Governmental Memorandum of Understanding which enabled the establishment of SAPP;
- Inter-Utility Memorandum of Understanding, which established SAPP’s basic management and operating principles;
- Agreement Between Operating Members which established the specific rules of operation and pricing; and
- Operating Guidelines, which provide standards and operating guidelines.

[10] [14] [22] [23]

Table 1 provides a summary of major energy efficiency and demand-side management (DSM) activities in Zambia.

Table 1: Energy efficiency and demand-side management (DSM) activities in Zambia

PROGRAMME TYPE	CFL EXCHANGE	ENERGY-SAVING AWARENESS	DEMAND MARKET PARTICIPATION	TIME-OF-USE TARIFF	HOT WATER LOAD CONTROL	SOLAR WATER HEATING	ENERGY EFFICIENCY IN BUILDINGS	ENERGY EFFICIENCY AUDITS	PREPAID METERS	GENERAL REHABILITATION	TRANSMISSION LINE UPGRADE	POWER FACTOR CORRECTION	DISTRIBUTION LOSS REDUCTION	STANDARDS AND PRODUCT LABELLING
Zambia	X	X		X		X		X	X	X	X	X	X	X

Note: The “X” indicates the presence of the listed policy type in the country.

Table 2 below provides some specific supplemental energy efficiency target programs in Zambia. Because most targets are qualitative rather than quantitative, the table is simply an indication of whether a particular policy target has been, or soon will be, implemented.

Table 2: The National Energy Efficiency Targeted Programs [19]

TARGET TYPE	LIGHTING RETROFIT	REDUCE ELECTRICITY DISTRIBUTION LOSSES	IMPROVED COOKING DEVICES	LOAD MANAGEMENT	STANDARDS AND LABELLING	FINANCING	REVISED BUILDING CODES
Zambia	X		X				

Note: The “X” indicates the presence of the listed policy type in the country.

Table 4 summarises the current energy efficiency support policies in Zambia, as reported in 2016.

Table 4: Policies initiated by 2016 [20]

POLICY TYPE	INDUSTRIAL COMMERCIAL LOAD REDUCTION	RESIDENTIAL INCENTIVES (LIGHTING, HOT WATER	SUPPORT FOR EFFICIENT COOKING AND HEATING	BUILDING EFFICIENCY GUIDELINES	SOLAR WATER HEATER SUBSIDIES	MANDATORY ENERGY MANAGEMENT FOR INDUSTRY AND	REDUCED DISTRIBUTION LOSSES	TRANSPORT EFFICIENCY STANDARDS	BIOFUELS PRODUCTION INCENTIVES/ TAX	VOLUNTARY BUSINESS ENERGY EFFICIENCY
Zambia			X							

Note: The "X" indicates the presence of the listed policy type in the country.

Demand Side Management is a systematic evaluation of energy utilization by matching the available energy to the desired production for use in industrial and public buildings with a view to identifying existing energy conservation opportunities. The Demand Side Management Program being undertaken by ZESCO is an initiative of the Ministry of Energy and Water Development and the World Bank ESMAP programme in collaboration with ZESCO Limited.

In mitigating power deficit ZESCO and SAPP embarked on EE Projects and DSM:

- Energy Saver Lamp distribution (utility driven)
- Solar Water Heater Project
- Hot Water Load control (Ripple Control)
- Commercial Lighting
- Prepaid meter Installation
- Investments in RES (Solar, Small hydro, Wind Farms)

[10] [14] [22]

Error! Reference source not found.5 below indicates Zambia's targeted GWh savings per product type by 2030, assuming a successful implementation of the various Energy Efficiency strategies.

Table 5: Committed targets for energy savings [22]

U4E PATHWAY TO ENERGY EFFICIENCY	TARGETED ANNUAL GWh SAVINGS BY 2030				
	LIGHTING	RESIDENTIAL REGRIGERATORSS	ROOM AIR-CONDITIONERS	INDUSTRIAL ELECTRIC MOTORS	TRANSFORMERS
Zambia	701.6	288.0	143.9	402.3	246.7

(Extracted from the U44E Country Assessment, December 2016)

2.6 Renewable Energy Projects in Zambia

In 2015 a Renewable Energy Feed-in Tariff (REFiT) strategy was developed and in 2016 Zambia held their first renewable energy tender for a total of 100 MW and set a record-low bid price for Africa at USD 0.06 per kWh under a 25-year PPA. [10]

Table 3 summarises the current renewable energy support policies in Zambia, as reported in 2016.

Table 3: Renewable Energy Support Policies initiated by 2016 [10]

POLICY TYPE	RENEWABLE ENERGY TARGETS	FEED-IN TARRIF / PREMIUM PAYMENT	ELECTRIC UTILITY QUOTA OBLIGATION	NET METERING / NET BILLING	TRANSPORT OBLIGATION / MANDATE	HEAT OBLIGATION / MANDATE	TRADING REC	TENDERING
Zambia	○	○			○			○

Note: The "EXISTING NATIONAL (could also include subnational)" indicates the presence of the listed policy type in the country.

Other renewable energy (RE) projects and developments includes:

1. Powerlink Zambia: Installation & operation of mini hybrid wind and solar systems in rural Zambia
2. Project Mulilo - LPG Distribution: Broad-based marketing and distribution platform for flare gas as a viable cooking fuel in Zambia's urban centres. Project Mulilo will bring about a revolutionary change in cooking practices in Zambia, where 97% of rural households and 57% of urban households currently cook using charcoal.
3. Biodiesel Plant: Set up a 50, 000 tonnes/day biodiesel processing plant in Lusaka.

[23] [24]

2.7 Key Challenges

Zambia has low electrification rates and is facing an electricity supply deficit. This position of electrification poses a threat to increased penetration of target appliances. For a large part of the population their need for or interest in these appliances, energy efficient or not, will not matter until electrification is expanded, especially with low private sector participation in rural electrification projects, where the main electrification challenge lies.

Other key challenges in adoption of efficient appliances in Zambia include:

- Aging infrastructure and water flow issues have hampered the provision of electricity and have led to load shedding;
- Underinvestment in generation and transmission infrastructure has led to a deterioration in the power network and tariffs are poorly structured impacting continued underinvestment and deterioration of the Power Sector. Transmission and distribution infrastructure upgrades are required, so Zambia is involved in two regional transmission projects; and inadequate funding to the REF (Rural Electrification Fund) also poses a challenge to rural electrification. SACREE (SADC

Centre for Renewable Energy and Energy Efficiency) as per details in Appendix A, works towards addressing SADC country challenges with regards to renewable energy and energy efficiency.

Table 7 sets out fiscal incentives and public financing initiatives. Funding sources available to the SADC countries for energy efficiency initiatives are listed in Appendix B.

Table 4: Renewable Fiscal Incentives and Public Financing initiated by 2016 [10]

POLICY TYPE	CAPITAL SUBSIDY, GRANT, OR REBATES	INVESTMENT OR PRODUCTION TAX CREDITS	REDUCTIONS IN SALES, ENERGY, VAT OR OTHER TAXES	ENERGY PRODUCTION PAYMENT	PUBLIC INVESTMENT, LOANS OR GRANTS
Zambia	○		○	○	○

Note: The ☐ "EXISTING NATIONAL (could also include subnational indicates the presence of the listed policy type in the country.

[10] [23]

2.8 Modelling Scenarios

The projection of savings estimates was calculated using three scenarios, each of which is entirely feasible.

1. The "Business as Usual (BAU)" scenario assumes that the current adoption rate of energy efficient technologies continues the same trend due to the normal rate of rising costs of electricity and increased public awareness.

   The information gathered during the country visits indicated an adoption of efficient technologies (MEPS & BAT) reducing less efficient products (below MEPS) by a specific percentage of the current market share by 2025 and 2030.

2. If "Minimum Energy Performance Standards (MEPS)" are to be implemented by means of regulations or incentives, an increased adoption of both the MEPS and BATS will take place. Current stock in the market is assumed to be sold, but no new stock of lower standard technologies will be allowed into the market. Currently, installed units are expected to last their normal operating lifetime, after which they will be replaced by MEPS or BAT.

3. Best Available Technology (BAT) implementation assumes that all implementation of new lighting is driven towards BAT standards while allowing MEPS and disallowing new sub-MEPS installation and sales.

<u>All Scenarios</u>

For all of the scenarios, an average increase in the electrification per year was used. These are long-term averages as provided by the electric utilities and conservative interpretations made by DNV GL.

Increases of the quantities of units were used in direct correlation with the assumed increase in electrification. Projected increases and decreases in adoption rates were derived from the country visits, averaged and rounded.

The information gathered during the country visits included the expected adoption of efficient technologies (MEPS & BAT) reducing less efficient products (below MEPS) by specific percentages of the current market share by 2025 and 2030. The resultant quantity of lights and market shares are shown in the following sections.

3 LIGHTING

According to the Zambian Energy Regulation Board (Annual Report, 2015), the Zambian Government announced a ban on local manufacturing and importation of incandescent bulbs and inefficient lighting devices in Zambia. The ban would be implemented gradually starting with the importation of such products effective January 2016. The ban on the sale of incandescent bulbs would be effective June 2016, and it was envisaged that their use would be completely phased out by December 2016. Therefore, even though incandescent bulbs are still found, lighting in Zambia is predominantly from CFL and Fluorescent (FL) sources, as illustrated in Figure 2.

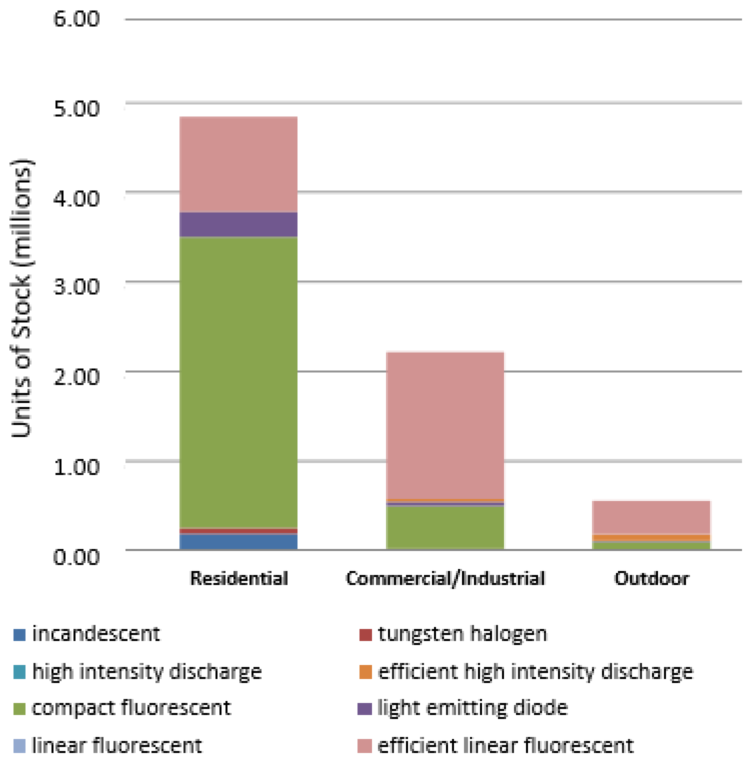

Figure 3-1: Sources of light in Zambia

Data relating to the main type of energy used for lighting by households was also collected in the 2015 Living Conditions Monitoring Survey.

Table 5 shows the percentage distribution of households by the main type of lighting energy by Residence, stratum and province. Electricity is used for lighting by 31.2 percent of households, although this covers both grid and off-grid (battery, solar PV) sources, as overall electrification rate is reported as only 18.8% (previously cited). [1]

Analysis by Residence shows that in rural areas torch was the most commonly used source of lighting energy at 70.6 percent, followed by a solar panel at 7.4 percent. In urban areas, the most commonly used source of lighting energy was Electricity 67.6 percent, followed by a candle at 16.3 percent.

[1] World Bank states that 18.8% national electrification rate, this survey suggests 31.2 percent. We've found that the locals often see batteries, solar panels and stand-alone generators as "electricity" even though this is not grid connected

In Eastern Province, a torch was the most commonly used source of lighting energy at 73.1 percent while electricity was the most commonly used in Lusaka Province at 70.9 percent.

Table 5: Percentage Distribution of Households by main type of lighting energy by residence, Stratum and Province, Zambia, 2015

Residence/ Stratum/ Province	Type of lighting energy									Not stated	Total	Total number of households
	Kerosene/ paraffin	Electricity	Solar panel	Candle	Diesel	Open fire	Torch	None	Other			
Total Zambia	**1.3**	**31.2**	**4.6**	**10.6**	**0.2**	**2.5**	**45.7**	**1.6**	**2.3**	**0.0**	**100**	**3,014,965**
Residence												
Rural	1.6	3.7	7.4	6.2	0.3	4.3	70.6	2.4	3.4	0.0	100	1,718,060
Urban	0.8	67.6	0.8	16.3	0.1	0.2	12.8	0.4	0.9	0.0	100	1,296,905
Stratum												
Small Scale	1.7	1.8	7.1	5.9	0.2	4.5	72.8	2.6	3.5	0.0	100	1,542,587
Medium Scale	0.5	4.2	18.2	3.0	0.4	1.2	70.5	0.0	1.9	0.0	100	56,974
Large Scale	3.5	20.0	23.0	5.2	0.0	0.0	47.3	0.0	0.8	0.3	100	2,807
Non-Agriculture	1.4	27.9	6.1	12.3	1.7	3.1	42.7	2.0	2.7	0.1	100	115,692
Low Cost	1.0	60.8	0.9	20.2	0.1	0.2	15.2	0.5	1.0	0.0	100	996,975
Medium Cost	0.2	88.8	0.7	4.5	0.1	0.0	5.4	0.1	0.2	0.0	100	166,580
High Cost	0.3	92.1	0.5	2.7	0.0	0.2	4.0	0.0	0.2	0.0	100	133,350
Province												
Central	2.5	18.4	6.2	8.4	1.0	1.9	58.9	1.1	1.7	0.0	100	292,049
Copperbelt	0.8	58.1	1.0	18.8	0.1	0.2	19.5	0.4	1.1	0.0	100	450,843
Eastern	0.6	6.9	9.6	3.8	0.0	2.7	73.1	2.8	0.5	0.0	100	342,161
Luapula	3.3	6.3	4.2	9.4	0.0	2.8	61.8	1.9	10.3	0.0	100	207,612
Lusaka	1.1	70.9	1.2	14.7	0.2	0.0	10.5	0.6	0.8	0.0	100	592,073
Muchinga	0.4	16.4	7.9	8.2	0.2	2.9	60.2	0.6	3.2	0.0	100	174,832
Northern	3.9	8.3	5.5	8.5	0.2	2.6	68.3	0.4	2.2	0.0	100	253,779
North Western	0.4	14.4	4.1	7.3	0.2	6.7	53.6	4.4	9.1	0.0	100	164,141
Southern	0.1	24.6	5.9	6.9	0.2	1.6	59.3	0.8	0.5	0.0	100	338,259
Western	0.5	6.0	6.2	9.3	0.0	13.0	56.3	6.5	2.1	0.2	100	199,215

Figure 3-2 shows national percentage distribution of households by the main type of lighting energy 2010/2015. The results show that there was an increase in the percentage of households who used electricity (2010-21.6 percent, 2015-31.2 percent) and torch (2010-11 percent, 2015-46.7 percent) as the main source of lighting energy. There was a decline in the use of kerosene/paraffin (2010-27.2 percent, 2015-1.3 percent) and candle (2010-26 percent, 2015-10.6 percent).

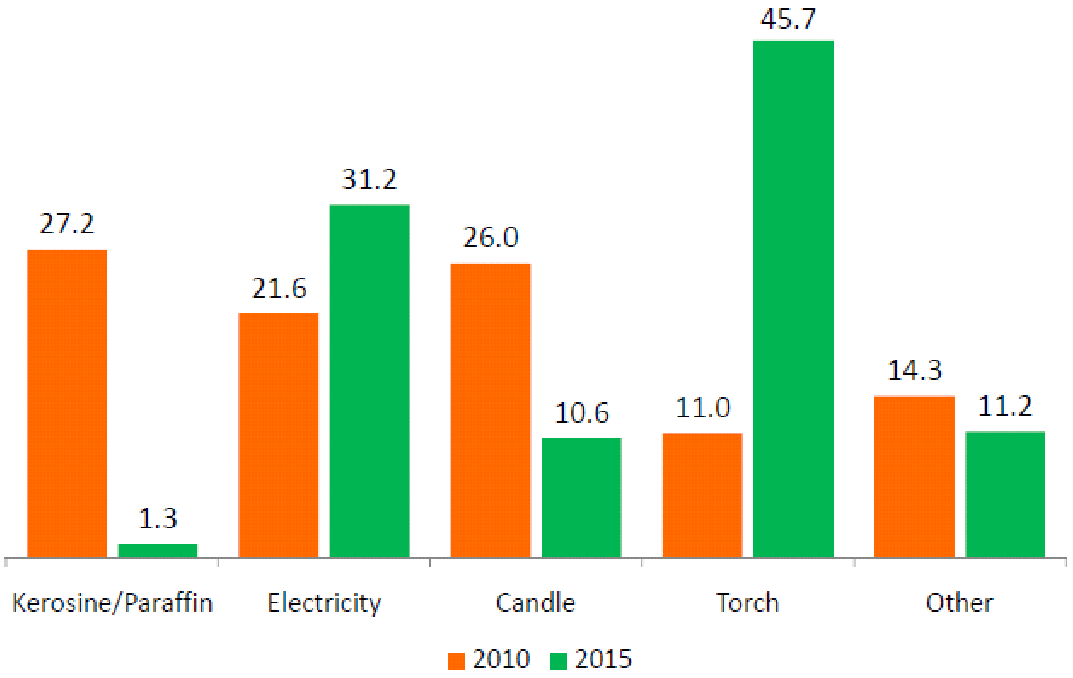

Figure 3-2: National Percentage Distribution of Households by man type of lighting energy, Zambia, 2010 and 2015

A 2015 survey by CTCN for this project shows 31% penetration of households that have all types of lighting with 8-10 lights per household. Regarding high-efficiency lighting, 49% of them are CFLs, 1% LED while the rest 50% incandescent lamps. The total number of CFL does not exceed 4.5 million in the country.

3.1 Status and Trends of Lighting Products

3.1.1 Market Drivers

Lights have a relatively short life expectancy compared to other electrical equipment considered in this project.

Average Rated Lifetime Hours					
	INCANDESCENT	FLUORESCENT	CFL	HALOGEN	LED
TYPICAL RANGE (HOURS)	750-2,000	24,000-36,000	8,000-20,000	2,000-4,000	35,000-50,000

Figure 3-3: Life Expectancy of Lights

Source: https://www.thelightbulb.co.uk/resources/light_bulb_average_rated_life_time_hours/

Short life expectancies lead to high replacement frequencies, which provide opportunities to change to newer, more efficient technologies within lighting. The small size of individual units, adoption of new technologies and the sheer volume of sales continually drive down the costs of both old and new types of lights.

Offices, factories and other operations that require light during daytime (Mon – Fri, 07h00 – 19h00) would have lights on for roughly 3000 hours per annum. In Zambia, residential lights are often on for 4 hours in the evening and two hours in the morning all year round, totalling 2190 hours per annum.

3.1.2 Local manufacturers, suppliers, retailers and other stakeholders

Local lighting suppliers in Zambia include Electrical Maintenance Luska Ltd., Kcm, Ketrom, Mach Innovations, Omerfem General Dealers, Sakama-foundy-metals and Pioneer Power Techniques. [25]

Residential lighting products are mostly purchased by households and small businesses from retail outlets, including Shoprite, General Supermarkets, Game, and OK Furniture. Most popular brands include Phillips, OSRAM and EUROlux. Also in the survey, it is mentioned that 60% of the products represent unknown brands while 40% are established brands.

3.1.3 Import/Export

Most household appliances in the SADC region are either manufactured in, or distributed by, South African companies. Although the South African presence in this market has been mitigated somewhat by aggressive importing of cheaper appliances from China and South Korea, there is a tendency to enforce the South African standards of labelling for importers and exporters. Table 6 shows a comprehensive summary of imports and exports of lighting products in the period between 2012 and 2016.

Table 6: Imports/Exports of Lighting Products Summary

Row Labels		Export	Import	Net
2012		9 777	2 287 947	2 278 170
2013		35 915	2 330 436	2 294 521
2014		26 402	2 982 985	2 956 583
2015		46 236	2 048 389	2 002 153
2016		9 777	2 287 947	2 278 170

Figure 3-4 presents a summary of imports and exports for the years 2012-2016. There is a clear indication that Zambia is mainly an importer of lighting products while some of the suppliers also export. The ratio between exports and imports, of course, is negligible. Also, there seems to be an increase in importing of lighting products over the past 2 years.

Figure 3-4: Summary of imports/exports for 2012-2016 [26]

3.1.4 Barriers to overcome [27]

Cost

Due to the low average income per household, consumers are very sensitive to costs. The typical consumer unlikely to be able to afford or justify the additional short-term expenses to gain energy efficiency, even with long-term cost savings.

Education

During the country visits, it became apparent that consumers are not aware of environmental and cost impacts of buying low efficiency products.

Import duty & tax

There is no reduction or waiving of import duty or taxes on energy efficient lights (CFL or LED). This is likely to protect the local manufacturing market. The result is that buyers are paying a premium for energy efficient products.

Emergency lighting

LEDs are often only seen as emergency lighting solutions, rather than energy saving solutions. In this case, the LED would come paired with a battery as stand-alone unit, rather than to replace inefficient lights in fixtures.

3.1.5 New vs. Used equipment

Lights are mostly replaced on burn-out and with life expectancies of around 2 years on average there is practically no market for used equipment. One scenario where lights are re-used is when lights are replaced for energy savings reasons and the old lights are donated to organizations that rely on public funding or charities such as hospitals, schools or libraries.

3.2 Potential Savings from Energy-Efficient Lighting

For a simple savings calculation, lights have been grouped into three categories:

1. All lights except: Fluorescent (FL), Compact Fluorescent (CFL) & LEDs
2. Fluorescent (FL) & Compact Fluorescent (CFL)
3. LEDs.

3.2.1 Benefits of Energy Efficiency – 3 Scenarios

For the Business-As-Usual (BAU), Minimum Energy Performance Standards (MEPS) and Best Available Technologies (BAT) cases, the starting quantities are the same and indicates the current estimate of quantities installed. The percentages indicate the rates of increase or decrease of the technologies during BAU, if MEPS are enforced or if BAT is pursued.

Table 3.7 BAU, MEPS, BAT scenarios for lighting.

Scenario	Description	QTY (2017)	QTY (2020)	Tech. Adopt (2025)	QTY (2025)	Tech. Adopt (2030)	QTY (2030)
Business as Usual	QTY Halo, Inc etc.	5 805 104	7 544 313	-10%	13 073 337	-20%	20 137 275
Business as Usual	QTY CFL & FL	3 361 776	4 368 964	14%	9 609 749	13%	20 837 617
Business as Usual	QTY LED	1 018 720	1 323 929	10%	2 804 023	50%	8 098 360
DNV GL Projected MEPS	QTY Halo, Inc etc.	5 805 104	7 544 313	-50%	7 262 965	-20%	11 187 375
DNV GL Projected MEPS	QTY CFL & FL	3 361 776	4 368 964	80%	15 165 210	-1%	29 051 303
DNV GL Projected MEPS	QTY LED	1 018 720	1 323 929	20%	3 058 935	50%	8 834 577
DNV GL Projected BAT	QTY Halo, Inc etc.	5 805 104	7 544 313	-80%	2 905 186	-20%	4 474 950
DNV GL Projected BAT	QTY CFL & FL	3 361 776	4 368 964	123%	18 758 256	-7%	33 555 085
DNV GL Projected BAT	QTY LED	1 018 720	1 323 929	50%	3 823 668	50%	11 043 219

Data & Assumptions:

- *Exchange Rate: 1 ZMK = 1.2 ZAR = 0.096 USD*
- *Average Residential marginal Electricity Tariff: 0.021 USD/kWh*
- *Average Industrial marginal Electricity Tariff: 0.050 USD/kWh*
- *Electricity Cost Increase: 10% per annum.*
- *Operating hours: 2 hr in morning (6-8am) and 4hr in the evening (6-10pm), 365 days per annum*

Assuming these adoption rates are accurate, the following savings are projected under the MEPS and BAT scenarios, under Table 3.3. The U4E targets are also shown as benchmarks.

Table 3.8 Projected savings for lighting under MEPS And BAT scenarios.

	Sum of GWh Savings (2025)	Sum of GWh Savings (2030)	Sum of Million USD Savings (2025)	Sum of Million USD Savings (2030)	Sum of GHG Savings (2025)	Sum of GHG Savings (2030)
DNV GL Projected MEPS	590	915	27	66	2	3
DNV GL Projected BAT	1 042	1 629	47	118	3	5
U4E Targets	598	702	13	15	2	2

3.2.2 Job creation/elimination from EE products.

The implementation of energy savings initiatives such as lighting retrofits, combined with manufacturing and distribution of new lights, are likely to generate a large number of jobs in Zambia.

3.3 Status of Policies and Initiatives

3.3.1 Standards and regulations

No Specific standards or regulations were found for lighting in Zambia.

3.3.2 Supporting Policies – Labelling and consumer awareness campaigns

Under a distribution program sponsored by ZESCO, the national electrical utility, six CFLs (with under 3 mg of mercury) were distributed free of charge to each household. The project was funded and assisted by the World Bank. [28]

3.3.3 Financial Mechanisms

Lighting Retrofits in Zambia were introduced by the government.

3.3.4 Monitoring, Verification and Enforcement

Compliance with lighting standards in current buildings is seen as voluntary, with very little enforcement of the limited building regulations that do exist. Health and safety standards require certain minimum light levels but do not specify any technologies. Other than that, new buildings are constructed and fitted according to building regulations which prescribe a certain level of lighting but also do not specify energy efficiency level. These regulations are supposed to be verified by building inspectors, but due to the rural nature of Zambia, construction often takes place unfortunately without adherence to design, consent and regulatory considerations.

3.3.5 Environmentally Sound Management

Zambia is bound by the SADC Protocol on Energy 1996, which states that: "energy efficiency and conservation applications have minimal adverse impact on the environment, relative to other energy applications". The handling of removed equipment like lighting, is addressed in the Environmental Management Act 10 of 2008 and related regulations, but it was clear that these were not properly enforced.

3.3.6 Other on-going projects/initiatives

Akon Lighting Africa

Akon Lighting Africa initiative (2015) was created to bring clean, renewable and affordable energy solutions primarily to rural and off-grid areas in Africa. The goal of the Akon Lighting Africa initiative is to provide solutions to the energy crisis in Africa through innovative, clean and accessible solar solutions – including street lamps, home-based solar kits, pre-paid micro-grids, lamps and recharge stations. The Akon Lighting Africa initiative supports technical training, transfer of skills and direct job creation. A network of young professionals will be developed and employed to install and maintain the solar energy solutions.

[29] [25] [26] [27] [28]

4 AIR-CONDITIONING

Air-condition units referred to in this section are limited to room air-conditioning (split or standalone) but do not include central cooling or heating systems with air handling units. Due to a low electrification rate, air-conditioning is installed in only 2% of homes in Zambia. Room air-conditioners can be segmented into window air-conditioners, portable air-conditioners and at least 3 sub-categories of split systems according to cooling capacity (e.g. 9’000 btu/h, 12’000 btu/h and 18’000 btu/h). While a survey conducted by CTCN showed that the 2% of the households with air-conditioning contrasts with 80% of non-residential applications.

4.1 Status and Trends of Air-conditioning Products

4.1.1 Market Drivers

Replacement cycles are typically 10 years for outdoor units exposed to elements such as sun and rain, while well maintained indoor units can last 15 or even up to 20 years.

Lower-end brands such as Midea are sold for between 650 – 750 USD for a medium sized (12000 Btu/h or 3.5kW) split unit, which includes supply and installation. Due to the lower initial costs, these units are increasing market share in an industry dominated by a few well-established household names. More well-known brands such as LG, DAIKIN or SAMSUNG are sold and installed for around 900 – 1200 US$ for the same capacity unit, depending on the model of choice [27] [28] [29].

4.1.2 Purchase of air-conditioning products, including where, and availability of EE products

Air-conditioning units are not “off-the-shelf” items in Zambia, as these are typically supplied and installed by a solution or service provider. Most of these service providers will partner with one or a few brands and act as local distributors and installers. A wide variety of brands provide almost all sizes and performance ratios available, yet Zambia does not specify MEPS for the import of equipment.

4.1.3 Local manufacturers, suppliers, retailers and other stakeholders

According to DNV GL research, the quantity of residential or commercial air-conditioning units that are manufactured locally is negligible. All major international brands are well represented by local distributors in Zambia. Air-conditioning units require annual services and are often repaired when broken, rather than replaced.

4.1.4 Import/Export

Most household appliances in the SADC region are either manufactured in, or distributed by, South African, Chinese or Indian companies, although the South African presence in this market has been mitigated somewhat by aggressive importing of cheaper appliances from abroad. The figure below shows a comprehensive summary of imports and exports of air-conditioning products in the period between 2012 and 2015. There is a clear indication that Zambia is mainly an importer of AC products. The ratio between exports and imports, of course, is negligible. Also, there seems to be a decrease in importing of AC products over the past 3 years.

Figure 4-1: Summary of Imports/Exports For 2012-2015

Source: https://comtrade.un.org/data/

4.1.5 Barriers to overcome

Due to the very poor economy in Zambia, only the upper income bracket can afford air-conditioning and makes up a very small percentage of the population. The perception that the cost of services outweighs the benefits often results in a lack of proper maintenance of air-conditioning units, which typically leads to significant decreases in efficiency or even early system failure.

4.1.6 New vs. Used Equipment

Re-use of equipment is not applicable to air-conditioning units, as the units are typically installed in a fixed location and not removed or sold second hand.

4.2 Potential Savings from Energy-Efficient Air-conditioning

For a simple savings calculation, units have been grouped into three categories:

1. Below Class B
2. Class B - A
3. Class A+ and better.

4.2.1 Benefits of Energy Efficiency – 3 Scenarios

The following table shows the benefits from energy efficiencies and adopts the three scenarios described earlier.

Table 4.1 BAU, MEPS, BAT scenarios for air-conditioning.

Scenario	Description	QTY (2017)	QTY (2020)	Tech. Adopt (2025)	QTY (2025)	Tech. Adopt (2030)	QTY (2030)
Business as Usual	Lower than Class B	78 057	101 443	-6%	183 601	-7%	328 762
Business as Usual	Class B - Class A	60 711	78 900	4%	157 558	2%	308 437
Business as Usual	Class A+ & Above	34 692	45 086	7%	92 886	11%	198 517

Scenario	Description	QTY (2017)	QTY (2020)	Tech. Adopt (2025)	QTY (2025)	Tech. Adopt (2030)	QTY (2030)
DNV GL Projected MEPS	Lower than Class B	78 057	101 443	-28%	140 630	-19%	219 325
DNV GL Projected MEPS	Class B - Class A	60 711	78 900	24%	188 375	1%	365 608
DNV GL Projected MEPS	Class A+ & Above	34 692	45 086	21%	105 039	24%	250 782
DNV GL Projected BAT	Lower than Class B	78 057	101 443	-35%	126 958	-33%	163 779
DNV GL Projected BAT	Class B - Class A	60 711	78 900	14%	173 400	-14%	288 408
DNV GL Projected BAT	Class A+ & Above	34 692	45 086	54%	133 686	49%	383 527

Data & Assumptions:

- *Exchange Rate: 1 ZMK = 1.2 ZAR = 0.096 USD*
- *Average Residential marginal Electricity Tariff: 0.021 USD/kWh*
- *Average Industrial marginal Electricity Tariff: 0.050 USD/kWh*
- *Electricity Cost Increase: 10% per annum*
- *Operating hours: 8 hours per day x 125 days per annum = 1 000 hours.*
- *Average cooling capacity: 3.5kW.*
- *Electricity Cost Increase: 8% per annum.*

The quantity and adoption rates of technologies are based on information from stakeholder interviews.

Assuming these adoption rates are accurate, the following savings are projected (3) to be achieved under the MEPS and BAT scenarios. The U4E targets are also shown as benchmarks.

Table 4.2 Projected savings for air-conditioning under MEPS And BAT scenarios.

	Sum of GWh Savings (2025)	Sum of GWh Savings (2030)	Sum of Million USD Savings (2025)	Sum of Million USD Savings (2030)	Sum of GHG Savings (2025)	Sum of GHG Savings (2030)
DNV GL Projected MEPS	12.3	37.8	1.3	6.5	0.0	0.1
DNV GL Projected BAT	23.8	89.4	2.5	15.4	0.1	0.3
U4E Targets	63.8	143.9	1.3	3.0	0.2	0.5

4.2.2 Job creation/elimination from Energy Efficient products

Energy efficient products will not have a direct impact on the Zambian market, as the bulk of units are imported; unless old units are banned replacement is mandatory.

4.3 Status of Policies and Initiatives

4.3.1 Standards and regulations

ISO/TC 86: Refrigeration and air-conditioning
https://www.iso.org/committee/50356.html

ISO/TC 86/SC 6: Testing and rating of air-conditioners and heat pumps

https://www.iso.org/committee/50376.html

4.3.2 Supporting Policies

No policies are in place to specifically drive the uptake of energy efficient units.

4.3.3 Financial Mechanisms

No financial mechanisms are available to consumers, manufacturers or importers to drive the adoption of energy efficient models.

4.3.4 Monitoring, Verification and Enforcement

Due to the lack of standards, no monitoring, verification or enforcement can take place.

4.3.5 Environmentally Sound Management

Zambia is bound by the SADC Protocol on Energy 1996, which states that: "energy efficiency and conservation applications have minimal adverse impact on the environment, relative to other energy applications". The handling of removed equipment is addressed in the Environmental Management Act 10 of 2008 and related regulations, but it was clear that these were not properly enforced.

4.3.6 Other on-going projects/initiatives

No current projects or initiatives exist to drive the adoption of energy efficient air-conditioning units rather than standard efficiency units.

5 REFRIGERATORS

Interviews in Zambia suggested that roughly 12% of households in Zambia have refrigerators, with primarily 1 unit per house.

5.1 Status and Trends of Refrigeration Products

5.1.1 Market Drivers

The average life expectancy for a properly maintained refrigerator is between 14 and 17 years depending on the model and size. Compact refrigerators typically run for 14 years on average, while a standard refrigerator will run up to 17 years. The life expectancy of refrigerators is affected by how well it is maintained and its construction. Some models may last only about 10 years, while others may run for up to 19 years. [30]

5.1.2 Purchase of refrigeration products, including where, and availability of EE products

Refrigerators are typically sold at furniture or white good stores, with some also from large retailers. Most refrigerators have standard energy efficiency markings displayed on the outside front and a variety of efficiencies were available at all the stores surveyed, ranging from MEPS (Class B) to BAT (Class A+++).

5.1.3 Local manufacturers, suppliers, retailers and other stakeholders

The quantity of refrigerators manufactured in Zambia is negligible. Further to that, retailers stock both inefficient and high-end energy efficient goods, mostly imported by large international players before passing these over to local distributors or selling directly to retailers.

5.1.4 Import/Export

As with lighting and most other household appliances in the SADC region, the bulk are either manufactured in, or distributed by, South African companies.

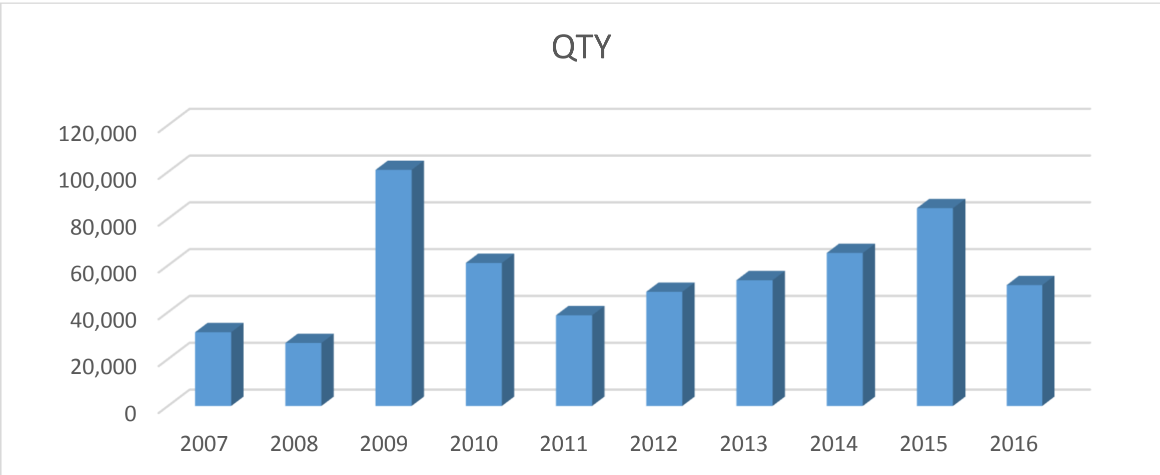

Figure 5-1: Import of refrigerators into Zambia

The primary origin is South Africa with over 500 000 of the roughly 550 000 units that entered the country in the past 10 years.

5.1.5 Barriers to overcome

High costs of energy efficient units drive consumers to purchase lower quality, entry level units at the expense of efficiency.

5.1.6 New vs. Used

Refrigerators are very seldom repaired in Zambia after their warranty period. Very small refrigerator repair industries are likely to be found in low-income areas, but accurate data is not available.

5.2 Potential Savings from Energy-Efficient Refrigeration Products

5.2.1 Benefits of Energy Efficiency – 3 Scenarios

Table 5.1 BAU, MEPS, BAT scenarios for refrigerators.

Scenario	Description	QTY (2017)	QTY (2020)	Tech. Adopt (2025)	QTY (2025)	Tech. Adopt (2030)	QTY (2030)
Business as Usual	Lower than Class B	559 461	727 075	-5%	1 329 925	-7%	2 381 411
Business as Usual	Class B - Class A	200 404	260 445	9%	545 134	10%	1 158 685
Business as Usual	Class A+ & Above	75 151	97 667	14%	214 376	17%	482 932
DNV GL Projected MEPS	Lower than Class B	559 461	727 075	-52%	671 962	-61%	504 584
DNV GL Projected MEPS	Class B - Class A	200 404	260 445	128%	1 144 802	27%	2 793 938
DNV GL Projected MEPS	Class A+ & Above	75 151	97 667	45%	272 672	38%	724 509
DNV GL Projected BAT	Lower than Class B	559 461	727 075	-69%	433 975	-80%	167 116
DNV GL Projected BAT	Class B - Class A	200 404	260 445	165%	1 326 374	6%	2 696 376
DNV GL Projected BAT	Class A+ & Above	75 151	97 667	75%	329 087	83%	1 159 541

Data & Assumptions:

- *Exchange Rate: 1 ZMK = 1.2 ZAR = 0.096 USD*
- *Average Residential marginal Electricity Tariff: 0.021 USD/kWh*
- *Average Industrial marginal Electricity Tariff: 0.050 USD/kWh*
- *Electricity Cost Increase: 10% per annum.*

Assuming these adoption rates are accurate, the following savings (Table 5.2) are projected to be achievable under the MEPS and BAT scenarios. The U4E targets are also shown as benchmarks.

Table 5.2 Projected savings for refrigerators under MEPS And BAT scenarios.

Row Labels	Sum of GWh Savings (2025)	Sum of GWh Savings (2030)	Sum of Million USD Savings (2025)	Sum of Million USD Savings (2030)	Sum of GHG Savings (2025)	Sum of GHG Savings (2030)
DNV GL Projected MEPS	91.5	265.3	4.1	19.2	0.3	0.8
DNV GL Projected BAT	126.6	335.3	5.7	24.3	0.4	1.0
U4E Targets	121.8	288.0	2.6	6.0	0.4	1.0

5.2.2 Job creation

The adoption of energy efficiency has no specific impact on the local job market. Jobs may include technicians, installing and repairing, trading, and supply of equipment, though these are currently in operation. Energy efficiency therefore plays little to no role in this market.

5.3 **Status of Policies and Initiatives**

5.3.1 Standards and regulations

Due to the large percentage of import from South Africa, refrigerators are expected to comply to SANS/IEC 62552 (MEPS) and SANS 62301 (Noise).

5.3.2 Supporting Policies – Labelling and consumer awareness campaigns

No supporting mechanisms were found in Zambia.

5.3.3 Financial Mechanisms

No financial mechanisms are currently in place to promote the adoption of energy efficient refrigerators.

5.3.4 Monitoring, Verification and Enforcement

No monitoring, verification or enforcement of legislation was found in Zambia.

5.3.5 Environmentally Sound Management

Zambia is bound by the SADC Protocol on Energy 1996, which states that: "Energy efficiency and conservation applications have minimal adverse impact on the environment, relative to other energy applications". However, there is little evidence that this is enforced.

5.3.6 Other on-going projects/initiatives

There are no ongoing projects or initiatives to drive the improvement of energy efficiency in the refrigerator market.

[26] [30]

6 MOTORS

Many factors affect the life expectancy of an electric motor. These factors include input power problems, improper mechanical installation, malfunctions in the load, and environmental factors, among others.

6.1 Status and Trends of Motors

6.1.1 Life Expectancy

If motors are operated under normal conditions, sized correctly for the application and within the manufacturer's design requirements, it can last 15 years or more. [31]Failure of motors can generally be grouped into electrical failure (windings, drives, etc.) and mechanical failure (bearings, mountings etc.).

Repair of electrical failures can be done by rewinding the motor. This typically only takes place after a catastrophic failure in the motor's insulation and winding, which usually happens due to a thermal breakdown. Motors are frequently replaced rather than rewound due to costs, convenience and the claim that rewinding may reduce the motor's efficiency. [32]

When looking at the mechanical failures, motor bearings or mountings might fail due to improper mechanical installation causing undesirable forces acting on the bearings and mountings, or simply due to poor maintenance.

A rough guide as to when to repair or replace is given in Figure 6-1 below (provided by ABB).

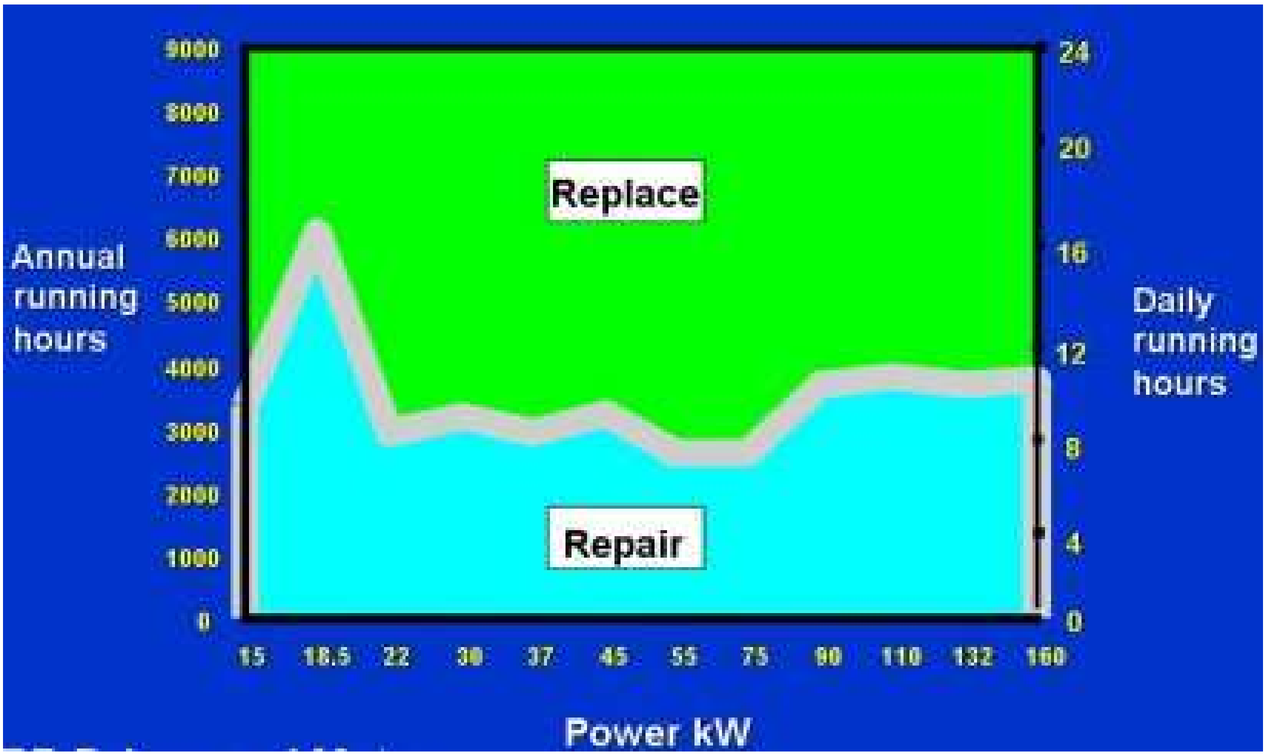

Figure 6-1: Repair or Replace [33]

6.1.2 Price

Motors are categorized as IE1 (least efficient), IE2 (more efficient) and IE3 (most efficient). A list of comparative motor prices is shown in **Error! Reference source not found.** below. IE3 motors are typically between 15-20% more expensive than their IE1 counterparts. Even though the operating costs of a typical motor is roughly 50% of the annual overall cost, additional costs are one of the biggest market barriers in countries where initial capital plays a major factor.

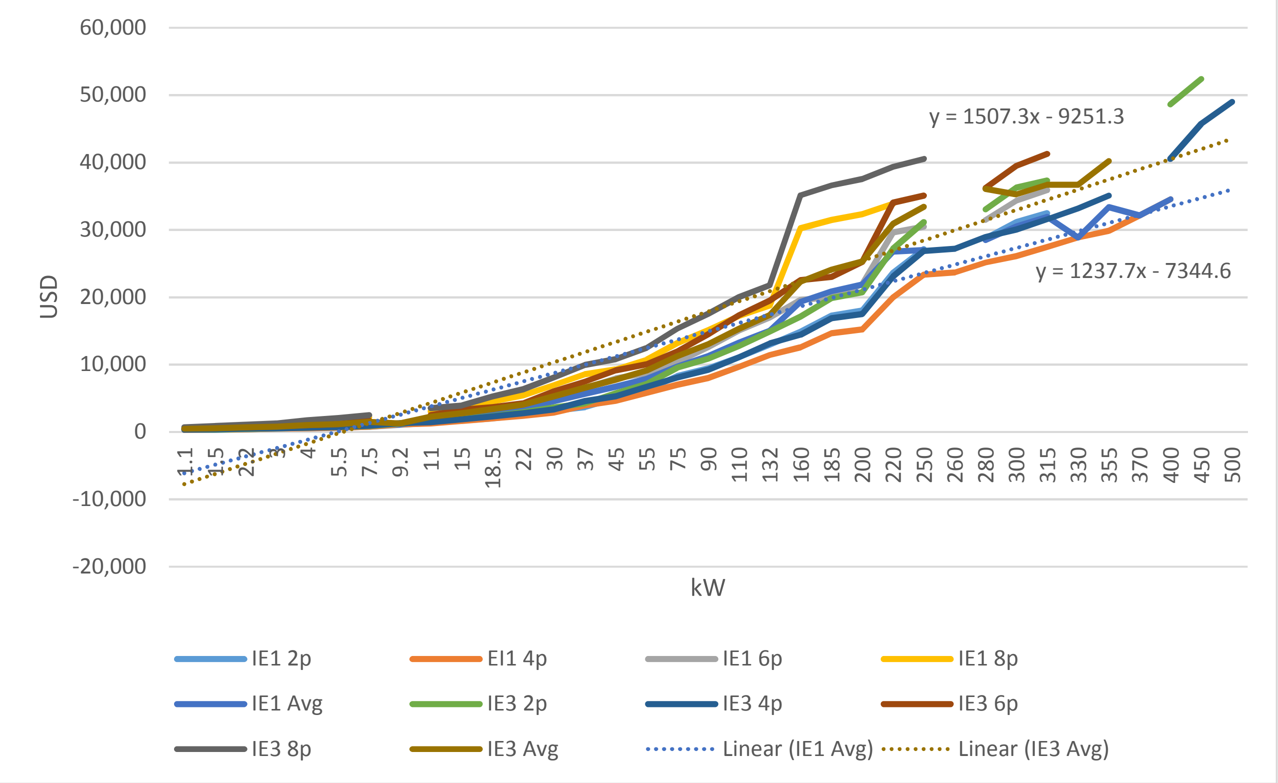

Figure 6-2 Motor pricing versus size

6.1.3 Purchase of motors, including where, and availability of EE products

Electrical motors are generally available from a wide variety of distributors and installers and include anything from old rewound motors to new premium efficiency motors.

Motors are not "off the shelf" items and are usually sold as part of a project, machine or installation. Therefore, the end user is often not in direct contact with the motor manufacturer or supplier during new installations. The motors are typically procured by a "project company" or solution provider selling the motor as part of a solution to the end user. The project companies are likely to provide "back to back" guarantees as provided by the motor manufacturers and are likely to administrate the service, repair and replacement of these motors on behalf of the client.

After the initial maintenance period provided by the motor supplier/installer, the client would typically take ownership of maintenance of the motor and might deal directly with the OEM suppliers or other local service companies to maintain the motors.

6.1.4 Local manufacturers, suppliers, retailers and other stakeholders

Eltech Investments Limited; Xplore Sourcing Enterprises Limited;

6.1.5 Import/Export

Zambia is almost exclusively an importer of motors with South Africa and China being the primary suppliers.

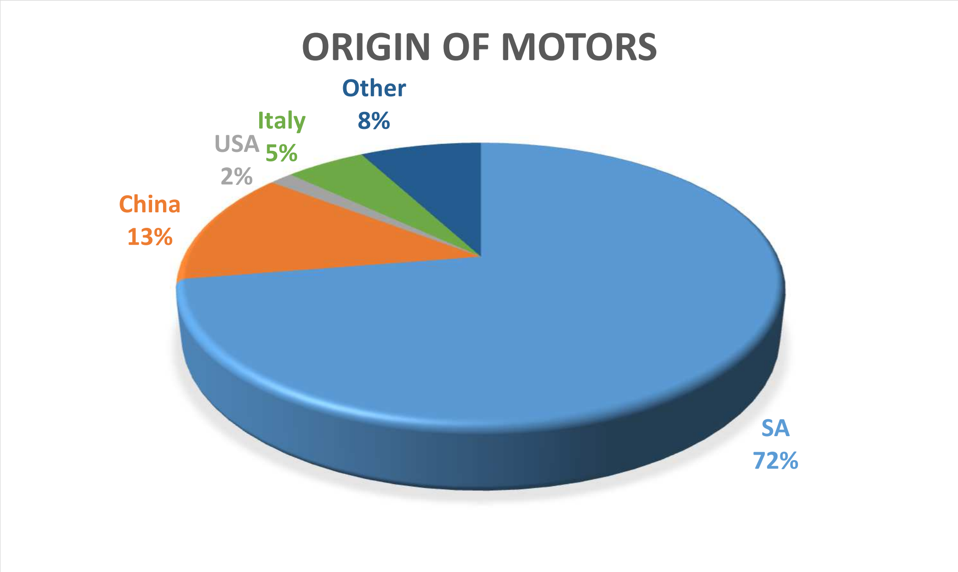

Figure 6-3: Origin of Motors

6.1.6 Barriers to overcome

Overall Inefficient Systems

Due to the low (subsidized) historical price of electricity in Zambia, most industrial and commercial systems and processes (which include electrical motors) were designed for low installation costs which did not necessarily take efficiency into consideration.

Negligible Savings

Apart from the fact that more efficient motors are more expense, there is a general perception that the savings from high efficiency motors are negligible when added to an overall inefficient system.

Rewinding Perception

Further to the above, the fact that motors can be rewound to perform at the same efficiency reduces the drive to buy new equipment. However, very few rewinders actual perform the rewinding to the same standards, so optimal efficiencies are hardly ever reached.

6.1.7 New vs. Used

Motors are typically used at their point of installation until a catastrophic failure occurs. In the cases where repair or rewinding takes place, motors are mostly re-installed in their initial position and will continue to be used there until the end of life. Therefore, there is little to no second-hand electrical motor industry to speak of.

6.2 **Potential Savings from Energy-Efficient Motors**

Modelling of the different scenarios has been explained in Section 2.

Even though Zambia does not explicitly list any motor standards, the country generally adopts IEC standards, as the bulk of imports are from South Africa. Therefore, the suite of SANS or IEC 60034 standards for motors are likely to prevail (SABS being based on the IEC standard). The tables below consider the current scenario (BAU-Business as Usual) as well as the adoption of improved MEPS and best available technologies (BAT) if these were to be driven by policies and regulations.

For a simple savings calculation, motors have been grouped into three categories:

1. IE1 and below
2. IE3
3. IE4 and premium.

6.2.1 Benefits of Energy Efficiency– 3 scenarios

Table 6.1 BAU, MEPS, BAT scenarios for motors.

Scenario	Description	QTY (2017)	QTY (2020)	Tech. Adopt (2025)	QTY (2025)	Tech. Adopt (2030)	QTY (2030)
Business as Usual	Class IE1 & below	1 008 540	1 310 699	-5%	2 397 457	-7%	4 292 972
Business as Usual	Class IE3	784 420	1 019 432	2%	1 999 282	1%	3 892 692
Business as Usual	Class IE4	448 240	582 533	8%	1 211 347	12%	2 612 227
DNV GL Projected MEPS	Class IE1 & below	1 008 540	1 310 699	-11%	2 246 039	-13%	3 762 364
DNV GL Projected MEPS	Class IE3	784 420	1 019 432	7%	2 094 619	9%	4 399 976
DNV GL Projected MEPS	Class IE4	448 240	582 533	13%	1 267 428	8%	2 635 550
DNV GL Projected BAT	Class IE1 & below	1 008 540	1 310 699	-13%	2 195 566	-20%	3 381 900
DNV GL Projected BAT	Class IE3	784 420	1 019 432	4%	2 044 146	6%	4 175 326
DNV GL Projected BAT	Class IE4	448 240	582 533	22%	1 368 373	23%	3 240 663

Data & Assumptions:

- *Exchange Rate: 1 ZMK = 1.2 ZAR = 0.096 USD*
- *Average Residential marginal Electricity Tariff: 0.021 USD/kWh*
- *Average Industrial marginal Electricity Tariff: 0.050 USD/kWh*
- *Electricity Cost Increase: 10% per annum*
- *Average Motor Size: 10kW (Source: ESKOM DSM Energy Efficient Motor Program)*
- *Average Operating Hours: 8 hours per day, 5 days per week, 50 weeks per annum.*
- *QTY and adoption of new technologies based on information from stakeholder interviews (BPC, Rewinders & others).*

Assuming these adoption rates are accurate, the following savings (Table 6.2) are projected to be achieved under the MEPS and BAT scenarios. The U4E targets are also shown as benchmarks.

Table 6.2 Projected savings for motors under MEPS And BAT scenarios.

	Sum of GWh Savings (2025)	Sum of GWh Savings (2030)	Sum of Million USD Savings (2025)	Sum of Million USD Savings (2030)	Sum of GHG Savings (2025)	Sum of GHG Savings (2030)
DNV GL Projected MEPS	172.3	525.3	18.5	90.7	0.5	1.6
DNV GL Projected BAT	267.1	1 169.1	28.6	201.8	0.8	3.5
U4E Targets	174.1	402.3	8.7	20.1	0.6	1.3

6.2.2 Job creation/elimination from EE products

Strict implementation of high EE standards might result in a reduced amount of motors being rewound. This will have a negative impact on the local motor rewinding industry, although that industry is considered small. On the other hand, this will drive the import of new, high-efficiency motors, which in turn will result in jobs in the distribution and sales sectors.

6.3 **Status of Policies and Initiatives**

No standards or regulations were found for motors in Zambia, however IEC and/or SANS standards are expected to take precedence, as is the case with several other industries in Zambia.

6.3.1 Supporting Policies – Labelling and consumer awareness campaigns

All electric motors are expected, but not required, to comply with IE/SANS labelling standards.

6.3.2 Financial Mechanisms

Currently, no funding mechanisms are in place to drive minimum energy performance standards.

6.3.3 Monitoring, Verification and Enforcement

Due to the lack of regulations, no monitoring, verification or enforcement can take place.

6.3.4 Environmentally Sound Management

Zambia is bound by the SADC Protocol on Energy 1996, which states that: "Energy efficiency and conservation applications have minimal adverse impact on the environment, relative to other energy applications".

6.3.5 Other on-going projects/initiatives

There are no on-going initiatives to enhance the adoption of efficient motors.

[31] [32] [33]

7 TRANSFORMERS

7.1 Status and Trends of Transformers

The power network in Zambia is owned and operated by the "Zambia Electricity Supply Company", commonly referred to as "ZESCO". The power networks are mostly distributed at the endpoints by pole mounted distribution transformers, some of them dating back to the mid 1900's. Distribution transformers built with amorphous iron cores have 70 % lower no-load losses compared to the best conventional designs, achieving up to 99,7 % efficiency for a 100 kVA unit. High efficiency transformers not only yield a net economic gain, but are advantageous to the environment, reducing greenhouse gas emissions [40].

7.1.1 Market Drivers

When a Transformer is operated under ANSI / IEEE basic loading conditions (ANSI C57.96), its normal life expectancy is about 20 years. The ANSI / IEEE basic loading conditions for Transformer are [34]:

- The Transformer is continuously loaded at rated kVA and rated Voltage
- The average temperature of the ambient air during any 24-hour period is equal to 30°C (86 °F) and at no time exceeds 40°C (104 °F).
- The height where the transformer is installed does not exceed 3300 feet or 1000 meters.

However, the increasing demand for access to electricity results in numerous additional (often illegal) connections, often pushing transformers to the very limit of their operational capacity.

7.1.2 Purchase of transformers, including where and availability of EE products

Transformers are ordered or purchased directly from the manufacturers and are often part of competitive tender processes, especially when being bought by ZESCO. Very low standards (compared to other international standards) for energy efficiency of transformers are enforced. Thus, there was no drive to adopt or produce energy efficient transformers.

7.1.3 Local manufacturers, suppliers, retailers and other stakeholders

Synergy transformers is the Indian manufacturer which exports to Zambia.

http://www.synergyelectricaltransformers.com/distribution-transformer-in-zambia.html

Elsewedy Electric Zambia

http://www.elsewedyelectric.com

Eltech Investments Limited; The Oracles General Suppliers; Xplore Sourcing Enterprises Limited;

7.1.4 Import/export – Principle ports of entry and primary sources of products

Most transformers in the SADC region are either manufactured in, or distributed by, South African companies. The same is true for transformers with roughly 69% coming from South Africa. Strong business ties along with competitive pricing have resulted in an increase in market share from both India and China.

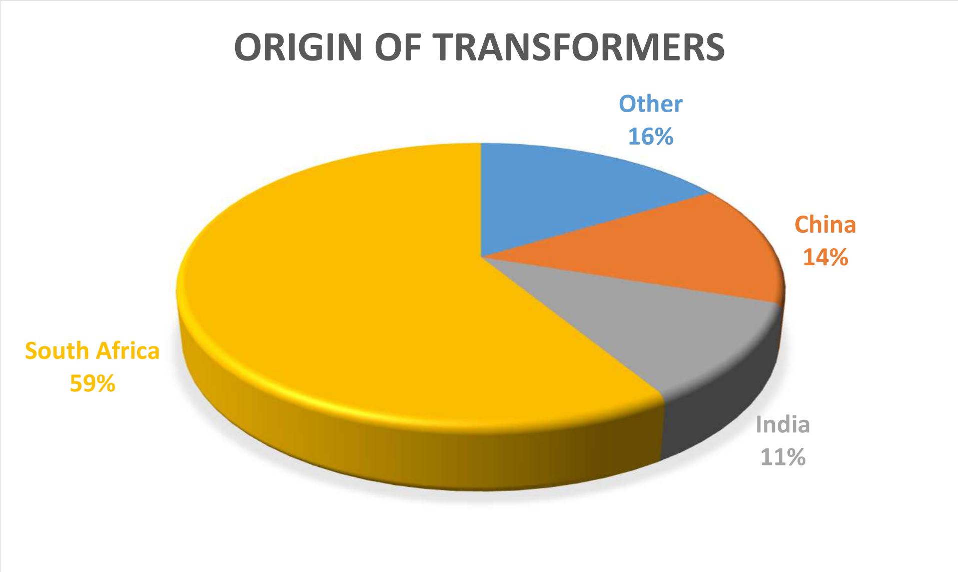

Figure 7-1: Primary sources of transformers

Costs of energy efficient transformers are still significantly higher than standard efficiency units and the relatively low cost of electricity combined with a general acceptance of system losses results in the very slow adoption of energy efficient transformers in South Africa. Further to that, the long life expectancy of typical transformers further reduces the potential uptake of energy efficient units.

7.1.5 New vs. Used

Due to the nature of transformer installations, transformers are typically not resold and there is little to no market for second-hand distribution transformers.

7.2 Potential Savings from Energy-Efficient Transformers

7.2.1 Benefits of Energy Efficiency – 3 scenarios

Table 7.1 BAU, MEPS, BAT scenarios for transformers.

Scenario	Description	QTY (2017)	QTY (2020)	Tech. Adopt (2025)	QTY (2025)	Tech. Adopt (2030)	QTY (2030)
Business as Usual	Not Rated	4 449	5 782	-8%	10 242	-20%	15 776
Business as Usual	SEAD Tier 3 or similar	12 783	16 613	-5%	30 456	-14%	50 351
Business as Usual	SEAD Tier 5 or similar	8 798	11 434	11%	24 437	26%	59 285
DNV GL Projected MEPS	Not Rated	4 449	5 782	-46%	6 012	-25%	8 682
DNV GL Projected MEPS	SEAD Tier 3 or similar	12 783	16 613	-1%	31 604	-27%	44 140
DNV GL Projected MEPS	SEAD Tier 5 or similar	8 798	11 434	25%	27 519	37%	72 590

Scenario	Description	QTY (2017)	QTY (2020)	Tech. Adopt (2025)	QTY (2025)	Tech. Adopt (2030)	QTY (2030)
DNV GL Projected BAT	Not Rated	4 449	5 782	-63%	4 119	-66%	2 696
DNV GL Projected BAT	SEAD Tier 3 or similar	12 783	16 613	-20%	25 571	-73%	13 522
DNV GL Projected BAT	SEAD Tier 5 or similar	8 798	11 434	61%	35 444	60%	109 191

Data & Assumptions:

- *Exchange Rate: 1 ZMK = 1.2 ZAR = 0.096 USD*
- *Average Residential marginal Electricity Tariff: 0.021 USD/kWh*
- *Average Industrial marginal Electricity Tariff: 0.050 USD/kWh*
- *Electricity Cost Increase: 10% per annum*
- Average Transformer Size: 315 kVA, 11kV/0.4kV.

Assuming these adoption rates are accurate, the following savings (Table 7.2) are projected to be achieved under the MEPS and BAT scenarios. The U4E targets are also shown as benchmarks.

Table 7.2 Projected savings for lighting under MEPS And BAT scenarios.

Row Labels	Sum of GWh Savings (2025)	Sum of GWh Savings (2030)	Sum of Million USD Savings (2025)	Sum of Million USD Savings (2030)	Sum of GHG Savings (2025)	Sum of GHG Savings (2030)
DNV GL Projected MEPS	101.1	240.8	10.8	41.6	0.3	0.7
DNV GL Projected BAT	203.7	666.4	21.8	115.0	0.6	2.0
U4E Targets	118.7	246.7	2.5	5.2	0.4	0.7

7.2.2 Job creation/elimination from EE products

Implementation of strict energy efficiency standards might result in an increase in replacements of current distribution transformers, which in turn will result in jobs in the local manufacturing industry.

7.3 Status of Policies and Initiatives

7.3.1 Standards and regulations

Power efficiency is generally an efficiency level determined by the instantaneous load power and the power losses in a system. However, since SANS 780 is based on the IEC transformer standards, the transformer rating is based on the rated input (primary side) parameters and not load side parameters or load side measurements.

7.3.2 Supporting Policies – Labelling and consumer awareness campaigns

There is no labelling scheme in Zambia to differentiate between the performances of transformers.

7.3.3 Financial Mechanisms

There are no visible and effective state or industry-funded programmes or initiatives to drive the adoption of energy efficient distribution transformers in Zambia.

7.3.4 Monitoring, Verification and Enforcement

SANS 780:2009 (comparable to IEC) specifies energy performance standards for distribution transformers and is enforced by the South African Bureau of Standards (SABS), as adopted by Zambia.

7.3.5 Environmentally Sound Management

Zambia is bound by the SADC Protocol on Energy 1996, which states that: "Energy efficiency and conservation applications have minimal adverse impact on the environment, relative to other energy applications". However, there is little evidence that this is enforced.

7.3.6 Other on-going projects/initiatives

No ongoing initiatives or projects are currently in place to drive the adoption of energy efficient transformers.

[26] [34]

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9 APPENDICES

9.1 Zambian Bureau of Standards (ZABS)

ZABS

The ZABS specializes in standardization, quality assurance, metrology and testing.

Its vision is: "The Zambia Bureau of Standards in partnership with its stakeholders will be the leader in the transformation of Zambian products and services into world-class quality for National prosperity."

Its role can be summarized as:

- to prepare Zambian Standards and to promote their use;
- to make arrangements or to provide facilities for the examination and testing of commodities, materials and substance from which commodities may be manufactured, processed, treated or finished;
- to provide quality control and quality assurance schemes for commodities in order to promote and improve trade;
- to coordinate the efforts of producers and consumers in the improvement of appliances, processes, new materials and products;
- to provide training and consultancy in standardization, quality management and quality assurance; and
- to establish metrological laboratories and other testing laboratories.

9.2 Zambian Transformer Manufacturers & Suppliers

Synergy transformers: Indian manufacturer which export to Zambia

http://www.synergyelectricaltransformers.com/distribution-transformer-in-zambia.html

Elsewedy Electric Zambia

http://www.elsewedyelectric.com

Eltech Investments Limited;

The Oracles General Suppliers;

Xplore Sourcing Enterprises Limited;

9.3 Distribution Transformers per SANS 780

Distribution Transformers as per SANS-780, IEC-76 & IS-2026

Maximum Ambient Temperature=45°C, Oil temperature Rise : 60°C, Winding Rise : 65° C,

Off circuit tap switch : +5% to -5% @ 2.5%, Typeof Winding : Aluminum wound

S.N.	KVA	Voltage Ratio (kv)	Phase	Over all Dimension in mm			No-Load Loss (W)	Load Losses at 75°C(W)	%Z at 75°C	Wt. of Txs. (kg)
				Length (L)	Width (W)	Height (H)				
1	16	11/0.240	1	705	405	1130	80	400	3.0-4.5%	215
2	25	11/0.240	1	760	525	1110	110	530	3.0-4.5%	245
3	25	33/0.240	1	830	580	1380	160	530	3.0-4.5%	335
4	50	11/0.240	1	810	590	1210	180	900	3.0-4.5%	370
5	50	33/0.240	1	920	620	1470	250	900	3.0-4.5%	485
6	16	11/0.415	3	905	530	1035	95	410	3.0-4.5%	280
7	25	11/0.415	3	960	550	1130	120	570	3.0-4.5%	400
8	50	11/0.415	3	1045	580	1200	180	1000	3.0-4.5%	515
9	100	11/0.415	3	1120	660	1290	300	1700	3.0-4.5%	705
10	200	11/0.415	3	1425	815	1370	520	2700	4.0-5.0%	1095
11	315	11/0.415	3	1590	910	1580	720	3800	4.0- 5.0%	1500
12	500	11/0.415	3	1750	970	1690	1100	5400	4.5- 5.5%	2025
13	630	11/0.415	3	1785	1010	1780	1300	6400	4.5- 5.5%	2260
14	800	11/0.415	3	1935	1135	1840	1600	8000	4.5- 5.5%	2670
15	1000	11/0.415	3	2035	1200	1910	1900	9500	4.5- 5.5%	3100
16	1250	11/0.415	3	2380	1440	1950	2250	11000	5.0- 6.5%	3740
17	1600	11/0.415	3	2385	1555	2390	2750	13500	5.0- 6.5%	4785
18	2000	11/0.415	3	2560	1650	2500	3250	16000	5.0- 6.5%	5700
19	25	33/0.415	3	1035	610	1400	170	570	3.0-4.5%	520
20	50	33/0.415	3	1130	680	1345	250	1000	3.0-4.5%	655
21	100	33/0.415	3	1315	605	1515	400	1700	3.0-4.5%	905
22	200	33/0.415	3	1500	730	1680	650	2700	4.0- 5.0%	1350
19	315	33/0.415	3	1645	1020	2135	890	3800	4.0- 5.0%	1850
20	500	33/0.415	3	1765	1140	2220	1230	5400	4.5- 5.5%	2410
21	630	33/0.415	3	1805	1175	2290	1450	6400	4.5- 5.5%	2705
22	800	33/0.415	3	1880	1230	2380	1700	8000	4.5- 5.5%	3160
23	1000	33/0.415	3	2090	1330	2400	2000	9500	4.5- 5.5%	3680
24	1250	33/0.415	3	2205	1390	2510	2350	11000	5.0 - 6.5%	4330
25	1600	33/0.415	3	2385	1585	2615	2820	13500	5.0 - 6.5%	5215
26	2000	33/0.415	3	2545	1680	2755	3300	16000	5.0- 6.5%	5970

Note: 1-All electrical performances are subject to tolerance as per Is-2026, IEC-76, SANS-780
2-Weigthts &dimension are subject to tolerance of ±10%

9.4 Energy Efficiency Funding initiatives IN SADC Region

a) **EREF ECOWAS Renewable Energy Facility -** TANZANIA

b) **EU-Africa Infrastructure Trust Fund (ITF) / Africa Investment Facility (AfIF) -** Sub-Saharan Africa

Attract and leverage financial resources and technical expertise to support infrastructure investments in Sub-Saharan Africa - Grants in the energy sector are for example used for geothermal, hydropower, solar power and wind power plants, transmission lines, improvement of energy efficiency and energy savings, etc.

c) **European Development Finance Institutions (EDFIs) Private Sector Development Facility -**

Sub Saharan African countries that are committed to reaching the Sustainable Energy for All (SE4ALL) objectives, except South Africa

The Facility aims to contribute to poverty reduction and economic development in Sub-Saharan Africa through the mobilisation of resources for projects in the sector of energy. In particular, the Facility aims to increase access to modern energy services and investments in renewable energy and energy efficiency, by promoting private sector investments and providing additional dedicated financial resources to African countries committed to meet the objectives of the SE4All initiative.

d) **Regional Technical Assistance Programme (RTAP) -** Tanzania

Make renewable energy and energy efficiency financing a standard business model that can be adopted by the local banks to support and diversify their revenue stream. RTAP is the TA component of a credit line established by AFD for financing renewable energy and energy efficiency projects

e) **Africa-EU Energy Partnership (AEEP) -** European and African member states –

AEEP 2020 includes energy efficiency (increase energy efficiency in all sectors)

f) **World Bank Energy Sector Management Assistance Program (ESMAP) - Africa Renewable Energy Access Program (AFREA I & II) -** Mozambique, Tanzania and Zambia

Promoting increased access to energy, with an emphasis on renewable energy, energy efficiency and energy access.

g) **ACP-EU Energy Facility -** Most countries in sub-Saharan Africa

To increase access to modern, affordable and sustainable energy services in rural and peri-urban poor areas by focusing on renewable energy solutions and energy efficiency measures; To improve governance and framework conditions in the energy sector at regional, national and local levels, in particular in respect of promoting access to energy services, renewable energy and energy efficiency;

h) **Clean Technology Fund (CTF) -** South Africa (and DPSP – Mozambique?)

Highly concessional resources to scale up the demonstration, deployment, and transfer of low carbon technologies in renewable energy, energy efficiency, and sustainable transport.

i) **Global Energy Efficiency and Renewable Energy Fund (GEEREF)** - Sub-Saharan Africa (African Renewable Energy Find L.P.)

Increase access to, capital for and the share of renewable energy and energy efficiency project developers and companies in developing countries and economies in transition;

j) AREF - Africa Renewable Energy Fund - GEEREF has committed USD 19.6 MILLION to THE AFRICA RENEWABLE ENERGY FUND, MANAGED BY BERKELEY ENERGY

AREF is a private equity fund focusing on renewable energy infrastructure investments across Sub-Saharan Africa, excluding South Africa.

9.5 SACREE Details

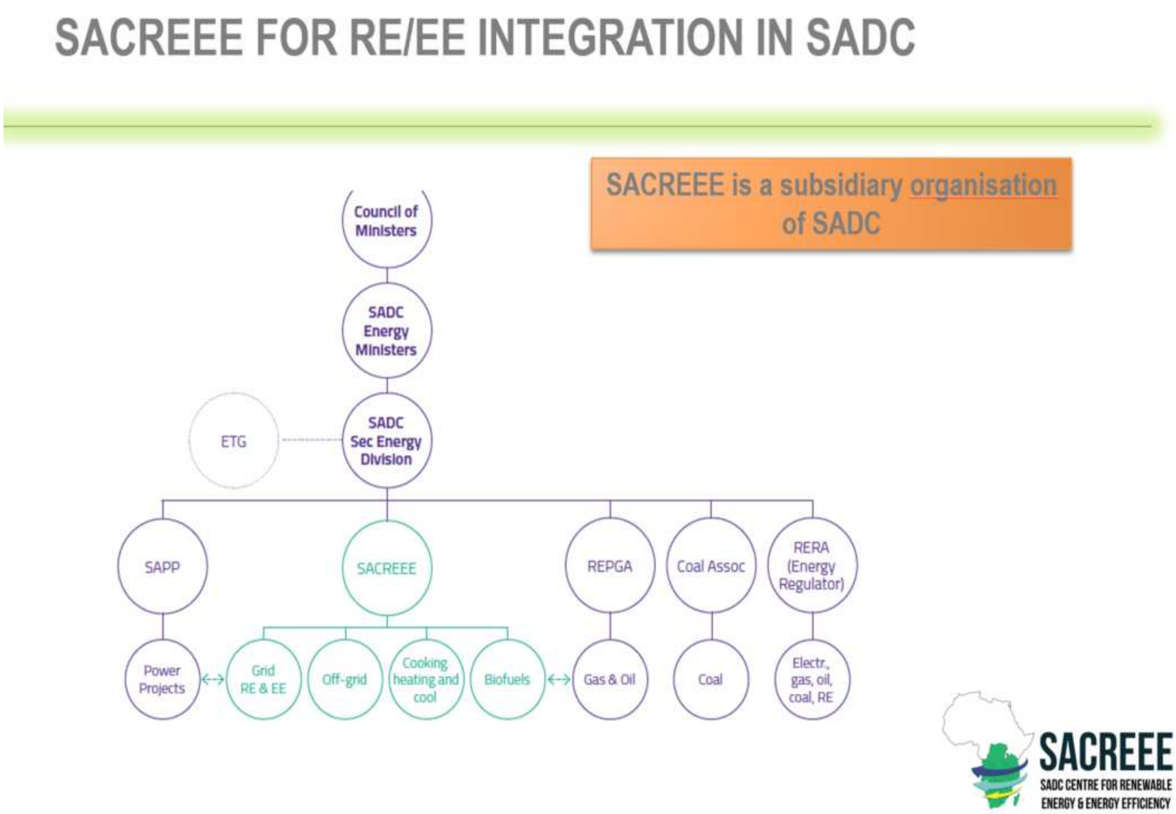
Extracted from the SACREEE_GNSEC_VEF2017.ppt

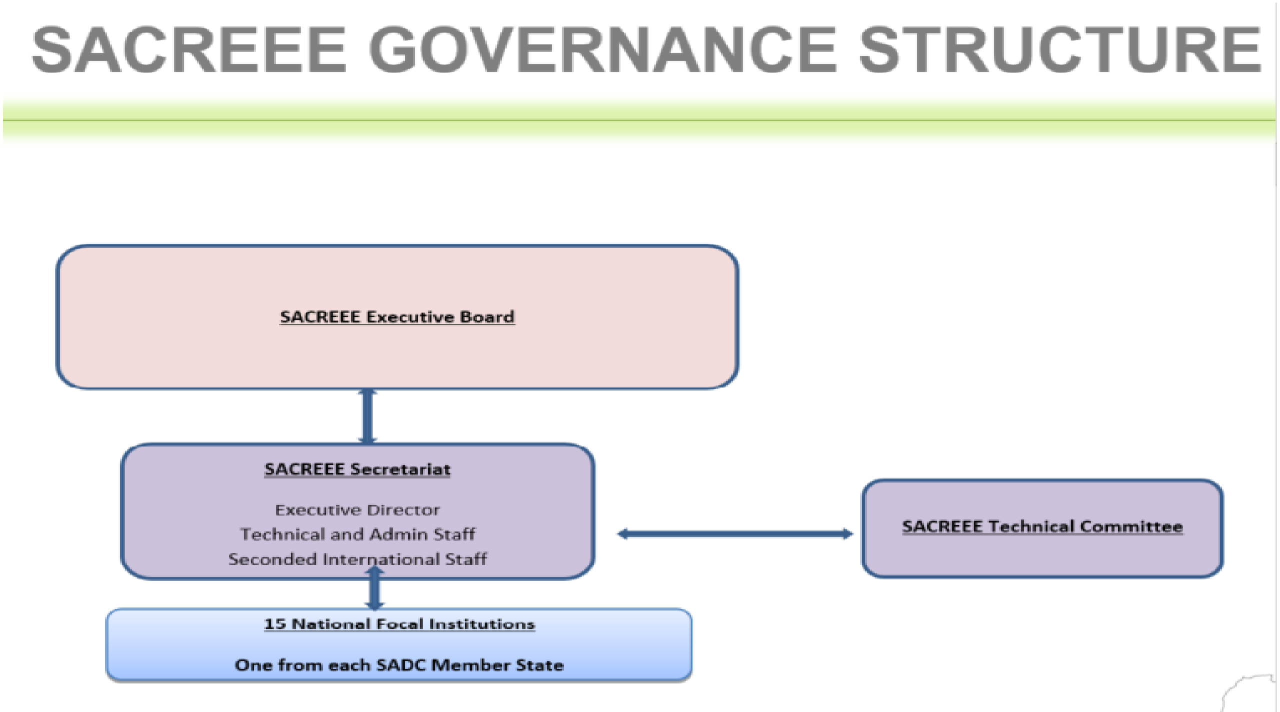
SACREEE is the **SADC CENTRE FOR RENEWABLE ENERGY AND ENERGY EFFICIENCY** – for the market-based adoption of renewable energy and energy efficiency. SACREEE was established in 2016 by the SADC Energy Ministers and endorsed by 35th SADC Council of Ministers Meeting.

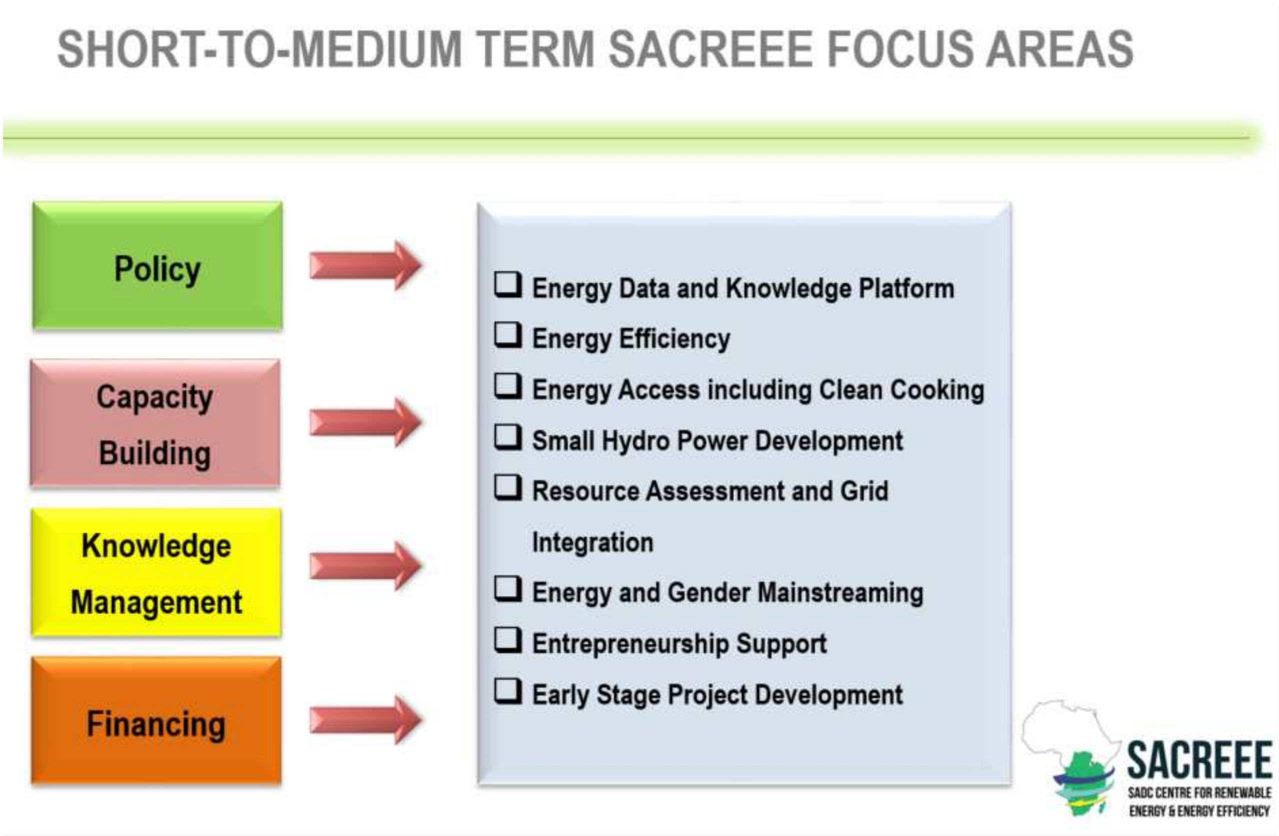
SACREEE's mandate is to implement the Regional Renewable Energy and Energy Efficiency Strategy and Action Plan (REEESAP) through the promotion of market-based adoption of renewable energy and energy efficient technologies and energy services

SACREEE is established on a sustainable basis through the following sources of support:

- Member States contributions
- Donor funding
- Cost recovery from services offered to projects.
- SACREEE Secretariat is based in Windhoek, Namibia




SACREEE GOVERNANCE STRUCTURE
SACREEE Executive Board
SACREEE Secretariat
Executive Director
Technical and Admin Staff
Seconded International Staff
SACREEE Technical Committee
15 National Focal Institutions
One from each SADC Member State


SHORT-TO-MEDIUM TERM SACREEE FOCUS AREAS
Policy
Capacity Building
Knowledge Management
Financing
Energy Data and Knowledge Platform
Energy Efficiency
Energy Access including Clean Cooking
Small Hydro Power Development
Resource Assessment and Grid Integration
Energy and Gender Mainstreaming
Entrepreneurship Support
Early Stage Project Development
SACREEE
SADC CENTRE FOR RENEWABLE ENERGY & ENERGY EFFICIENCY

PROVIDING REGIONAL SUPPORT TO NATIONAL ACTIONS - SACREEE ACTIVITIES

SACREEE develops and executes regional programs and projects in order to support SADC Member States

- To increase access to sustainable energy services;
- To develop sustainable energy markets;
- To improve the legal and regulatory framework and ensure policy coherence and alignment of RE & EE activities with national/regional and international policies;
- To align the national actions with international commitments and climate change actions (e.g. NDCs)
- To support donor harmonization, coordination and to create synergies with other ongoing initiatives;
- To strengthen local capacities through capacity building activities
- To foster networks between research and training institutions (*Network of Energy Excellence for Development (NEED), SOLTRAIN, etc*) as well as organize train-the-trainers workshops;
- To improve the availability of quality energy data and information for sound decision making on policy and investment

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SACREEE
SADC CENTRE FOR RENEWABLE ENERGY & ENERGY EFFICIENCY

SADC Industrial Energy Efficiency Programme (SIEEP)

SIEEP contributes to the competitiveness of the industrial sectors of SADC Member States by building their capacity to adopt, invest and utilise energy efficient technologies and practices.

Target group are medium and large scale industries.
SIEEP is in line with the SADC Industrialization Strategy and Roadmap, 2015-2063.

Current Activities (in cooperation with the European Union)

- Assessment of EE potential in Industries
  - potential on electricity energy saving opportunities,
  - potential for renewable energy heating and cooling applications in industry,
  - capacity to implement energy and efficiency measures
  - capacity of industries on implementing ISO 50001
- Development of a regional program for Industrial Energy Efficiency to be endorsed by the Member States

SACREEE
SADC CENTRE FOR RENEWABLE ENERGY & ENERGY EFFICIENCY

SADC CENTRE FOR RENEWABLE ENERGY AND ENERGY EFFICIENCY – SACREEE

MAIN CHALLENGES IN THE SADC REGION:

POLICY AND REGULATION

- Lack of enabling policies and regulations that stimulate markets for RE and EE
- Energy policy developed in isolation with regional and international trends leading to disharmony
- Standards and labelling of equipment are not harmonized across the region to allow an integrated market
- Need to integrate into the post- 2015 Inclusive and Sustainable Industrial Development (ISID) agenda highlighting the importance of energy

TECHNICAL

- Weak and limited electricity grid infrastructure that limits possible grid connection of RE generated electricity
- Knowledge and experience not shared across borders
- Low local content of technology leading to high RE equipment maintenance costs

CAPACITY

- Limited capacity and awareness of the technical and economic possibilities of RE/EE technologies and their applications
- Low R&D capacity and funding and little regional cooperation between R&D institutions
- Technical capacity for installation and operation and management of RE systems is limited
- Limited capacity to initiate, implement and manage Public- Private Partnership (PPP) projects effectively
- Limited capacities to identify, develop, and implement innovative RE/EE projects

MARKETS

- Limited information on availability of RE resources on which to base decision to invest
- Potential EE improvement technologies not widely known in the Region
- Limited information on the social and environmental impacts and acceptability of the technology
- Markets for RE/EE technologies and energy services fragmented along national boundaries
- Lack of knowledge at vocational and university level

FINANCING

- Limited support available for bankable project preparation
- Limited exposure of local Financial Institutions to RE/EE investment projects
- Limited experience on special purpose soft loans for RE/EE projects for SMEs and low-income sections of the population.
- Perceived risky nature of the RE/EE projects

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The Climate Centre and Network (CTCN) fosters technology transfer and deployment at the request of developing countries through three core services: technical assistance, capacity building and scaling up international collaboration. The Centre is the operational arm of the UNFCCC Technology Mechanism, it is hosted and managed by the United Nations Environment and the United Nations Industrial Development Organization (UNIDO), and supported by more than 300 network partners around the world.

CTCN
CLIMATE TECHNOLOGY CENTRE & NETWORK

CTCN contact details:

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About DNV GL

Driven by our purpose of safeguarding life, property and the environment, DNV GL enables organizations to advance the safety and sustainability of their business. We provide classification and technical assurance along with software and independent expert advisory services to the maritime, oil and gas, and energy industries. We also provide certification services to customers across a wide range of industries. Operating in more than 100 countries, our 16,000 professionals are dedicated to helping our customers make the world safer, smarter and greener.