



ENERGY SECTOR REPORT

2019



VISION

A proactive, firm and fair energy regulator

MISSION STATEMENT

To regulate the energy sector in order to ensure efficient provision of reliable and quality energy services and products

OUR MOTTO

“We safeguard your interests”

CORE VALUES

- | | |
|---------------|--------------------|
| 1. Integrity | 4. Transparency |
| 2. Excellence | 5. Predictability |
| 3. Team Work | 6. Accountability. |

EDITORIAL TEAM

Alfred M. Mwila	Director – Economic Regulation
Simweemba Buumba	Senior Manager – Research and Pricing
Rodgers K. Muyangwa	Manager - Economic Regulation - Electricity
Lungowe Lutangu	Manager - Economic Regulation - Fossil Fuels
Zephaniah Mwanza	Financial Analyst – Fossil Fuels
Mwanje Mambwe	Economic Analyst – Fossil Fuels
Besa Chimbaka	Economic Analyst – Electricity
Mangani W. Phiri	Financial Analyst – Electricity
John Karabassis	Economic Analyst – Electricity
Cletus Sikwanda	Economist – Research
Raymond Muyowwe	Statistician
Jessie Bbilika	Engineer – Fossil Fuels
Eric Musama	Engineer – Electricity
Lungowe Mukumbuta	Licensing Officer
Shungu Williams	Community Liaison Officer

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ABREVIATIONS

AfDB	African Development Bank
BOZ	Bank of Zambia
BSA	Bulk Supply Agreement
CEC	Copperbelt Energy Corporation Plc
EIA	Energy Information Agency
ERB	Energy Regulation Board
ESI	Electricity Supply Industry
GRZ	Government of the Republic of Zambia
HFO	Heavy Fuel Oil
IAREP	International Access to Renewable Energy Programme
IDC	Industrial Development Corporation
INDENI	INDENI Petroleum Refinery Company Limited
IPP	Independent Power Producer
IFC	International Finance Corporation
KNB	Kariba North Bank
KNBEPC	Kariba North Bank Extension Power Corporation Limited
KPI	Key Performance Indicator
LHPC	Lunsemfwa Hydropower Company Limited
LPG	Liquefied Petroleum Gas
LSG	Low Sulphur Gasoil
MD	Maximum Demand
MoE	Ministry of Energy
NECL	Ndola Energy Company Limited
NFT	Ndola Fuel Terminal
NWEC	North Western Energy Corporation Limited
OMC	Oil Marketing Company
OPEC	Organisation of the Petroleum Exporting Countries
PPA	Power Purchase Agreement
PQD	Power Quality Directives
PQMS	Power Quality Management System
PSA	Power Supply Agreement
SADC	Southern Africa Development Community
SAPP	Southern African Power Pool
UPP	Uniform Pump Price
TAZAMA	TAZAMA Pipelines Limited
TPPL	TAZAMA Petroleum Products Limited
ZABS	Zambia Bureau of Standards
ZEMA	Zambia Environmental Management Agency
ZSA	Zambia Statistics Agency
ZPL	Zengamina Power Company Limited
ZESCO	ZESCO Limited

UNITS OF MEASUREMENT

Bbl	Barrels of oil
GWh	Giga-Watt hour (1,000 MWh)
K	Zambian Kwacha
Km	Kilometre
kV	Kilo Volt
kVA	Kilo Volt Amperes (1,000 Volt Amps)
kW	Kilo Watt
kWh	Kilo Watt Hour
m/bd	million barrels per day
MW	Mega Watt
MWh	Mega Watt Hour (1,000 kWh)
MT	Metric Tonne (in this document means a mass equivalent to 1,000 kg)
m ³	Cubic Meters
US\$	United States of America dollar

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Ndola Energy Company Limited
North Western Energy Corporation Limited
Office for Promotion of Private Power Investment
Oil Marketing Companies
Road Transport and Safety Agency
Rural Electrification Authority
Southern African Power Pool
TAZAMA Pipelines Limited
TAZAMA Petroleum Products Limited
Zambia Atomic Energy
Zambia Statistics Agency
Zengamina Power Limited
ZESCO Limited

FOREWORD



Energy has continued to be the backbone of the Economy, sustaining economic transformations in Zambia. The role of the energy sector is particularly important for driving Zambia's economic growth. In order to increase access to energy which is necessary for stimulating economic growth for the country, competitive and stable energy prices are one of the key factors augmented by a strong and conducive regulatory framework. Therefore, for continued growth of the Zambian economy, the mandate of the Energy Regulation Board Energy (ERB), i.e. 'to regulate the energy sector', in line with the provisions of the Energy Regulation Act No. 12 of 2019, cannot be overemphasized. Further, the Seventh National Development Plan (7NDP) prioritizes investments in infrastructure and energy in order to improve the economic status of Zambia.

During 2019, the ERB in line with its vision, made significant progress towards ensuring the efficient provision of reliable and quality energy services and products, amidst several global and domestic challenges. According to the vision 2030, it is

envisaged that Zambia will achieve universal access to clean, reliable and affordable energy at the lowest total economic, financial, social and environmental cost consistent with national development goals, by 2030.

With the above background, it is with great pleasure that we present to you the 2019 edition of the Energy Sector Report which provides useful information pertaining to the performance of the energy sector in Zambia. The report highlights the various programs, projects and initiatives undertaken during the period under review and aimed at improving the performance of the sector. In addition, the report presents the key focus areas for the period under review as well as the opportunities and prospects, going forward.

In the petroleum sub-sector, the pursuit towards achieving cost reflective petroleum product prices continued to be the goal for the ERB during 2019. In line with the key factors that determine petroleum prices in Zambia, the ERB adjusted petroleum prices three times during 2019. There was one downward price adjustment in February and two upward price adjustments in September and December, 2019, respectively. As a way of enhancing national strategic reserves and supply of petroleum products, the Government continued upgrading the number and spread of fuel depots across the country. As at December, 2019, Mansa depot was 99 percent complete and it is envisaged that the depot will be completed and commissioned during 2020. Further in order to increase the number of retail sites in rural areas, the Government made significant progress at constructing fuel service stations in remote parts of the country. Two retail sites in Mporokoso and Luwingu districts of Northern Province were successfully developed, officially opened and leased out to Oil Marketing Companies (OMCs) during 2019.

Despite having recorded significant progress in several areas, the lack of adequate service stations in some rural areas and illegal fuel vending continued to be the major areas of concern for the petroleum sub-sector in 2019. Consequently, the ERB in collaboration with law enforcement agencies managed to seize illegal fuel valued at approximately ZMW 1.74 million and prosecuted suspected illegal fuel vendors during the year.

Beyond 2019, the petroleum sub-sector is expected to experience developments in many areas including the acquisition of a strategic partner for INDENI, in the quest to recapitalise and modernise the refinery in order to improve its efficiency. The Government pronouncement on Private Sector Participation in the procurement of petroleum products is also expected to be implemented with the enactment of the Petroleum Management Bill. Additionally, Government is expected to continue with the development of rural retail sites in 2020, with new areas such as Kalabo and Lukulu having already been identified.

The electricity sub-sector has over the years been adversely affected by the impact of climate change which has negatively impacted rainfall patterns and compromised the hydropower generation. In order to mitigate this, the Zambian Government in line with the objective of the National Energy Policy, 2019, targeting increased exploitation of renewable energy in order to diversify the energy mix, continued to embark on various initiatives such as, diversification of electricity sources, during 2019.

With regard to Renewable Energy development, remarkable progress was recorded in the year under review which included the commissioning of the 54.3 MW Bangweulu and 34 MW Ngonye solar power plants resulting in an increase of the percentage share for solar in the national installed generation mix to 3 percent from 0.04 percent in 2018. Furthermore, under the auspices of the Renewable Energy Feed in Tariff Strategy, the GETFiT Zambia programme, which is a partnership between Ministry of Energy and the Germany Development Bank (KfW) aimed at facilitating private sector investment in small and medium-scale renewable energy, awarded contracts to Six Solar PV Independent Power Producer (IPP) projects with a total capacity of 120 MW, in 2019. Additionally, the ERB in collaboration with Zambia Bureau of Standards (ZABS) with support from the International Finance Corporation (IFC) drafted standards for mini-grids as a way of complementing the Regulatory Framework for mini-grids. The new mini grid regulations are expected to be gazetted during 2020 to facilitate implementation.

In line with the national energy policy that aims to promote cost reflective tariffs in the electricity sub-sector, the ERB successfully re-launched the Electricity Cost of Service Study (COSS) on 3rd December, 2019 with continued funding from the African Development Bank (AfDB). The study is expected to be completed in a period of one year. In the meantime, the Government also continued making remarkable progress on the energy reforms. The National Energy Policy 2019 which sets out Government's intentions and provides an overarching framework for energy sector development was also approved by Cabinet. As a consequence of the Policy, we are proud to announce that the new Energy Regulation and Electricity Bills, aimed at enhancing the regulatory framework of the ERB and facilitating increased investment in the electricity sub-sector, were assented in December 2019 and Commencement Orders are expected in 2020.

Above all, we continue to trust and believe that the 2019 edition of the Energy Sector Report will be an important source of data and information to all stakeholders including the Government; other regulators; utilities; non-governmental organizations; the academia; investors and energy consumers regarding the developments that occurred in Zambia's energy sector during 2019. We further hope that the information shared in this report will serve as a valuable input for programmes and projects designed to improve the performance of the energy sector and the Zambian economy as a whole.



Langiwe Hope Lungu (Ms.)

Director General

July 2020

OVERVIEW OF THE ENERGY SECTOR IN ZAMBIA

Zambia's energy sector comprises electricity, petroleum and renewable energy. The primary sources of energy used in Zambia include: hydro, biomass, coal, wind, and petroleum. Out of these sources of energy, petroleum is the only energy resource that is wholly imported. Energy is one of the key sectors of the Zambian economy. According to Gazette Notice No. 6526 of 2016, the Ministry of Energy (MoE) is responsible for the development and management of the energy sector. Following the enactment of the Energy Regulation Act, Cap 436 of the Laws of Zambia the Energy Regulation Board (ERB) was established to regulate all undertakings in the energy sector.

The major players in the petroleum sub-sector include TAZAMA Pipelines Limited (TAZAMA), INDENI Petroleum Refinery Company Limited (INDENI), TAZAMA Petroleum Products Limited (TPPL), OMCs, Retailers (Dealers) and Transporters. While major players in the electricity subsector include, the vertically integrated ZESCO Limited (ZESCO), Copperbelt Energy Corporation (CEC), North Western Energy Corporation (NWECC), Independent Power Producers (IPPs), mini grid operators and solar in the renewable energy sub sector.

As at 30th September, 2019¹, Zambia's Gross Domestic Product (GDP) at current prices was estimated at K221,153.1 million with Electricity, gas and steam contributing 3.5 percent share, as shown below. However, in real terms, the electricity sector experienced negative growth of 4.9 percent² during the first three quarters of 2019 and contributed -0.1 percent to the national GDP.

Gross value added and percentage shares by industry at current prices, Q1 2018 to Q3 2019

KIND OF ECONOMIC ACTIVITY	2018				2019				2019 Annual Preliminary Shares
	Q1	Q2	Q3	Q1+Q2+Q3	Q1*	Q2*	Q3**	Q1+Q2+Q3	
Agriculture, forestry and fishing	2,230	2,029	1,616	5,875	2,442	2,214	1,673	6,329	2.9
Mining and quarrying	8,817	10,221	11,269	30,307	10,050	10,594	8,441	29,085	13.2
Manufacturing	4,945	4,962	6,096	16,002	5,147	5,571	6,239	16,957	7.7
Electricity, gas, steam	1,805	2,222	2,377	6,404	2,628	2,603	2,599	7,830	3.5
Water supply	231	187	179	597	186	202	196	584	0.3
Construction	4,704	6,243	7,138	18,086	6,117	6,127	6,767	19,011	8.6
Wholesale and retail trade	12,316	13,444	16,013	41,773	15,042	16,075	18,485	49,602	22.4
Transportation and storage	4,327	4,540	5,596	14,462	4,999	5,252	5,937	16,188	7.3
Accommodation and food service activities	787	992	1,114	2,893	921	1,048	1,188	3,157	1.4
Information and communication	1,107	1,087	1,158	3,353	1,100	1,163	1,230	3,494	1.6
Financial and insurance activities	3,708	3,872	3,385	10,966	3,900	4,027	4,043	11,970	5.4
Real estate activities	2,880	2,999	3,108	8,986	3,276	2,613	2,632	8,520	3.9

¹ At the time when the report was prepared, information for the fourth quarter was not available.

² Gross Value Added by industry at constant 2010 prices, Q1+Q2 +Q3 of 2019

KIND OF ECONOMIC ACTIVITY	2018				2019				2019 Annual Preliminary Shares
	Q1	Q2	Q3	Q1+Q2+Q3	Q1*	Q2*	Q3**	Q1+Q2+Q3	
Professional, scientific and technical	715	908	888	2,512	1,121	1,351	1,278	3,750	1.7
Administrative and support service	699	681	694	2,075	787	901	817	2,506	1.1
Public administration and defense	2,410	2,463	2,411	7,284	2,496	2,561	2,665	7,722	3.5
Education	4,108	4,202	4,109	12,418	4,063	4,230	4,351	12,644	5.7
Human health and social work activities	622	663	608	1,893	599	629	652	1,879	0.8
Arts, entertainment and recreation	91	197	319	607	113	256	385	754	0.3
Other service activities	222	336	358	916	230	506	274	1,010	0.5
Total Gross Value Added for the economy	56,724	62,247	68,437	187,408	65,217	67,924	69,852	202,993	91.8
Taxes less subsidies	4,556	4,948	5,873	15,377	5,507	5,885	6,768	18,160	8.2
Total for the economy, at market prices	61,281	67,195	74,310	202,785	70,724	73,810	76,620	221,153	100.0

Source: Zambia Statistics Agency (ZSA)

1.0 INTRODUCTION

Macro-economic Outlook

The global economy was forecasted to grow by 2.9 percent in 2019 compared to 3.9 percent recorded in 2018. This was the lowest level of global economic growth experienced since 2008 to 2009³. A notable feature of the sluggish growth in 2019 was the sharp and geographically broad-based slowdown in manufacturing and global trade. This was driven by the higher tariffs such as those between the United States of America (USA) and China, as well as the prolonged uncertainty surrounding trade policy which depressed investment and demand for capital goods, which are heavily traded. The automobile industry contracted owing to shocks, such as disruptions from new emission standards in the euro area and China that have had durable effects.

According to the World Bank, Sub-Saharan Africa's economic growth remained slow due to the persistent uncertainty in the global economy and the slow pace of domestic reforms. Overall growth in Sub-Saharan Africa was projected to rise to 2.6 percent in 2019 from 2.5 percent in 2018. The recovery in the region's three largest economies (i.e. Nigeria, South Africa, and Angola) remained weak and was weighing on the region's prospects. In Nigeria, growth in the non-oil sector had been sluggish, while in Angola the oil sector remained weak. In South Africa, low investment sentiment weighed on economic activity. Meanwhile, the average growth among non-resource-intensive countries was also projected to edge down, reflecting the effects of tropical cyclones in Mozambique and Zimbabwe, political uncertainty in Sudan, weaker agricultural exports in Kenya, and fiscal consolidation in Senegal⁴.

In the domestic economy Zambia's Real GDP growth rate was projected to slow down to 2 percent in 2019, down from 3.7 percent in 2018. Zambia's economy was hit by drought in the south and western parts of the country which lowered the 2018/19 agricultural production and hydropower electricity generation considerably. Severe electricity rationing followed and long periods of electricity outages which resulted in dampened activities in almost all economic sectors. The year-on-year inflation rate at the end of December 2019 was recorded at 11.7 percent from 7.9 percent in December 2018. The increase in inflation reflected a combination of an increase in prices for food items, upward adjustments in fuel prices as well as the pass through effect from the depreciation of the Kwacha⁵.

In 2019, the Bank of Zambia (BOZ) increased the Monetary Policy Rate twice in May and November 2019, to 10.25 percent and 11.50 percent, respectively⁶. The increase was mainly taken to counter the inflationary pressure that included exchange rate pass-through effects and hence support the overall macroeconomic stability in the country.

During the period under review, the average commercial banks' lending rates increased to 25.63 percent from 23.92 percent in 2018. This rise was in response to the increase in the cost of funds as reflected by the monetary policy rate upward adjustments in May and November 2019, respectively.

Generally, in 2019 the Kwacha exchange rate depreciated against the United States Dollar. The Kwacha averaged K11.99/US\$ in the first quarter and declined to K12.90/US\$ in the second quarter. The rate further depreciated to K13.00/US\$ and K13.87/US\$ in the third and fourth quarter, respectively. According to the Ministry of Finance (MoF), the depreciation was attributed to the heightened demand in the market induced by petroleum, electricity and fertilizer imports, amidst reduced supply of foreign exchange⁷.

³ <https://www.imf.org/en/Publications/WEO>

⁴ <https://www.worldbank.org/en/news/press-release/2019/10/09/global-uncertainty-continues-to-slow-growth-in-africas-economies>

⁵ <https://www.mof.gov.zm/download/speeches/MINISTERIAL-STATEMENT-ON-THE-STATE-OF-THE-ECONOMY-BY-HONOURABLE-MINISTER-OF-FINANCE-DR.-BWALYA-K.E-NG%25E2%2580%2599ANDU-FEBRUARY-2020.pdf>

⁶ <https://www.boz.zm/monitory-policy-decisions.htm>

⁷ Ministry of Finance, Ministerial Statement – February, 2020

Performance of the Global Energy Sector

According to the International Energy Agency (IEA), global energy demand increased by 0.9 percent in 2019 compared to 2.3 percent in 2018⁸. This deceleration was mainly due to slower global economic growth and the impact of milder weather on heating and cooling. There was, however, significant variation across energy sources, with coal showing an absolute decline and renewables recording an increase. Electricity demand grew at the slowest rate since the financial crisis. Energy efficiency continued to improve but at levels well below those needed to meet the Sustainable Development Goals (SDGs).⁹

In 2019 the global renewables underwent both the largest absolute growth and the fastest rate of growth, with their overall use increasing by 3.7 percent. Wind power and solar photovoltaic (PV) power experienced another year of double-digit growth, although solar PV growth slowed. While use of renewables expanded in almost all regions, more than 40 percent of the global growth in electricity generation from renewables was concentrated in China. Further, during 2019, renewable energy outpaced coal by providing 23 percent of power generated, compared to coal's 20 percent share.

Meanwhile the demand for electricity increased only a third of the rate of growth rate (4%) seen in 2018 as demand fell in almost all major advanced economies. Global demand growth slowed not only because of lower economic growth, but also because heating and cooling energy demand fell while energy efficiency improved. Lower electricity demand growth underpinned the global decline in coal demand.

The demand for oil, including biofuels, grew in 2019 by 0.8 percent or 0.8 million barrels per day (mb/d), led by growth in China¹⁰. Crude oil prices fluctuated between US\$68.60/bbl and US\$51.38/bbl, during 2019. The prices rose to peak levels in the first quarter mainly as a result of increased demand amidst reduced supply caused by commitment by the Organisation for Petroleum Exporting Countries (OPEC) and participating non-OPEC countries to restore global oil market stability. Beyond the first quarter peaks, crude oil prices started to decline due to uncertainty about world economic and global oil demand outlooks and the continued trade tensions between the USA and China. The decline continued until mid-year when relative stability was attained and until the last quarter of 2019 when the prices started to gradually rise again. The gradual increase in the fourth quarter was caused by increased demand from Asia which was supported by positive expectations for trade agreement between the USA and China, as well as improved expectations for global oil demand amongst better than expected economic indicators in some major economies.

Performance of the Petroleum Sub-sector – Zambia

In 2019, national consumption of petroleum products increased to 1,453,190 MT from 1,344,908 MT reflecting an increase of 8.1 percent. Generally, there was an increase in the consumption for all petroleum products in 2019 compared to 2018 except for kerosene. The increase in petroleum consumption was matched by an increase in the number of operational retail sites which increased from 354 in 2018 to 364 in 2019. Additionally, there was an increase in the number of OMCs to 91 from 87 in 2018 while the number of licensed lubricant dealers also increased from 28 in 2018 to 59.

The ERB made three price adjustments in February, September and December, 2019, respectively. In February, 2019, the prices of fuel were reduced while prices were revised upwards in September and December 2019. The movements in fuel prices were largely due to the depreciation of the Zambian Kwacha against the United States Dollar and rise of crude oil prices on the global market.

The ERB continued to implement the fuel marking programme and 1,533,517.93m³ of fuel was marked in the period under review. There was an increase in the pass rate of the fuel marked from 79 percent in 2018 to 96.97 percent in 2019. The increase in the pass rate showed that most of the fuel that was distributed in the country was from legitimate sources and of acceptable quality.

⁸ <https://www.iea.org/reports/global-energy-review-2019>

⁹ <https://www.iea.org/reports/global-energy-review-2019>

¹⁰ <https://www.eia.gov/todayinenergy/detail.php?id=42415>

In line with the 7NDP strategy of enhancing strategic reserves and supply of petroleum products, the Government continued upgrading the number and spread of fuel depots across the country in 2019. Under the programme of strategic petroleum reserves enhancement, the Government had commenced the construction of Mansa (6.5 million litres) and Chipata (7.0 million litres) fuel depots in 2018. During the year under review, Mansa fuel depot had reached 99 percent completion, while Chipata was at 8 percent. Further, two rural retail sites, namely the Mporokoso and Luwingu were officially opened and leased out to OMCs to provide retail services in rural areas in 2019.

Performance of the Electricity Sub-sector – Zambia

In 2019, the national installed capacity of electricity increased to 2,981.31MW¹¹ from 2,898.23 MW in 2018, representing a 2.86 percent increase. This was mainly attributed to the commissioning of the 54.3 MW Bangweulu and 34 MW Ngonye solar power plants. Additionally, standard micro grids for solar (0.067 MW) were also commissioned. Meanwhile, ZESCO decommissioned 5.28 MW diesel power plants as follows: Kabompo (2 MW); Zambezi (1.36 MW); Mufumbwe (0.8 MW); Lukulu (0.32); and Chavuma (0.8 MW). The decommissioning was mainly on account of connecting the districts to the national grid. Despite the increase in the national installed capacity, the generation sent out declined from 16,189 GWh in 2018 to 15,040 GWh in 2019, reflecting a 7.1 percent decline. This was due to the poor rainfall pattern recorded in the 2018/2019 rainy season and led to ZESCO to carry out demand load management in the second half of the year. Consequently, according to ZSA, the electricity sector experienced negative growth of 4.9 percent and contributed -0.1 percent to the national GDP in the first three quarters of 2019.

During the period under review, the ERB approved ZESCO's application to increase tariffs by an average of 113 percent across its customers except for mining, exports and Power Purchase Agreements (PPA) based customers. The analysis of ZESCO's tariff application was premised on principles of Revenue Requirement, that is, revenues of the regulated Utilities have to cover the utility's operating expenses, taxes and depreciation and ensure a fair rate of return (profit) on assets utilised for production and supply of electricity and energy services. ZESCO had stated that the rise in the cost of power purchases from local Independent Power Producers (IPPs) and rising Operating and Maintenance (O&M) costs with no corresponding increases in revenue posed a threat to the viability of the company. On the basis of ZESCO's financial information, the ERB determined ZESCO's revenue requirement to meet part of the O&M costs and earn a reasonable return.

In addition, Government continued making progress on the energy reforms, during 2019. Cabinet approved the 2019 National Energy Policy arising from the review of the 2008 National Energy Policy which was necessitated to incorporate new developments not only in the energy sector and the entire economy but also the regional and international environment as the country aspires to become a middle-income economy by 2030. As a result of the Policy, the new Energy Regulation and Electricity Bills, aimed at enhancing the regulatory framework of the ERB were enacted and Commencement Orders were expected in 2020. Further, the ERB successfully re-launched the Electricity COSS on 3rd December, 2019 with continued funding from the African Development Bank (AfDB). The ERB engaged Energy Market and Regulatory Consultants (EMRC) as Consultants to undertake and complete the study within 12 months. The major focus of the study among others is to determine the economic cost of supply of electricity from generation, transmission, distribution, and supply and determine the appropriate structure and levels of economic tariffs per customer category. The terms of reference for the study are presented in appendix 9.

Performance of the Renewable Energy Sub-sector - Zambia

During the period under review, there was an addition of 88.3 MW of renewable energy capacity through the commissioning of the 54.3 MW Bangweulu and 34 MW Ngonye solar power plants. These two power plants contributed to the increase in the diversification of the national installed generation mix with percentage share for solar increasing to 3 percent from 0.04 percent in 2018.

¹¹ Other Independent Generators such as Zambia Sugar and Dangote are not included in the installed capacity

Additionally, under the auspices of the Renewable Energy Feed in Tariff Strategy, the GETFiT Zambia programme, which is jointly managed by the Ministry of Energy (MoE) and KfW Development Bank, continued with the programme aimed at facilitating private sector investment in small and medium-scale renewable energy Independent Power Projects in the country. In 2019, GETFiT Zambia awarded contracts to six Solar PV Independent Power Producer (IPP) projects with a total capacity of 120 MW.

Further, in order to complement the Regulatory Framework for Mini-grids, the ERB in collaboration with Zambia Bureau of Standards (ZABS) with support from the International Finance Corporation (IFC) developed standards for mini-grids. The standards will provide technical specifications in the design, safety and reliability in operation and maintenance of mini-grid systems in Zambia. The rationale is to enhance the ease of doing business in the renewable energy sub-sector for private companies intending to invest in rural areas and increase the low electrification rates in rural areas. It is expected that the new mini grid regulations and standards will be gazetted during 2020, after which the rules will be implemented.

The report is arranged in six sections as follows: section one presents the introduction, section two highlights the performance, focus areas and outlook in the petroleum subsector in 2019, section three highlights the performance and the outlook in the electricity subsector, section four discusses the performance of the renewable energy subsector, section five discusses licensing in the energy sector while section six discusses consumer affairs issues.

2.0 PETROLEUM SUB-SECTOR

This section discusses Zambia's petroleum sub-sector value chain. In particular, the section discusses the performance of the upstream and downstream players in the petroleum sub-sector. The upstream players include INDENI, TAZAMA and TPPL while downstream players include OMCs, Retailers (Dealers) and Transporters. The section also highlights the licensing activities performed by the ERB during the year under review with regards to auditing, compliance monitoring and development of standards. Further, the focus areas and outlook in the petroleum sub-sector are also discussed.



Petroleum products bulk storage tanks

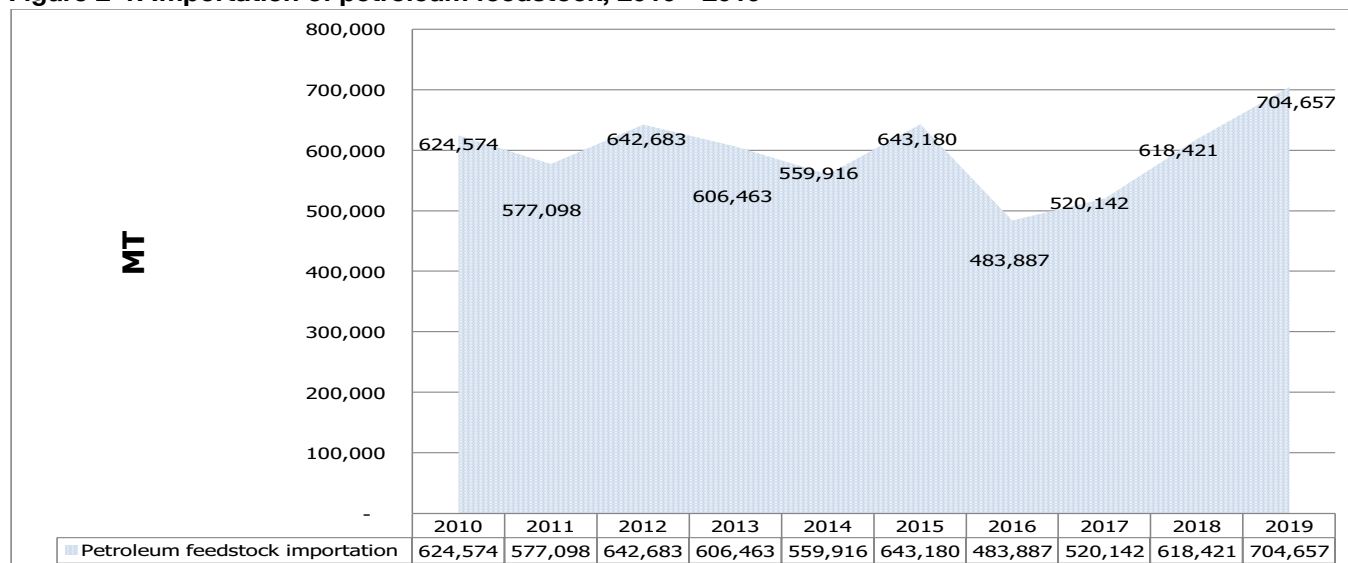
2.1 IMPORTATION OF FUEL

As there are no known reserves of crude oil in Zambia, the country's petroleum requirements are serviced by the importation of petroleum feedstock and finished products by both Government and OMCs. Zambia imports petroleum feedstock in form of spiked crude oil and finished products mainly from the Middle East. The finished petroleum products include petrol, Low Sulphur Gasoil (LSG), Jet A-1, Liquefied Petroleum Gas (LPG) and Heavy Fuel Oil (HFO). Spiked crude oil typically comprises 46 percent diesel, 41 percent crude oil (from Oman or Murban) and 13 percent condensate/naphtha. The Government through competitive bidding selects a supplier for petroleum feedstock. The product is then pumped through the 1,710 km TAZAMA Pipeline to INDENI for processing into finished products. The finished products are stored at the TPPL and then sold to various OMCs.

2.1.1 Importation of petroleum feedstock

In 2019, there was an increase in the volume of imported petroleum feedstock to 704,657 MT from 618,441 MT in 2018 reflecting 13.9 percent increase. In 2019, there were seven cargoes imported compared to six cargoes in 2018. The number and composition of the cargoes to be imported is mainly driven by the market demand. Figure 2-1 shows the trend in the importation of petroleum feedstock in the country from 2010 to 2019.

Figure 2-1: Importation of petroleum feedstock, 2010 - 2019



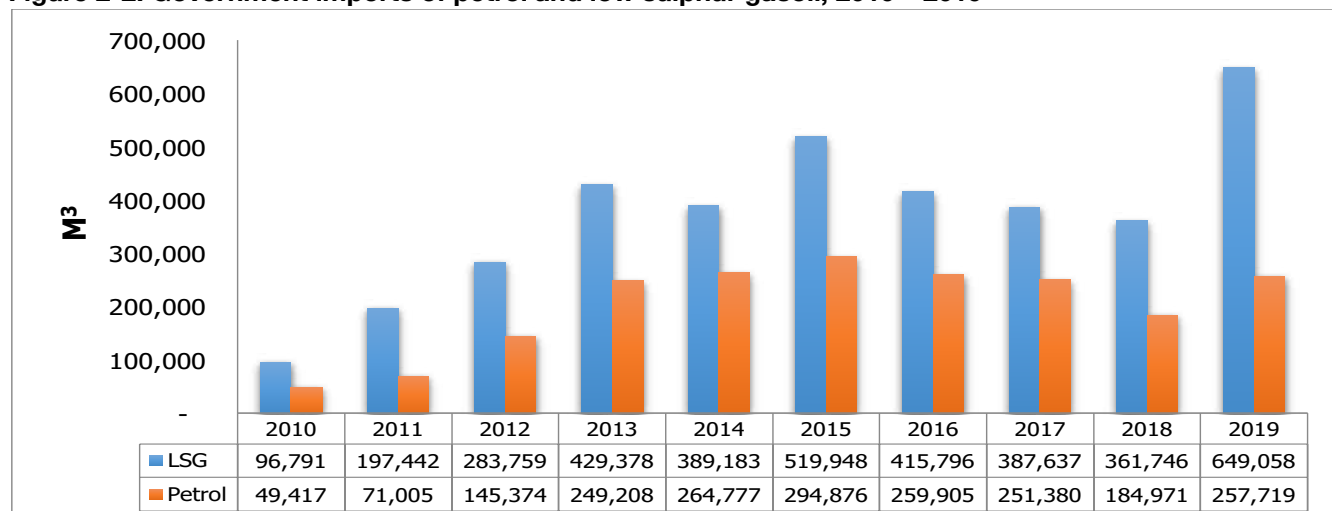
The average imported petroleum feedstock from 2010 to 2019 was 598,104 MT. Generally, in the last five years the importation of petroleum feedstock was above the average except for 2016 and 2017. The dip in 2016 was on account of a rejected cargo that was imported while the dip in 2017 was attributed to relatively fewer cargoes imported, as Zambia imports an average of six cargoes per year.

2.1.2 Importation of finished petroleum products

2.1.2.1 Government imports of petrol and low sulphur gasoil

Petrol and LSG are imported by Government contracted suppliers to complement INDENI production. In the second half of 2018, the ERB revoked the importation waiver that was granted to selected OMCs to import petrol and diesel. This decision was in place until 15th December 2019 when selected OMCs were again granted waivers to import petrol and LSG. The implication of this decision was an increase in the volumes of imports supplied by Government suppliers for both petrol and LSG to meet the market demand. Government imports of petrol increased from 184,971 M³ in 2018 to 257,719 M³ reflecting an increase of 39.3 percent. Similarly, the importation of LSG increased to 649,058 M³ in 2019, from 361,746 M³ in 2018, representing 79.4 percent, increase. Figure 2-2 shows the trend in annual imports of volumes of petrol and LSG from 2010 to 2019.

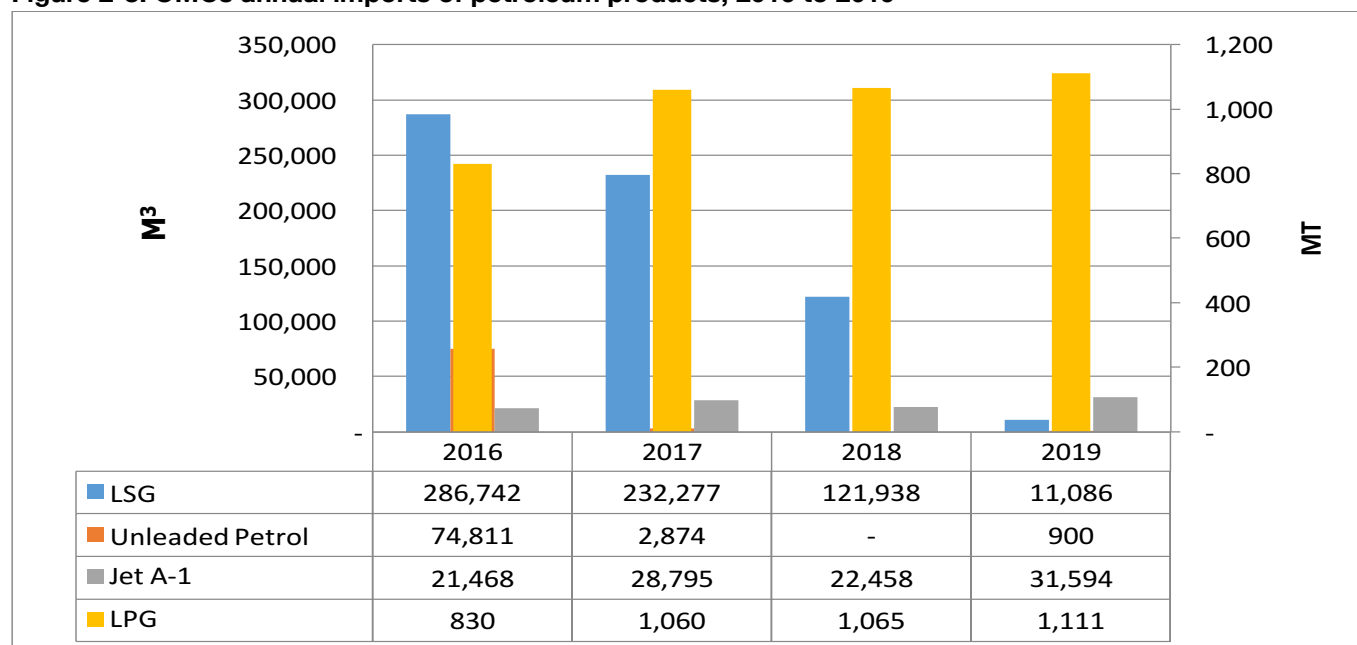
Figure 2-2: Government imports of petrol and low sulphur gasoil, 2010 – 2019



2.1.2.2 Imports of finished petroleum products by OMCs

In December 2019, INDENI went on shutdown due to lack of petroleum feedstock. Consequently, the Government issued a waiver to selected OMCs to import prescribed volumes of petrol and LSG to ensure security of supply in the country. As at 31st December 2019, 11,086 M³ and 900 M³ of LSG and petrol, respectively, were imported into the country by OMCs. Figure 2-3 depicts the annual imports of petroleum products by OMCs from 2016 to 2019.

Figure 2-3: OMCs annual imports of petroleum products, 2016 to 2019¹²



The importation of LPG increased in 2019 to 1,111 MT compared to 1,065 MT in 2018 reflecting 4.3 percent increment. Similarly, the importation of Jet A-1 increased by 40.7 percent from 22,458 M³ in 2018 to 31,594 M³ in 2019.

2.2 OPERATIONS AT TAZAMA PIPELINES LIMITED

TAZAMA was commissioned in 1968 and had a plated throughput capacity of 1.1 million MT per annum. With time, TAZAMA pipeline's throughput capacity has reduced to about 800,000 MT per annum, attributed mainly to wear and tear of the pipeline. Consequently, the contribution of the crude oil which is transported through TAZAMA pipelines, to national demand has gradually fallen over the years. As at the end of 2019, the contribution of the crude oil to national demand was 43.3 percent.

¹² LPG is measured in MT

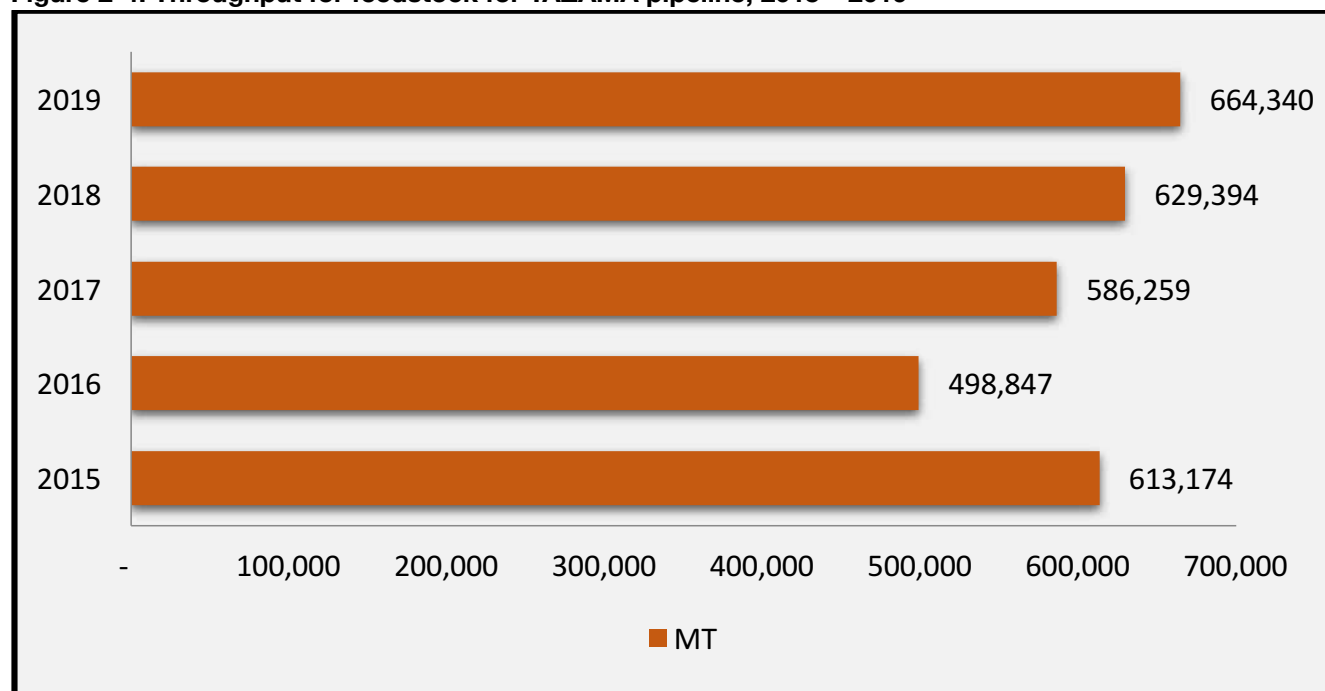


Delegation taking a tour at TAZAMA Pipelines Limited

2.2.1 TAZAMA throughput

In 2019, TAZAMA operated at a throughput of 664,339.69 MT, compared to a throughput of 629,394 MT in 2018, representing an increase of 5.55 percent. The increased throughput was mainly as a result of replacement of old engines. As at the end of 2019, TAZAMA had replaced engines, at 5 out of 7 pump stations. During the five year period from 2015 to 2019, the pipeline operated at an average throughput of 598,403 MT. Figure 2-4 depicts the throughput for TAZAMA from 2015 to 2019

Figure 2-4: Throughput for feedstock for TAZAMA pipeline, 2015 – 2019



2.2.2 Rehabilitation and maintenance works at TAZAMA



Pipeline replacements in Tanzania

During the year under review, TAZAMA conducted rehabilitation works on the pipeline and pumping stations. The rehabilitations and replacement works at TAZAMA are conducted on an annual basis in order to enhance reliability of the pump stations and pipeline infrastructure. The rehabilitations and replacement works conducted by TAZAMA during the year under review are depicted in table 2-1.

Table 2-1: TAZAMA rehabilitations and maintenance works

No.	Rehabilitation Works	Status/Comment
1.	Rehabilitation of crude oil storage tank ZT1 at Kigamboni Tank Farm in Dar es Salaam, Tanzania	The rehabilitation works on ZT1 that commenced in 2018, to replace bottom plates were completed in 2019. During 2019, the planned annual rehabilitation programmes of repairing the storage tank and sand blasting was done to improve the tank integrity and reliability thereby securing the storage of crude oil.
2	Rehabilitation of crude oil storage tank ZT5 at Kigamboni Tank Farm in Dar es Salaam, Tanzania	The rehabilitation program on ZT5 was conducted to repair some leakages observed on the tank, repair the landing rake as well as mending of the floating roof deck. By the end of 2019, the rehabilitation works were on-going and being carried out as part of the in-house works to improve the integrity and reliability of the tank.
3	Replacement of main pumping units at Morogoro and Mbeya pumping stations in Tanzania	This is part of the on-going project of replacement of all old pumping units to improve the pump station discharge and enhance reliability of the pumping station. Five out of the seven pump stations have so far been completed
4	Pipeline Rehabilitation	This was part of the on-going rehabilitation program carried out in-house to improve the reliability of the pipeline. The exercise involves replacement of corroded sections of the pipeline and replacement of eight inch pipes with 12 inch pipes.

2.3 OPERATIONS AT INDENI PETROLEUM REFINERY COMPANY LIMITED

INDENI was established in 1973, designed to process comingled or spiked crude¹³. INDENI processes a variety of petroleum products through the refining of petroleum feedstock. The main products refined from the feedstock are white and black products¹⁴ which include LPG, Butane, unleaded petrol, kerosene, Jet A-1, Automotive Gasoil, Fuel Oil, Bitumen and other petroleum products¹⁵.

INDENI has a name plate (design) throughput capacity of 1,100,000 MT per annum and a plated processing rate was 165 m³/Hr. However, the throughput capacity has over the years reduced to around 850,000 MT per annum due to wear and tear of the plant. INDENI's annual throughput per year is largely reliant on the volume of petroleum feedstock received from TAZAMA.



INDENI Petroleum Refinery Plant

2.3.1 INDENI throughput

INDENI throughput during the five year period, 2015 to 2019 averaged 626,943.60 MT. In 2019, INDENI recorded the highest throughput for the period at 700,277 MT, compared to 646,907 MT, recorded in 2018, while the lowest throughput was 544,069 MT, recorded in 2016. In 2019, the refinery was operational for 330.43 days, having shut down for 34.57 days due to lack of petroleum feedstock to process¹⁶. This was against 293 days of operation and 72 days of shutdown in 2018.

The 34.57 shutdown days reported in 2019 were lower than the set ERB Technical KPI shutdown days of 50, indicating that INDENI achieved its KPI target on operational days. Figure 2-5 shows petroleum feedstock processed by INDENI, during the period 2015 to 2019.

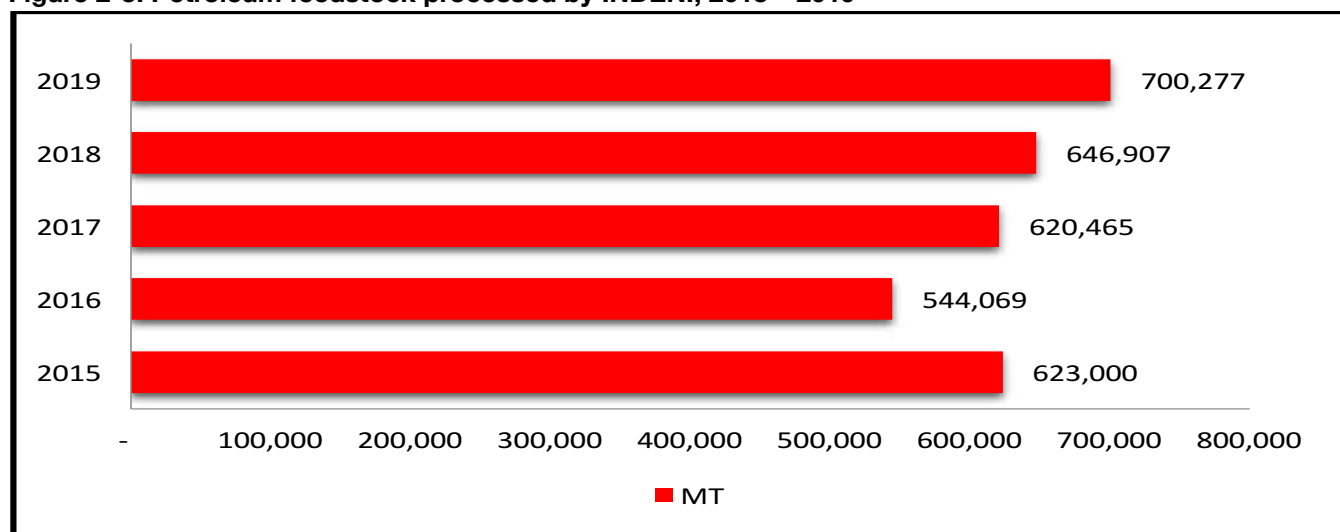
¹³ Comingled or spiked crude is a mixture of crude oil, gasoil and naphtha that is procured to meet the configuration of the refinery plant.

¹⁴ White petroleum products are refined products which contain no Sulphur while Black products contain Sulphur within them.

¹⁵ Other products that come from the refinery include Reformate, Special cut kerosene, Industrial kerosene and Illuminating kerosene.

¹⁶ During the period when there's lack of feedstock at INDENI, Government normally contracts OMCs to import petroleum products through the issuance of waivers. This was the case in 2019

Figure 2-5: Petroleum feedstock processed by INDENI, 2015 – 2019



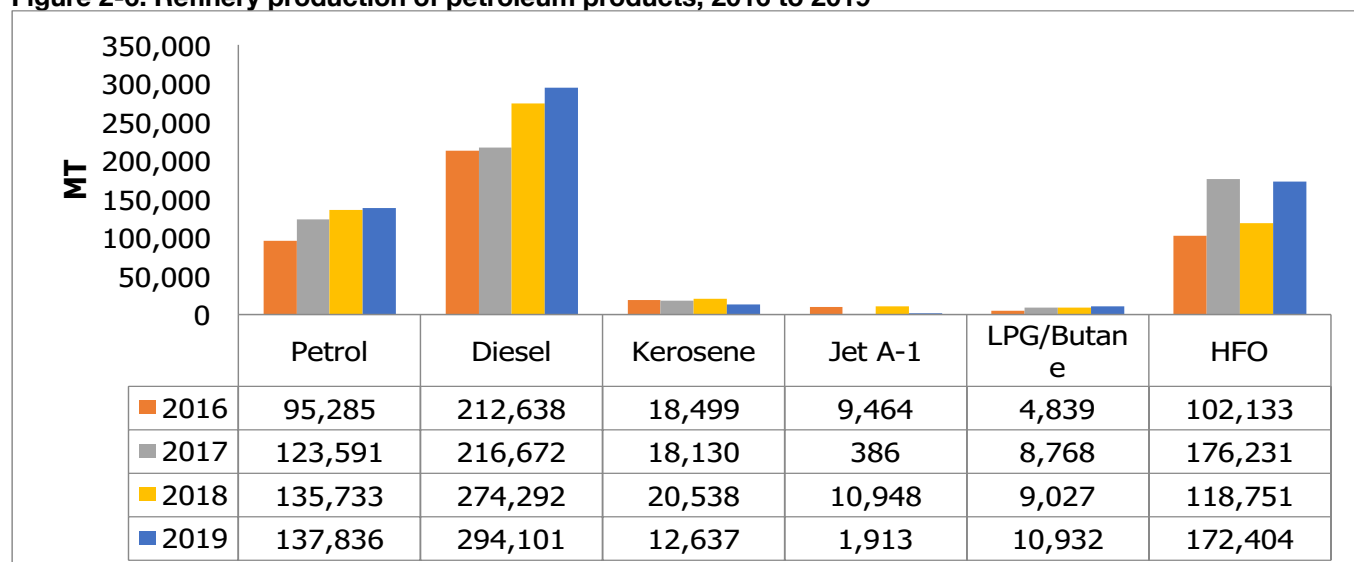
Source: INDENI

There was no production of bitumen due to lack of suitable petroleum feedstock. However, the plant was available for production of bitumen.

2.3.2 INDENI refinery production of petroleum products

During the past five years, INDENI has produced close to 50 percent of the total petrol and diesel consumed in the country, however, this pattern has since changed in the last three years. For instance in 2019, INDENI accounted for 35.2 percent of the national consumption of diesel and petrol. This was 0.2 percentage points lower than 35.4 percent accounted for in 2018. The contribution by INDENI towards national consumption has been falling on account of the state of the infrastructure and changes in demand i.e. INDENI does not produce LSG¹⁷ which is now the standard requirement by most users such as the mines and other specialized users. The balance of the national requirement is supplied as imported finished products. Figure 2-6 shows the Refinery production of petroleum products from 2016 to 2019.

Figure 2-6: Refinery production of petroleum products, 2016 to 2019



In 2019, like the previous years, diesel was the most produced petroleum product at 294,101 MT reflecting 7.2 percent increase compared to 274,292 MT, produced in 2018. The dominance of high diesel consumption is due to the high demand by the mines, which in 2019 accounted for 286,001 MT or 32.3 percent. HFO was the second highest produced at 172,404 MT from 118,751 MT, reflecting an increase of 45.2 percent. This

¹⁷ Low sulphur gasoil contains 0.005ppm Sulphur content while automotive gasoil (diesel) contains 0.50 ppm sulphur content

increase was mainly attributed to the processing of mostly Oman feedstock which has a higher HFO yield. The use of Oman crude feedstock was deliberate and was necessitated by the need to provide more feedstock of fuel to Ndola Energy Company Limited's (NECL) HFO power plant, following the reduction in generation by ZESCO's hydro power plants. Zambia normally imports Murban crude which produces relatively less HFO than Oman crude.

As depicted in figure 2-6 above, the production of all petroleum products generally increased except for Jet A-1 and Kerosene which declined in 2019 compared to 2018.

2.4 NATIONAL CONSUMPTION OF PETROLEUM PRODUCTS

In 2019, the total national consumption of petroleum products increased from 1,344,908 MT in 2018 to 1,453,190 MT, reflecting an increase of 8.1 percent. There was an increase in the consumption for all petroleum products in 2019 compared to 2018 except for kerosene. Generally, kerosene consumption has been declining since 2015. This can be attributed to the low market demand driven by increased availability and access to modern fuels at household level such as electricity, solar lamps and batteries. Table 2-2 shows the national consumption of petroleum products in the country, from 2010 to 2019.

Table 2-2: National fuel consumption of petroleum products by type, 2010–2019

	Heavy Fuel Oils (MT)	LPG (MT)	Jet-A1 (MT)	Kerosene (MT)	Unleaded Petrol (MT)	Diesel (MT)	Total Consumption
2010	46,845	1,848	29,130	17,330	160,982	496,568	752,703
2011	49,461	2,424	32,593	19,898	182,123	577,836	864,335
2012	60,222	658	49,477	14,669	234,224	675,756	1,035,006
2013	50,793	3,021	49,613	12,315	275,604	676,078	1,067,425
2014	116,821	3,680	38,049	13,776	304,562	700,577	1,177,465
2015	129,149	3,230	44,160	18,300	366,524	818,418	1,379,781
2016	97,881	2,742	27,237	16,045	347,266	791,277	1,282,449
2017	161,766	4,719	26,070	16,242	325,940	794,485	1,329,222
2018	144,610	7,006	27,106	15,335	327,029	823,822	1,344,908
2019	173,485	7,841	29,005	10,831	346,575	885,453	1,453,190

In 2019, diesel was the most consumed product at 885,453 MT (1,054,111 M³)¹⁸ followed by petrol at 346,575 MT (462,100 M³)¹⁹, while the least consumed was LPG at 7,841 MT.

Consumption of diesel increased by 7.5 percent, from 823,822 MT (974,307 M³) in 2018 to 885,453 MT (1,054,111 M³) in 2019. Similarly, the consumption of petrol increased by 6.0 percent, from 327,029 MT (436,039 M³) in 2018 to 346,575 MT (463,021 M³) in 2019.

The national consumption of HFO increased by 20.0 percent; from 144,610 M T in 2018 to 173,485 MT in 2019. During 2019, there was increased demand for HFO for power production necessitated by low water levels and reduced hydro power generation.

Further, during 2019, the consumption of Jet A-1 increased by 7.0 percent from 27,106 MT (34,792 M³) recorded in 2018 to 29,005 MT (36,484 M³).

The national consumption of LPG increased by 11.9 percent from 7,006 MT in 2018 to 7,841 MT in 2019, while the national consumption of kerosene decreased to 10,831 MT (13,538 M³) in 2019 from 15,335 MT (23,019 m³) in 2018.

¹⁸ In the case of diesel, 1 Metric Tonne is equivalent to 1.19 m³ using a density of 0.84 kilograms/litre.

¹⁹ In the case of petrol, 1 Metric Tonne is equivalent to 1.33 m³ using a density of 0.75 kilograms/litre.

2.4.1 Daily national average consumption of petroleum products

Table 2-3 shows the trend in national average daily consumption of petroleum products for the period 2012 to 2019. During the period under review, the average daily consumption of all petroleum products (except kerosene), increased compared to 2018.

The daily national average consumption for diesel increased to 2,887,785 litres from 2,686,959 litres in 2018. Similarly, the daily national average consumption of petrol increased to 1,266,029 litres in 2019 from 1,194,627 litres in 2018.

Further, the daily national average consumption of Jet A-1 increased to 99,956 litres from 93,411 litres in 2018. Meanwhile, the national daily average consumption of HFO and LPG increased to 475,302 kg and 20,973 kg in 2019 from 396,192 kg and 19,195 kg in 2018, respectively. Meanwhile, the daily national average consumption for kerosene reduced to 37,091 litres in 2019 from 52,847 litres in 2018.

Table 2-3: Daily national average consumption, 2012 – 2019

	Diesel (L)	Unleaded Petrol (L)	Kerosene (L)	Jet A-1 (L)	Heavy Fuel Oil (Kgs)	LPG (Kgs)
2012	2,178,102	855,614	50,237	169,441	164,993	1,802
2013	2,179,138	1,006,772	42,297	169,907	139,160	8,278
2014	2,284,986	1,112,555	47,474	131,126	320,058	10,083
2015	2,669,334	1,338,901	63,065	152,183	353,834	8,849
2016	2,580,813	1,268,551	54,950	93,863	268,168	7,513
2017	2,591,276	1,190,649	55,972	89,841	443,196	12,929
2018	2,686,959	1,194,627	52,847	93,411	396,192	19,195
2019	2,887,785	1,266,029	37,091	99,956	475,302	20,973

2.4.2 Daily national average consumption by province

The provincial average daily consumption of diesel, petrol and kerosene in 2019 is depicted in table 2-4. Lusaka, Copperbelt and North Western provinces consumed most of the petroleum products, while Luapula, Muchinga and Western provinces, in that order, consumed the least volumes of petroleum products during 2019.

Table 2-4: Provincial average daily consumption of diesel, petrol and kerosene, 2019

Product	Diesel (L)	Unleaded Petrol (L)	Kerosene (L)	Total
Central	159,086.00	78,235.30	1,353.40	238,674.70
Copperbelt	772,524.80	263,408.30	9,965.30	1,045,898.40
Eastern	72,252.00	67,216.40	1,468.80	140,937.20
Luapula	35,538.10	20,233.60	5,490.00	61,261.70
Lusaka	859,975.00	651,573.10	14,580.20	1,526,128.30
Muchinga	27,330.00	16,189.70	334.30	43,854.00
Northern	59,716.10	28,606.10	2,499.80	90,822.00
Northwestern	757,300.10	40,489.20	509.90	798,299.20
Southern	119,292.00	85,706.00	889.30	205,887.30
Western	24,770.90	14,370.90	0.40	39,142.20
Total	2,887,785.00	1,266,028.60	37,091.40	4,190,905.00

The national daily average consumption of diesel, petrol and kerosene combined was 4,190,905 litres in 2019. In terms of provincial daily average consumption, Lusaka province accounted for the largest proportion of the national average daily petroleum consumption at 36.4 percent (1,526,128.3 litres). This comprised 859,975 litres of diesel, 651,573.1 litres of petrol and 14,580.2 litres of kerosene.

Copperbelt province was the second province with the largest proportion of the national average daily petroleum consumption at 1,045,898.4 litres reflecting 25.3 percent of the total national average daily consumption. This comprised 772,524.8 litres of diesel, 263,408.3 litres of petrol and 9,965.3 litres of kerosene.

North-Western province was the third highest consumer of diesel, Kerosene and petrol accounting for a combined average daily consumption of 798,299.3 litres. This reflected 19.0 percent of total national average daily consumption and comprised 757,300 litres of diesel and 40,489 litres of petrol.

In terms of overall average daily consumption, the highest top three provinces (Lusaka, Copperbelt and North Western provinces) consumed 80.4 percent of the total national daily average consumption. This is in line with the level of economic activities in these provinces and the number of retail outlets. Specifically, the mines on the Copperbelt province and North Western Province consume a lot of diesel.

Meanwhile, the lowest three provinces (Luapula, Muchinga and Western) accounted for 3.4 percent of the total national daily average consumption of the three petroleum products combined. Amongst these, Western province recorded the lowest (0.9 percent) followed by Muchinga (1.0 percent) and Luapula at 1.5 percent. The rest of the four provinces, that is, Central, Eastern, Southern and Northern provinces collectively consumed 16.2 percent of the total national daily average consumption of the three petroleum products combined.

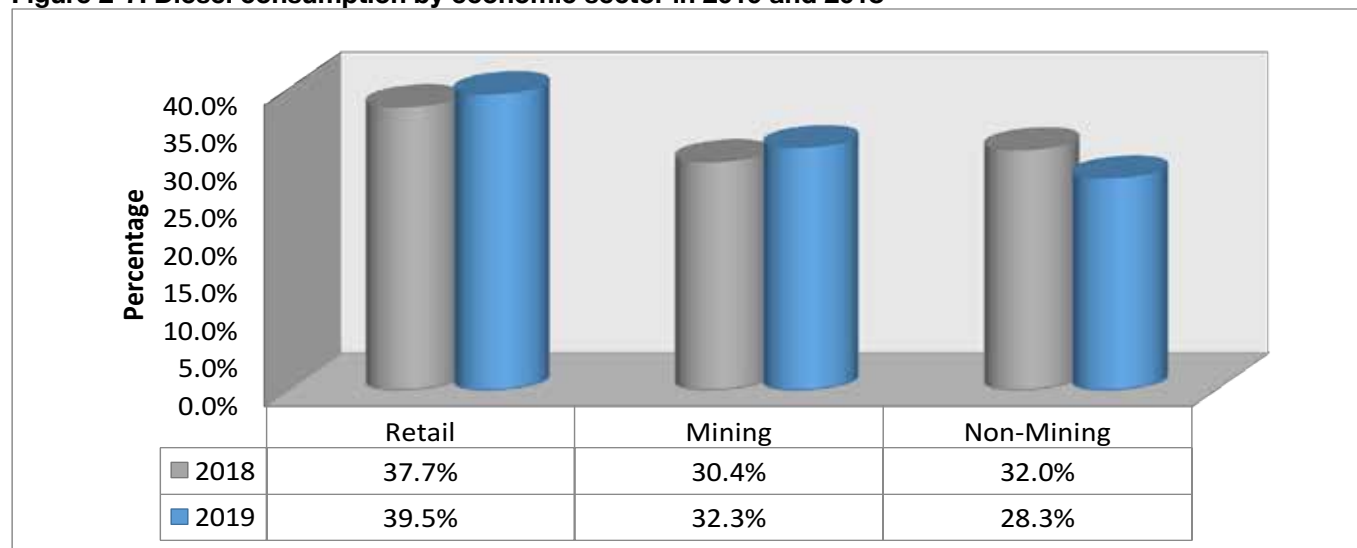
2.4.3 Consumption of petroleum products by economic sector

This section discusses the consumption of petrol and diesel by economic sector. The economic sectors are classified as follows: retail, mining and non-mining. Retail refers to petroleum products that are sold at the service stations, while mining refers to petroleum products delivered to and directly consumed by the mines. Non-mining refers to all the other sectors in the economy such as agriculture, transport, manufacturing and construction.

2.4.3.1 Consumption of diesel by economic sector

The retail sector accounted for the highest proportion of diesel consumption at 39.5 percent in 2019 followed by the mining sector at 32.3 percent. The proportions for both sectors increased during 2019, compared to 2018. Meanwhile, the non-mining sector recorded a decline in consumption of 3.7 percentage points from 32 percent in 2018 to 28.3 percent in 2019. The consumption by economic sectors for diesel is shown in Figure 2-7.

Figure 2-7: Diesel consumption by economic sector in 2019 and 2018



2.4.3.2 Consumption of petrol by economic sector

similar to the trends observed in the previous year, petrol consumption was predominantly retail accounting for 97.4 percent in 2019, followed by the non-mining at 2.4 percent and mining sector at 0.2 percent. Figure 2-8 shows petrol consumption by economic sector in 2019 and 2018.

Figure 2-8: Petrol consumption by economic sector in 2019 and 2018



2.5 MARKET SHARE OF OIL MARKETING COMPANIES

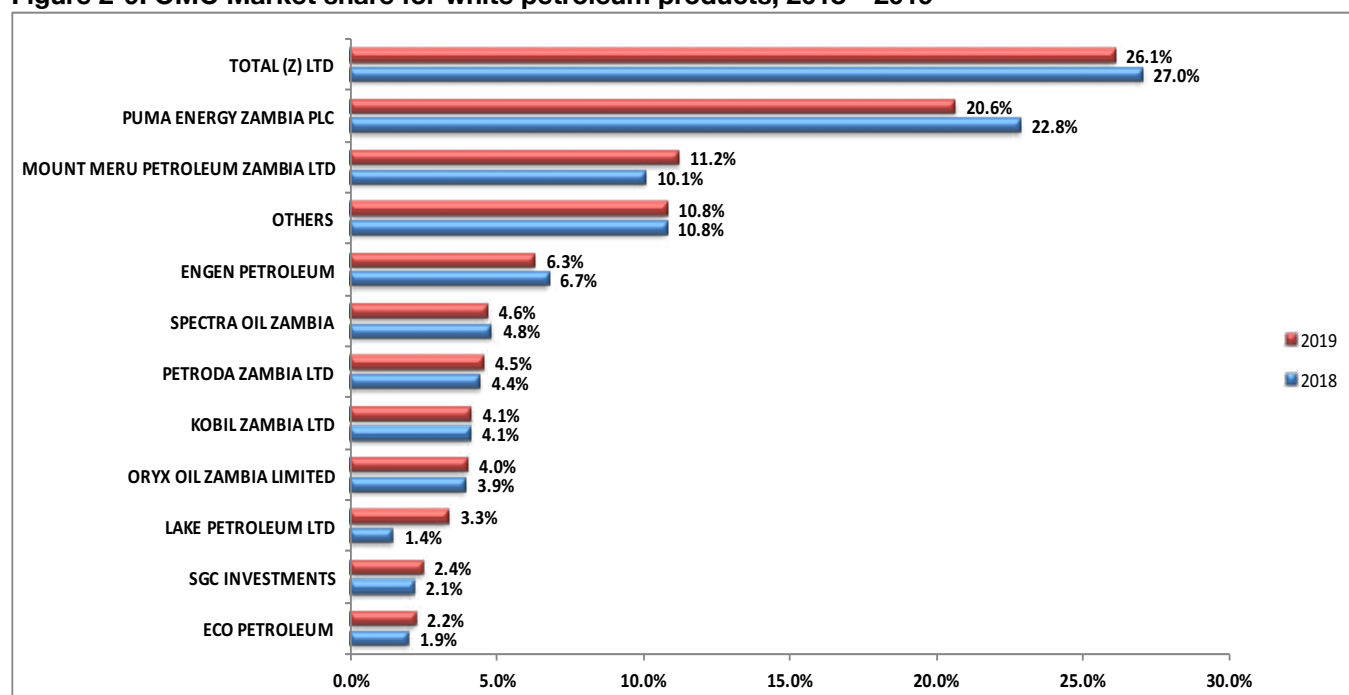
The OMCs are the distributors of petroleum products in Zambia. The sizes of the OMCs are assessed by their market share which refers to the percentage of the total volume of sales in a specified period. It is expressed as a percentage of the total sales of an OMC to the total sales in the industry in a specified period of time. As at 31st December, 2019 there were a total of 91 OMCs licensed by the ERB. This section gives an outline of the combined market share of petroleum products, that is, diesel, petrol, Jet A-1 and Lubricants, for OMCs

2.5.1 Market share for white petroleum products

During the period under review, Puma Energy Zambia Plc (Puma Energy) and Total Zambia Limited (Total Limited) continued to lead the market for white products with a combined market share of 46.7 percent in 2019 compared to 49.8 percent in 2018. Total Limited maintained its lead with a market share of 26.1 percent compared to 27.0 percent in 2018. This was followed by Puma Energy which recorded a market share of 20.6 percent in 2019 compared to 22.8 percent in 2018. However, the market shares for both Puma Energy and Total Limited declined by 2.2 and 0.9 percentage points, respectively.

Mount Meru Petroleum Zambia Limited (Mount Meru) was third in the hierarchy at 11.2 percent reflecting a growth of 1.1 percentage points, from the market share recorded in 2018. This was followed by Engen Petroleum at 6.3 percent (0.4 percentage points decline). Further, Petroda, Oryx, Lake Petroleum, SGC and ECO, all recorded increases in market share by 0.1; 0.1; 1.9; 0.3 and 0.3 percentage points, respectively. Meanwhile, Kobil maintained its market share at 4.1 percent, while Spectra Oil Zambia Limited (Spectra Oil), recorded a decline of 0.2 percentage points. The market share for the rest of the OMCs is shown in Figure 2-9.

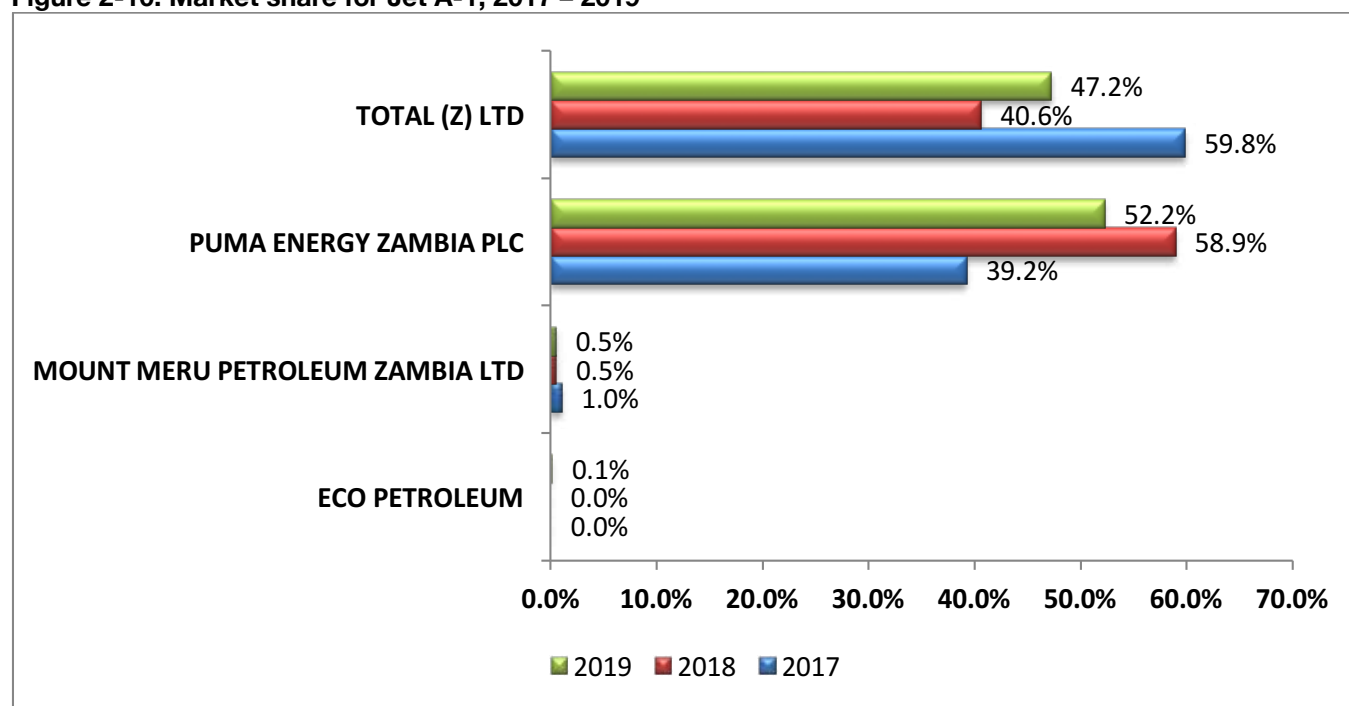
Figure 2-9: OMC Market share for white petroleum products, 2018 – 2019



2.5.2 Market share for Jet A-1

In 2019, there were four OMCs dealing in Jet A-1 namely; Eco Petroleum, Puma Energy, Total Limited and Mount Meru. Of these four, Puma Energy and Total Limited continued to dominate the market share for Jet A-1 in 2019. The two companies collectively accounted for 99.4 percent market share in 2019 reflecting a marginal decrease of 0.1 percentage points from 99.5 percent recorded in 2018. Puma Energy had the highest market share at 52.2 percent followed by Total Limited at 47.2 percent. The market share for Jet A-1 is shown in figure 2.10.

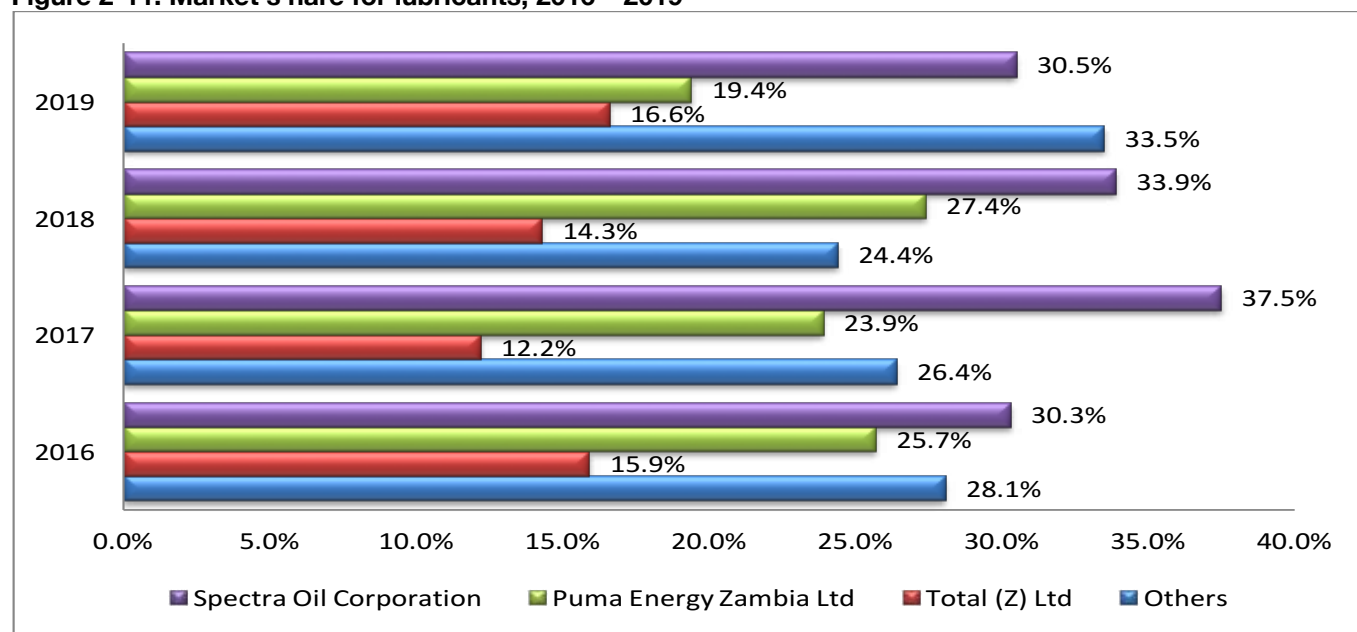
Figure 2-10: Market share for Jet A-1, 2017 – 2019



2.5.3 Market share for Lubricants

During 2019, the total number of companies dealing in lubricants and licensed by the ERB was 59. Out of these 59 licensees, only 34 were active and reported on their performance in 2019. Based on the submissions, Spectra Oil maintained its lead in the market for lubricants at 30.5 percent. However, despite the lead, its market share declined by 3.4 percentage points from 33.9 percent in 2018. This was followed by Puma Energy whose market share decreased by 8.0 percentage points from 27.4 percent to 19.4 percent. Total Limited was next in the hierarchy with a market share of 16.6 percent. The market share for lubricants during the period, 2016 to 2019 is shown in figure 2-11.

Figure 2-11: Market share for lubricants, 2016 – 2019



2.5.4 Retail sites network

The retail distribution network for OMCs and independent dealers by district and province, as at 31st December, 2019 is depicted in Appendix 1. The retail service stations accounted for 97.4 percent sales for petrol and 39.5 percent for diesel in 2019. The retail sites are typically classified into three as Company Owned-Company Operated (COCO), Company Owned-Dealer Operated (CODO) and Dealer Owned-Dealer Operated (DODO).

There were a total of 364 operational retail service stations mostly located in urban areas as at 31st December, 2019. Lusaka province had the highest number of service station at 146 (40%) followed by the Copperbelt province at 93 (26%). The province with the least number of service stations was Western province at eight (2%).

2.5.5 LPG storage facilities

There has been increased demand for LPG in the country in the past few years which however has not matched with the increase in investment. The LPG retail market remains small and is characterized by a few players. The reason cited for slow investment is the high capital costs, associated with the set up. There are relatively more players in the export market because of lesser barriers to entry such as the requirement for storage facilities. Table 2.5 shows the LPG storage facilities in the country in 2019.

Table 2-5: LPG storage facilities in 2019

No.	Name	Capacity (MT)	Location
1.	INDENI	1,800	Ndola
2.	Afrox Zambia Limited	143	Ndola, Kitwe and Lusaka
3.	Exclusive Brands Africa	90	Lusaka
4.	Oryx Gas	134	Lusaka and Ndola
5.	Ogaz Zambia	50	Lusaka
6.	Minegases	45	Chingola, Ndola and Kitwe
7.	Chingases	55	Lusaka
8.	Mount Meru Petroleum	100	Lusaka
9.	Kobil Zambia Limited	40	Lusaka
10.	Oxyzam Zambia Limited	41	Lusaka
11.	Grand Total	2,498	

2.6 PRICING OF PETROLEUM PRODUCTS

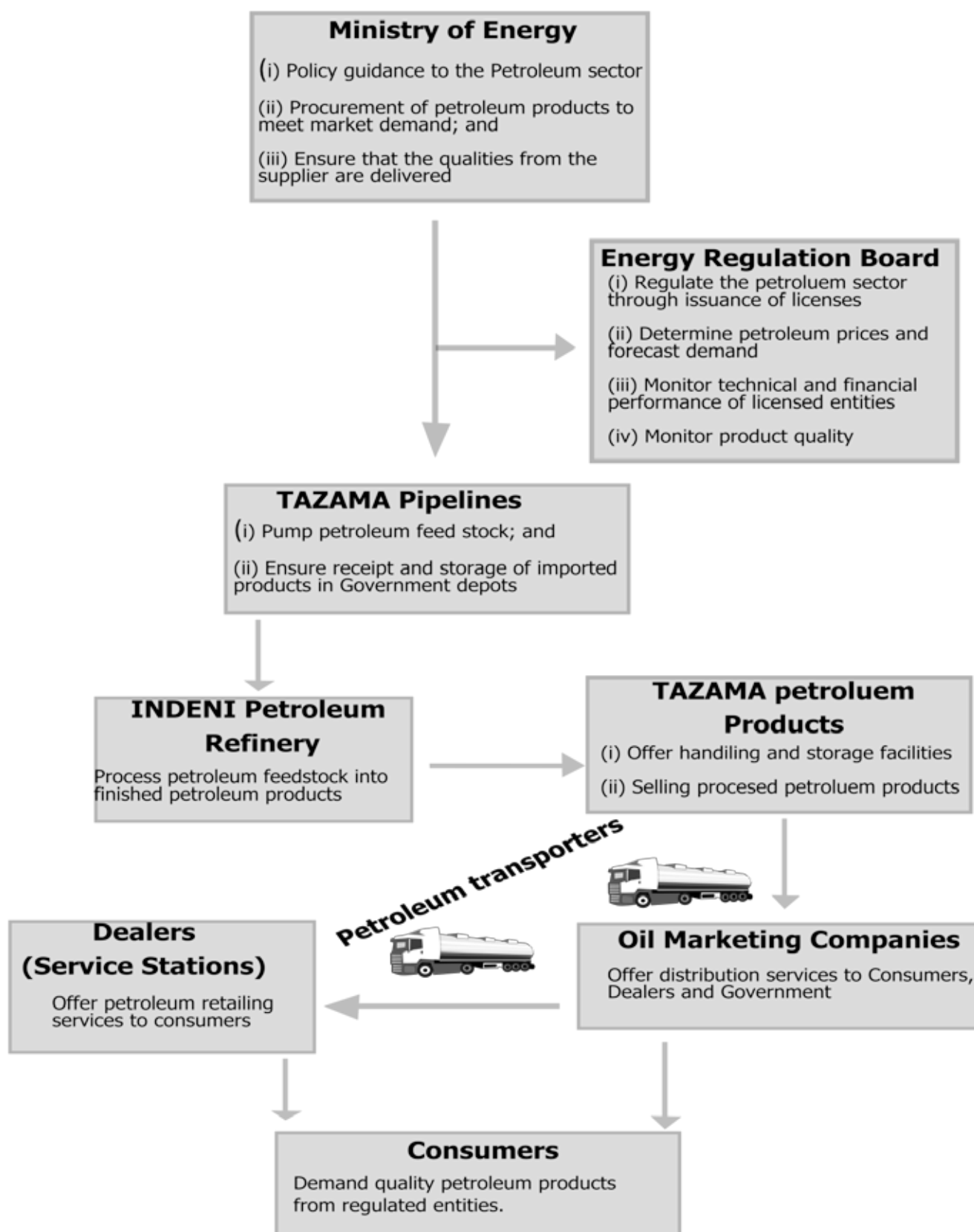


Motor vehicle being refueled at a filling station

Fuel prices in Zambia are set by the ERB using the Cost plus Model (CPM), which has been in effect since January 2008. The CPM operates on the principle that the final price of petroleum products should cover all costs in the supply chain. The role of pricing for the ERB starts at the point when the importation documents are presented by the importer.

Figure 2-12 depicts the different supply chain players and the roles that they play in the supply and pricing of petroleum products.

Figure 2-12: Details of the roles of the players in the petroleum supply chain



2.6.1 Determinants of petroleum prices

Theoretically, the price of any product in a competitive market is determined by demand and supply of the product. In the case of petroleum products, prices globally are determined by a combination of factors such as the following: exchange rate, cost of crude oil, refining costs, distribution costs, marketing costs and government policy (taxes and subsidies). Other factors that may influence global oil prices are depicted in figure 2-13.

Figure 2-13: Global factors that influence global oil prices

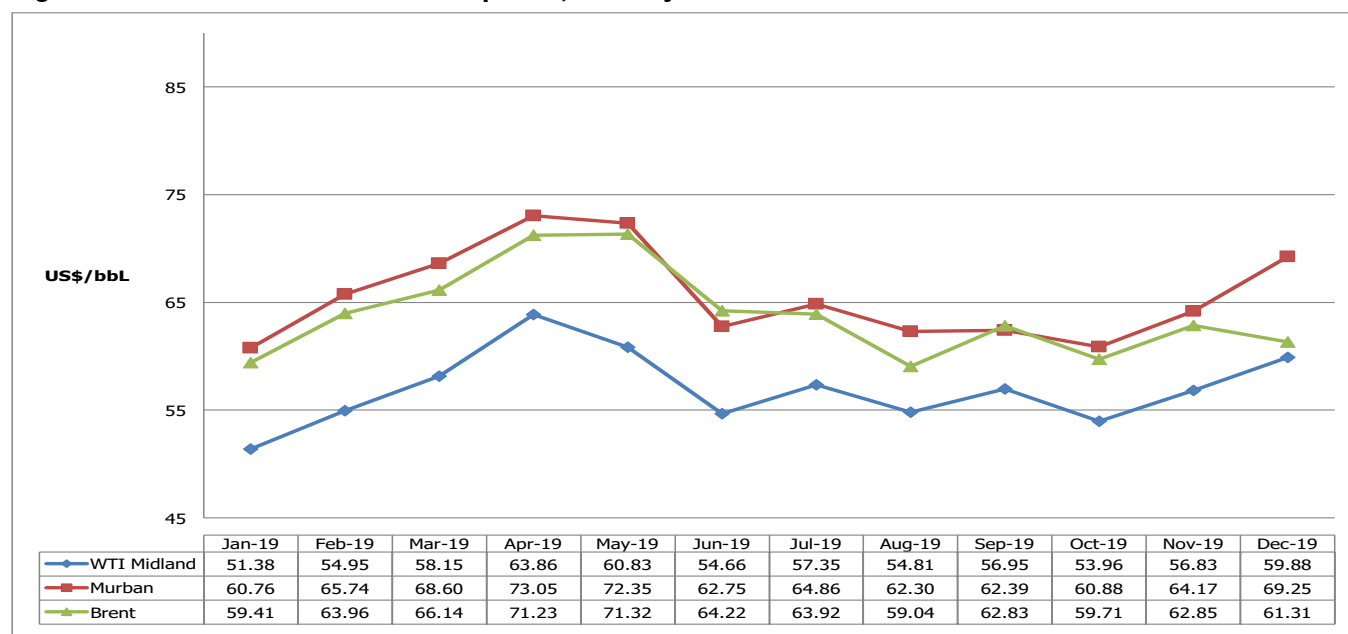


Source: Energy Information Agency (EIA)

Thus, for an oil importing country like Zambia, prices of fuel are largely influenced by the combined effect of the movement in the international oil prices and the exchange rate. Implying that, major changes in these two factors could result in either an increase or a reduction in the wholesale and the pump price. In addition, changes in the cost-lines such as levies, duties and fees; margins for transporters, OMCs or dealers; and pumping or processing fees can also trigger a price adjustment.

2.6.2 Trends in the international oil prices in 2019

In 2019, crude oil prices fluctuated between a low of US\$51.38/bbl and a peak of US\$73.05/bbl. The peak which was attained in the second quarter of 2019 was mainly as a result of increased demand amidst reduced supply caused by commitment by the OPEC and participating non-OPEC countries to restore global oil market stability. Beyond the second quarter peaks, prices started to decline due to uncertainty about world economic and global oil demand outlooks and the continued trade tensions between the United States of America (USA) and China. The decline continued until mid-year when relative stability was attained up until the last quarter of 2019 when the prices started to gradually rise again. The gradual increase in the fourth quarter was caused by increased demand from Asia which was supported by positive expectations for trade agreement between the USA and China. Crude oil prices closed the year at US\$59.88/bbl, US\$69.25/bbl and US\$61.31/bbl for WTI Midland, Murban and Brent, respectively. Figure 2-14 shows the trend in international oil prices in 2019.

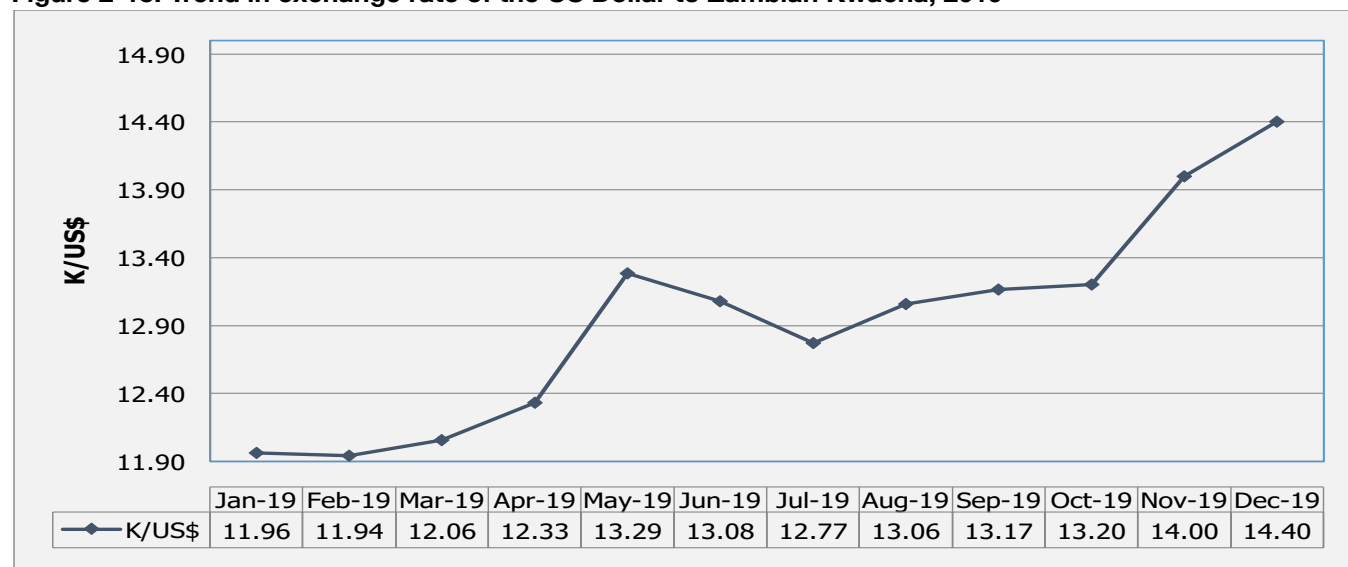
Figure 2-14: Trend in international oil prices, January 2019 to December 2019.

Throughout 2019, the price of WTI Midland was consistently lower relative to the other two types of crude oil.

2.6.3 Trend in the exchange rate in 2019

Between January and December, 2019, the kwacha to US dollar exchange rate depreciated by 20.24 percent, from K11.96/US to K14.40/US\$. The trend in depreciation was consistent throughout the year except between May and July when there was a slight appreciation following the Central Bank's intervention to contain the volatility.

The general trend in depreciation was mainly as a result of increased demand for foreign exchange, a stronger US dollar and negative market sentiments arising from the credit rating downgrade of Zambia from Caa1 to Caa2, by Moody's Credit Rating Agency. According to the Bank of Zambia, the depreciation in the last half of the year was sustained by increased demand for petroleum and fertilizer imports in addition to adverse market expectations associated with the indicative need for electricity imports in order to supplement domestic supply.²⁰ This is depicted in figure 2-15.

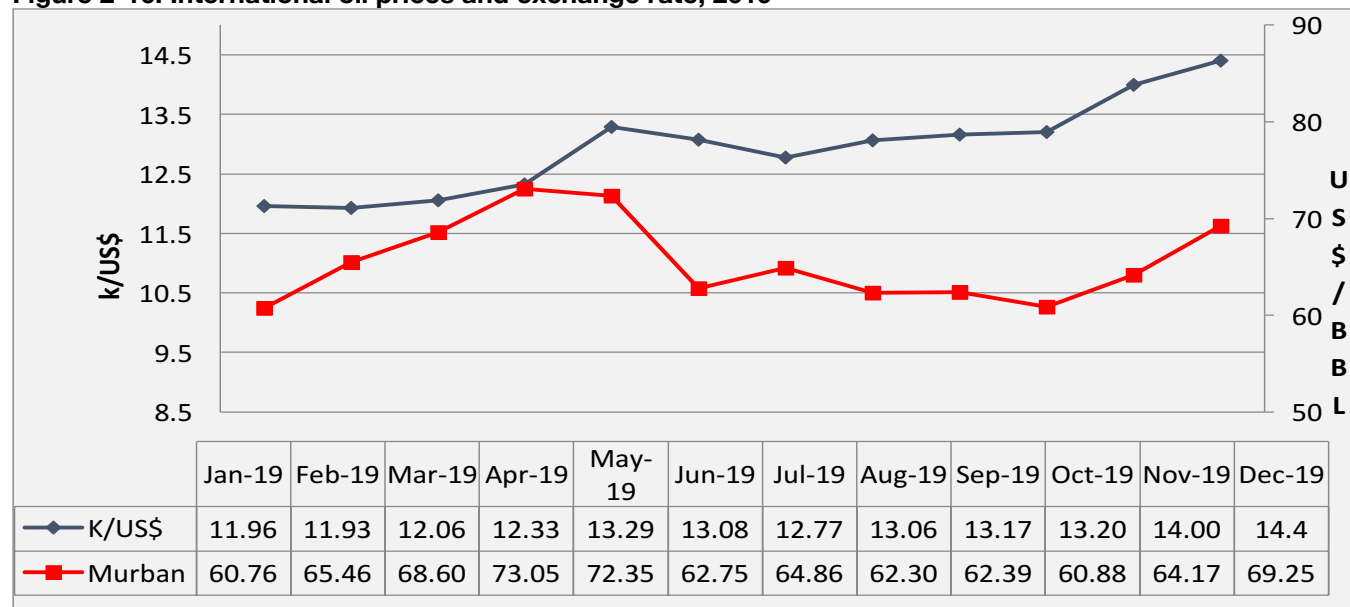
Figure 2-15: Trend in exchange rate of the US Dollar to Zambian Kwacha, 2019

²⁰ In the last part of the year, the country started to experience electricity deficits that necessitated the importation of power. Further, there is pressure associated with the commencement of agricultural season which necessitates the importation of fertilizer and other requisite inputs.

2.6.4 Trends in the international oil prices and the exchange rate

Figure 2-16 illustrates the movements in the international oil prices and the exchange rate of the Kwacha to the United States Dollar in the year 2019.

Figure 2-16: International oil prices and exchange rate, 2019



Fuel prices in Zambia are reviewed each time a cargo is received and in line with the Government Policy of about every 60 days. The fuel prices are largely influenced by the movement of the two main fundamentals namely, the international oil prices and the exchange rate between the Kwacha and the United States Dollar. In cases where the kwacha appreciates against the United States Dollar and the international oil prices decline, fuel prices would be expected to reduce. Similarly when the fundamentals move in the opposite direction where the Kwacha depreciates against the United States Dollar and the international oil prices increase, fuel prices would be expected to increase.

In some instances, there are cases where the two fundamentals move in opposite directions, such as where the Kwacha depreciates while the international prices decline. In such instances the gains from one variable, being the international oil prices, are negated by the depreciation of the Kwacha against the United States Dollar. Fuel prices would consequently change marginally or remain at the obtaining level during the period of a particular review.

During the period under review, the ERB reviewed and adjusted fuel prices three times in February, September and December 2019, respectively.

2.6.5 Petroleum pricing mechanism in Zambia

The ERB continued to review fuel prices using the CPM during the year 2019. Price reviews using CPM are done whenever petroleum feedstock and finished petroleum products are imported into the country, that is, every 45 to 60 days. This implies that petroleum prices are reviewed every sixty days.

For petrol, diesel, kerosene and LSG, the ERB regulates both the wholesale and retail prices whilst for other petroleum products such as LPG, Jet A-1, HFO and Bitumen the ERB only sets the wholesale prices. For LPG, Jet A-1, HFO and Bitumen, the ERB uses light handed regulation where the seller is allowed to set the retail price but the cost build ups are reviewed and considered for reasonableness. The cost elements in the CPM are divided into two groups:

- i. Wholesale price build up; and
- ii. Pump Price build up.

2.6.5.1 Wholesale price build-up

Table 2-6 shows the different cost elements in the wholesale price build up.

Table 2-6: Cost Elements in the wholesale price as at 31st December, 2019

No.	COST ELEMENT	MEASURE	BASIS
a.	Cost-Insurance-Freight (US\$/MT)		Contract/Supplier Invoice
b.	Ocean Losses	0.00%	Contract
c.	Wharfage	1.25%	Tanzanian Harbour Authority
d.	Insurance	0.11%	Insurer
e.	TAZAMA Storage Fee (US\$/MT)	2.00	TAZAMA
f.	TAZAMA Pumping Fee (US\$/MT)	49.00	Determined by ERB
g.	TAZAMA Pipeline Losses (<i>pipeline consumption of 0.50% & allowable pumping losses of 0.50%</i>)	1.00%	Determined by ERB
h.	Agency Fee (US\$/MT)	5.00	Agency Agreement
i.	Refinery Fee (US\$/MT)	55.38	Determined by ERB
j.	Refinery Processing Losses	5.00%	Determined by ERB
k.	Terminal Losses (<i>1% for LPG, 0.5% for Petrol Kerosene & Jet A-1, 0.3% for diesel & HFO</i>)	1%, 0.5%, 0.3%	Best Practice

Appendix 2 shows the petroleum value chain in Zambia while the components of the CPM are depicted in Appendix 3. To account for both petroleum feedstock and finished petroleum products, the CPM computes a weighted wholesale price for both diesel and petrol as depicted below:

The weighted average wholesale price of diesel is calculated as follows:

- Expected Revenue from imported Low Sulphur Gasoil (LSG) (A) = Total quantity of Imported LSG *The landed unit cost CIF TAZAMA depot*
- Revenue expected from INDENI Diesel (B) = Expected Diesel yields from processed Cargo *Computed Diesel Wholesale price as per CPM*
- Weighted Average Wholesale Price (C) = (A+B)*

$$\frac{\text{INDENI diesel yields} + \text{LSG Import Quantity}}{\delta}$$

$$C = \frac{(A + B)}{\delta}$$

Where $\delta = \text{INDENI diesel yields} + \text{LSG Import Quantity}$

The weighted average wholesale price of petrol is calculated as follows:

- i. *Expected Revenue from imported Petrol (D) = Total quantity of Imported Petrol x The landed unit cost CIF TAZAMA depot*
- ii. *Revenue expected from INDENI Petrol (E) = Expected Petrol yields from processed Cargo *Computed Petrol Wholesale price as per CPM*
- iii. *Weighted Average Wholesale Price (F) =*

$$F = \frac{(D + E)}{\delta}$$

Where $\delta = \text{INDENI petrol yields} + \text{petrol Import Quantity}$

2.6.5.2 Pump price build-up

The pump price build up constitutes the terminal fee, marking fee, respective statutory excise duty on the different products, the OMC, dealer and transporters margins which are all determined by the ERB, the ERB fees of 0.7 percent of turnover, the SRF (for infrastructure development in the sector and procurement of strategic reserves) and the Value Added Tax (VAT) on products. Table 2-7 below shows the price build-up for the retail prices of petrol, diesel, kerosene and LSG.

Table 2-7: Cost Elements in the pump price as at 31st December 2019

No.	DETAILS	UNIT COSTS	WORKINGS
1	Wholesale Price to OMC	K10.90, K10.57, K13.33 & K12.53 per litre each for petrol, diesel, kerosene and LSG, respectively.	a
2	Terminal Fee	K0.063/litre	b
3	Marking Fee	K0.10/litre	c
4	Excise Duty (incl.) road levy	K2.07 for Petrol, K0.66 for Diesel, K0 for Kerosene and K0.66 for LSG	d
5	Ex TAZAMA depot		E=(a+b+c+d)
6	Transport Cost	K0.26/litre for Petrol, K0.26/litre for Diesel, K0.09/litre for Kerosene and K0.26/litre for LSG	f
7	OMC Margin	K0.89/litre	g
8	TOTAL (Excl VAT)		h=(e+f+g)
9	Dealer Margin	K0.65/litre	i
10	PRICE TO DEALER		j= (h+i)
11	ERB Fees	0.7%	k
12	Strategic Reserves Fund	K0.15/litre for Petrol, Diesel, Kerosene and LSG	l
13	Price before VAT		m=(j+k+l)
14	VAT	16%	n
15	UNIFORM PUMP PRICE	K/litre	o=(m+n)

The proportions of the cost lines in the pump price build-up as at 31st December 2019 is depicted in table 2-8 below:

Table 2-8: Proportions of cost lines in the pump price build-up as at 31st December, 2019

	PETROL (%)	DIESEL (%)	KEROSENE (%)	LSG (%)
Wholesale to OMC	61.85	67.80	86.66	70.08
Ndola Fuel Terminal Fee	0.36	0.40	0.41	0.35
Marking Fee	0.55	0.62	0.63	0.54
Excise Duty	11.75	4.23	0.00	3.69
Transportation cost	1.48	1.67	0.58	1.45
OMC Margin	5.05	5.71	5.78	4.98
Dealer Margin	3.69	4.17	4.22	3.64
ERB Fees (0.007)	0.63	0.63	0.74	0.63
Strategic Reserves Fund	0.85	0.96	0.97	0.84
VAT (0.16)	13.79	13.79	0.00	13.79
Uniform Pump Price	100.00	100.00	100.00	100.00

The highest cost component for each of the four products at the pump relates to the wholesale prices which stand at 61.85 percent for petrol, 67.80 percent for diesel, 70.08 percent for LSG and 86.66 percent for kerosene respectively. The wholesale prices all have a direct input factor of the procurement cost (CIF) for both the petroleum feedstock and the finished petroleum product. The second highest costs on the build-up are the mandatory fees of VAT and Excise duty for petrol at 26 percent and 18 percent for both diesel and LSG. It is worth noting that there is no VAT and Excise duty charged on kerosene. Other notable cost lines related to petroleum downstream margins for OMCs, Dealers and Transporters ranged between 2 percent and 6 percent.

2.7 STRATEGIC RESERVE FUND

During the period under review, the Strategic Reserve Fund (SRF) fee was maintained at K0.15/litre for petrol, diesel, kerosene, LSG and jet A-1, and K0.15/kg for HFO and LPG. The ERB collects this fee through OMCs and has put in place a monitoring mechanism to ensure that OMCs remit the correct amount into the fund.

The fund is managed by ERB on behalf of Government. The fund is for the purpose of developing petroleum infrastructure such as fuel depots.

2.8 ANNUAL REVIEW OF PETROLEUM DOWNSTREAM MARGINS

The ERB has established a stakeholder committee that meets annually to review petroleum downstream margins and make recommendations to the Board. The committee comprises representatives from the ERB, OMCs, rural and urban dealers, petroleum transporters, Ministry of Energy and the UPP manager. The guiding principle in reviewing the margins is to ensure that the margins are updated and reflective of the cost of doing business. Further, the margins are reviewed so as to ensure that they are consistent with the changing economic variables such as inflation and exchange rate among others. In 2019, the stakeholder committee met to review the margins and made recommendations. As at the end of the review period, the margins were as follows: OMCs at K0.89/litre, dealers at K0.65/litre, transporters at K0.95/M³/km for distances above 20km and K1.39/M³/km for distances below 20 km.

2.9 UNIFORM PETROLEUM PUMP PRICE

In order to keep the prices uniform across the country, the ERB continued to implement the Uniform Pump Pricing (UPP) mechanism. The UPP entails that the price of fuel applied at all retail sites throughout the country are the same for petrol, diesel, kerosene and LSG, respectively. Before the introduction of the UPP, the prices of these products at retail sites furthest from Government fuel depots were higher than the prices obtaining at sites closer to the Government fuel depots. To make the model operational, the government has contracted an independent manager to ensure that the UPP fund is maintained to allow for contributions into the fund and claims out of the fund. The UPP fund is influenced by changes in petroleum prices and other cost build up factors. Therefore, the role of the UPP manager is to ensure that the integrity of this fund is maintained when any of the factors in the cost build up change. Table 2-9 depicts how transport differentials are determined under the UPP mechanism.

Table 2-9: Transport differentials for Kasama from all Government fuel depots

PETROL				
TRANSPORTATION COSTS BY TOWN				
Town	Distribution Hub	Total Cost in Build Up	Actual Cost	Differential
		K/ Litre	K/ Litre	K/ Litre
		A	B	C=(A-B)
Kasama	Ndola Fuel Terminal	0.26	0.73	(0.47)
Kasama	Mpika Depot	0.26	0.23	0.03
Kasama	Lusaka Depot	0.26	0.82	(0.56)
Kasama	Mongu Depot	0.26	0.67	(0.41)
Kasama	Solwezi Depot	0.26	1.00	(0.74)

As depicted in table 2-9, for a retail site uplifting petrol from Ndola Fuel Terminal (NFT), given that the ERB determined a transport margin that resulted into an actual transport rate of K0.73/litre/Km for Kasama town. In order to conform to the uniform pump pricing in the price build-up for petrol, a rate of K0.26/km/litre is applied. However, when a transporter delivers petrol to a retail site in Kasama from NFT, the applicable charge for the transportation service to the OMC will be the actual cost of K0.73/litre/Km. The OMC will then claim the difference of K0.47/litre/Km from the UPP Fund for quantities delivered from NFT.

2.10 PRICING FRAMEWORK FOR JET A-1

During 2019, stakeholders made presentations to ERB in order to make the price of Jet A-1 competitive. The ERB approved the introduction of a market based formula pricing (import parity pricing) and migrated from using cost-plus based pricing to import parity based pricing (IPP) for Jet A-1 only in order to have the price more responsive to movements in the market fundamentals. The two petroleum pricing models CPM and IPP both work on the principle of full cost recovery and a self-financing procurement cycles. The CPM has the following features:

- Wholesale price build-up based on different suppliers of petroleum feedstock and finished petroleum products at different CIF prices;
- Account for different cost elements up to wholesale price;
- For the retail cost build-up, beyond the wholesale price account for regulated and statutory cost-lines such as margins and taxes respectively.
- Fuel pump prices adjusted if the 2.5% threshold of the wholesale price is breached.
- Prices are reviewed every 60 days in line with the Government policy.

In the case of IPP, the following are the notable features:

- i. Uses benchmark prices on the international market.
- ii. Prices are reviewed on a monthly basis.
- iii. The 2.5% threshold of the wholesale price can be used.
- iv. Determinants are also benchmark international oil price and exchange rates.

Due to the responsive nature of the IPP model, industry stakeholders requested that a migration be considered given the noted fluctuations in the market. Further, use of the IPP mechanism is aimed at promoting efficiency in the pricing of Jet A-1 while at the same time ensuring that the domestic price of Jet A-1 reflects the cost trends of petroleum products on the international market. This will enable consumers to pay fair prices for fuel, while allowing the refinery to generate sufficient income to operate viably. Full implementation of IPP will entail monthly reviews of Jet A-1 benchmark prices.

During 2019, the ERB conducted test runs of the pricing of Jet A-1 using the IPP model. The test runs followed the stakeholder consultative meetings at which the financial model and operational guidelines were approved. Being a fundamental shift in pricing, the implementation of the IPP framework for Jet A-1 underwent further stakeholder consultations beyond the period when it was planned to be implemented, i.e. in 2019. As at end of 2019, the consultative processes were still underway.

2.11 BIOFUELS PRICING FRAMEWORK

In 2019, a pricing model was developed by the ERB for the purpose of national pricing of biofuels. The proposed pricing framework was IPP based and was supposed to be used as benchmark prices for negotiating with biofuel suppliers based on their production and transportation costs. After stakeholder consultations with industry players, it was resolved that while the proposed pricing model was ideal, and relevant, it could not be implemented until an industrywide study of the development of the biofuel industry is undertaken. The proposed pricing model would form an input into the study recommendations. The argument for an industrywide study was premised on the fact that the domestic market for biofuels was not adequately developed for it to allow for price benchmarking on the international market. Based on the foregoing, it was recommended that the proposed pricing model be submitted to the MoE and MoF who have since established a Biofuels Technical Committee that will spearhead the implementation of the National Biofuels Programme in Zambia. As at the end of 2019, the works of the committee were on-going.

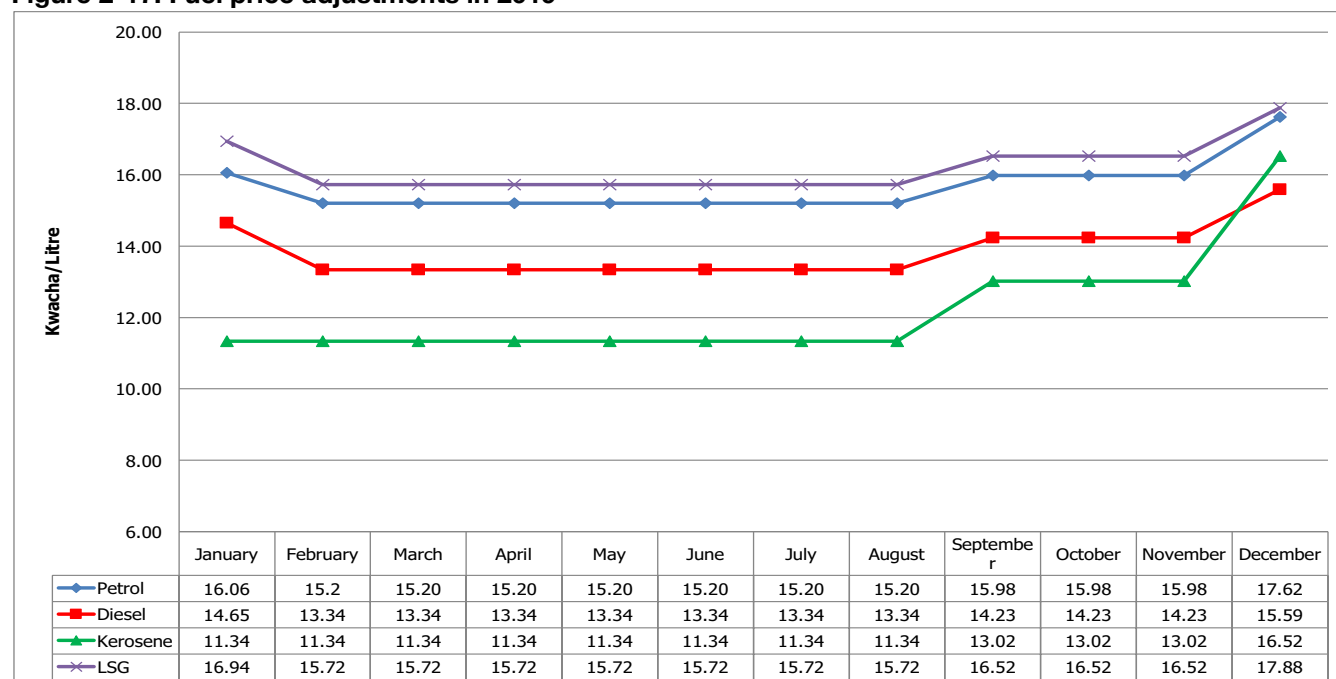
2.12 LOCAL AND REGIONAL FUEL PRICES

2.12.1 National fuel pump prices

The ERB effects price changes to petroleum products only if the proposed change to prevailing wholesale prices is greater than 2.5 percent, on average. This implies that petroleum products prices are not adjusted if the average change in the computed or proposed wholesale price is less than the 2.5 percent threshold.

Consistent with the movement in the two fundamentals that determine the price of fuel in Zambia, the ERB made three fuel price adjustments in the year 2019. There was one downward price adjustment in February and two upward price adjustments in September and December, 2019, respectively. In February, fuel prices were reduced by 5.35 percent, 8.94 percent and 7.20 percent for petrol, diesel and LSG respectively, while kerosene remained unchanged. Meanwhile, in September, the price of petrol, diesel, LSG and kerosene were increased by 5.13 percent, 6.67 percent, and 14.81 percent and further by 10.26, 9.56 and 26.88 percent in the December adjustment. This is depicted in figure 2-17.

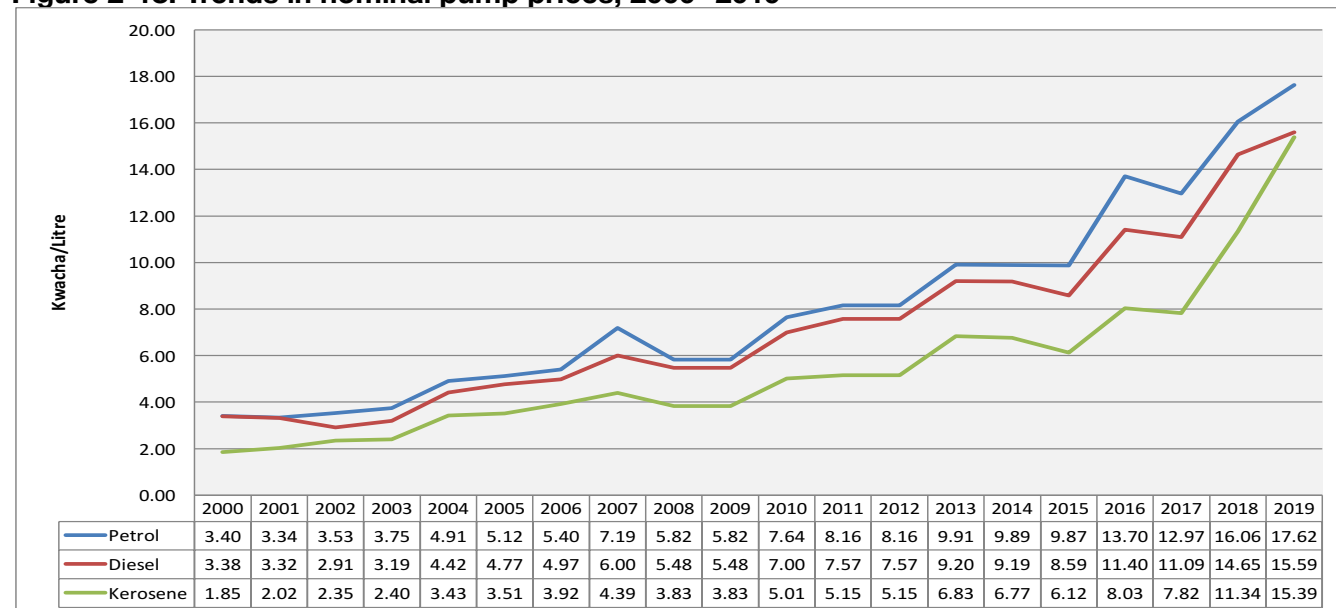
Figure 2-17: Fuel price adjustments in 2019



2.12.2 Trends in domestic fuel prices

Figure 2-18 shows the trend in nominal pump prices of petrol, diesel and kerosene since 2000.

Figure 2-18: Trends in nominal pump prices, 2000 -2019



Over the past twenty years, the nominal pump prices²¹ of petrol, diesel and kerosene have generally been rising, gradually before 2015 and more steeply beyond. The steep rise was in response to a policy directive of removing subsidies from fuel pricing and making it cost reflective from 2013 onwards. From the year 2001, the price of petrol has constantly been higher than the price of diesel and kerosene, respectively. This is due to differences in taxes. For instance kerosene attracts zero excise duty while petrol was at K2.07/litre and diesel was at K0.66/litre in 2019.

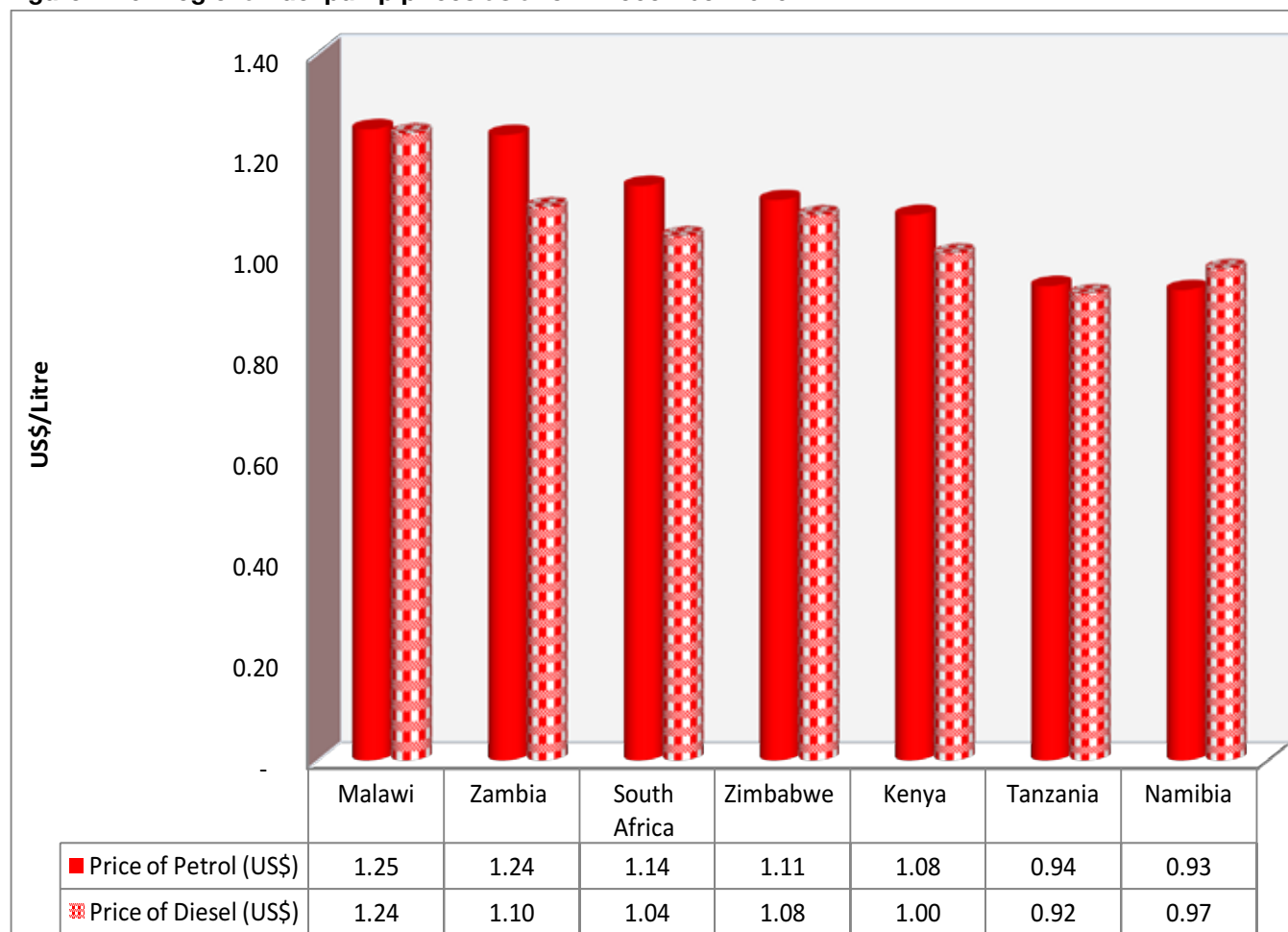
²¹ Nominal prices refer to current monetary values

The price of petrol increased from K9.91 per litre in 2013 to K17.62 per litre in 2019. Similarly, the price of diesel increased from K9.21 per litre to K15.59 per litre, in 2019, while that of kerosene increased from K6.83 per litre to K15.39 per litre.

2.12.3 Regional fuel prices

Figure 2-19 shows the regional pump price comparison of petrol and diesel as at 31st December 2019 in selected African countries.

Figure 2-19: Regional fuel pump prices as at 31st December 2019



Source: National Energy Regulators/Department of Energy websites

As at 31st December, 2019, the price of petrol in the region, was highest in Malawi, followed by Zambia²². South Africa exhibited the third highest price in the region, followed by Zimbabwe, Kenya, Tanzania and Namibia. Similarly, diesel prices were highest in Malawi followed by Zambia, Zimbabwe, South Africa, Kenya and Namibia. The differences in regional prices is mainly attributed to differences in levies, taxes, treatment and quantum; proximity to the sea; government policy, varying importation and production mode (refinery vs finished products); different supply options in terms of road or rail; differences in policy instruments, different infrastructure investment in terms of roads, refinery or pipeline.

²² The BOZ daily market average rate of K14.22/US\$, as at 31st December, 2019 exchange rate was used to convert the local prices for Zambia from K/litre to US\$ per litre

2.13 AUDITS OF LICENSEES IN THE PETROLEUM SUB-SECTOR

2.13.1 Petroleum Product Quality Monitoring

183 petroleum product samples were collected from the Government and OMC depots country wide for testing against respective Zambian Petroleum Product Quality Standards in 2019. This is in line with the ERB's mandate of ensuring product quality as stipulated in the Strategic Business Plan 2018-2021. The overall results for the tests are presented in the table 2-10 below.

Table 2-10: Petroleum products sample test results, 2018 - 2019

Product	No. of Samples Collected		Quality Compliance (%)	
	2018	2019	2018	2019
Unleaded Petrol	76	57	91%	95%
Diesel (Automotive Gas Oil)	89	73	61%	99%
Low Sulphur Gas Oil	33	43	96%	100%
Kerosene	12	3	100%	100%
Jet A -1	13	7	100%	100%
Total	223	183	95%	98%

An overall average compliance rate of 98 percent was recorded for 2019 against the set SBP target of 94 percent. This was an improvement from the overall average compliance rate of 95 percent recorded in 2018. The improvement in the quality of petroleum products was attributed to the enforcements undertaken and the implementation of the fuel marking programme.

2.13.2 Technical audits of petroleum infrastructure

Compliance monitoring assessments were carried out for petroleum infrastructure and results are shown in the table 2-11 below.

Table 2-11: Results of petroleum infrastructure compliance monitoring, 2018-2019

Facility	% COMPLIANCE			
	2019	TARGET	2018	TARGET
Filling Station	89.6	89.0	86.9	87.0
Fuel Depot	87.1	89.0	90.8	87.0
LPG Depot/ Filling Plant	76.6	89.0	90.8	87.0
Refinery	97.5	89.0	94.8	87.0
Pipeline	94.5	89.0	96.4	87.0
Total	90.2	89.0	91.4	87.0

2.13.3 Infrastructure grading of service stations

During the period under review, no infrastructure grading of the service stations were done. The grading system was being enhanced to take into account emerging issues in the industry.

2.13.4 Technical KPIs - TAZAMA

Overall, TAZAMA achieved the set KPI targets by the ERB due to the replacement of Old Engines with new ones, which led to reduced breakdowns/unplanned shutdowns. However, the set KPI target for safety and environment was not achieved due to leaks/spillages caused by internal corrosion. The performance of TAZAMA against the ERB set KPIs for the year under review is shown in table 2-12.

Table 2-12: TAZAMA's performance against technical KPIs - 2019

No.	Indicator	KPI Target	Actual Performance	Comment
1.	Throughput (Metric Tonnes)	650,000	664,340	Achieved
2.	Operational days	315	318	Achieved
3.	Pumping Rate (m ³ /hr)	105	105.58	Achieved
4.	Consumption and Loss (%)	1.20	0.92	Achieved
5.	Safety & Environment/ No. of incidents	0	11	Not achieved

Failure to achieve the safety and environment target was due to leaks/spillages caused by internal corrosion.

2.13.5 Financial KPIs - TAZAMA

In 2019, the ERB conducted financial KPIs audits for TAZAMA. The agreed financial KPIs for TAZAMA are trade debtor days and current ratio. Table 2-13 shows the financial KPI performance of TAZAMA, during the period under review.

Table 2-13: TAZAMA's performance against financial KPIs - 2019

Indicator	KPI Target	Actual Performance	Comment
Current ratio	1.2	11.0	Achieved
Debtor days	15	24.05	Not achieved

The KPI audit results revealed that TAZAMA managed to achieve the KPI target for current ratio, but failed to achieve the target for debtor days.

2.13.6 Technical KPIs - INDENI

The technical KPIs performance of INDENI for the year under review is shown in table 2-14.

Table 2-14: INDENI's performance against technical KPIs - 2019

No.	Indicator	KPI Target	Actual Performance	Comment
1.	Throughput/MT	700,000	700,256	Achieved
2.	Operational days	315	318.64	Achieved
3.	Consumption and Loss (%)	8.50	7.69	Achieved
4.	Quality compliance for refined petroleum products	100	100	Achieved
5.	Safety & Environment/ No of incidents	0	29	Not achieved

2.13.7 Financial KPIs - INDENI

In 2019, the ERB conducted financial KPIs audits for INDENI. The agreed financial KPIs for INDENI are trade debtor days and current ratio. Table 2-15 shows the financial KPIs performance of INDENI, during the period under review.

Table 2-15: INDENI's performance against financial KPIs - 2019

Indicator	KPI Target	Actual Performance	Comment
Current ratio	1.0	3.21	Achieved
Debtor days	15	24.3	Not achieved

The KPI audit results revealed that INDENI managed to achieve the KPI target for current ratio but failed to achieve the target for debtor days

2.13.8 Technical KPIs - TPPL

The performance of TPPL against technical KPIs for the year under review is shown in the table 2-16 below.

Table 2-16: TPPL's performance against technical KPIs - 2019

No.	Indicator	Product	Set KPI target	ACTUAL PERFORMANCE	Comment
1	Unaccountable Losses (%)	Diesel	0.30	0.19	Achieved
		Petrol	0.50	0.39	Achieved
		Kerosene	0.30	0.12	Achieved
2	No. of Petroleum Product Quality Incidents	-	0	1	Not achieved
3	No. of Safety and Environmental incidents	-	0	0	Achieved

2.13.9 Financial KPIs - TPPL

In line with its mandate, 'to monitor the efficiency and performance of undertakings, having regard to the purposes for which they were established', the ERB undertook financial KPIs audits for TPPL, on four agreed ratios, namely, the current ratio, debtor days, asset turnover ratio and creditor days.

Table 2-17 shows the financial KPI performance of TPPL, during the period under review.

Table 2-17: TPPL's performance against financial KPIs - 2019

Indicator	KPI Target	Actual Performance	Comment
Current ratio	1.2	3.21	Achieved
Debtor days	15	0	Achieved
Asset turnover	2.0	0.58	Not achieved
Creditor days	90	74	Achieved

The KPI audit results revealed that TPPL managed to achieve the KPI targets for debtor days, current ratio and creditor days but failed to achieve the target for the asset turnover only.

2.14 GOVERNMENT OWNED STORAGE DEPOTS FOR WHITE PRODUCTS



TPPL fuel depot

In line with the Seventh National Development Plan strategy of enhancing strategic reserves and supply of petroleum products, the Government continued upgrading the number and spread of fuel depots across the country in 2019. Under the programme of strategic petroleum reserves enhancement, the Government commenced the construction of Mansa and Chipata fuel depots in 2018. Table 2-18 shows the status of these two (2) depots as at 31st December, 2019.

Table 2-18: Status of the construction of GRZ owned storage depots for white products as at 31st December, 2019

No.	Fuel Storage Depot	Estimated Cost US\$ ¹ million*	Status
1.	Mansa Fuel Depot	32	<ul style="list-style-type: none"> Progress on the development of the Mansa Depot was at 99% by the close of December 2019. The depot will have a total storing capacity of 6.5 million litres comprising 4 million litres of diesel, 2 million litres of petrol and 0.5 million litres of kerosene The depot is expected to be completed and commissioned in 2020.
2.	Chipata Fuel Depot	37	<ul style="list-style-type: none"> Construction works were underway during the period under review. Progress on the development of the depot was at 8% by close of December 2019. The depot will have a capacity of 7.0 million litres with the following breakdown: 4 million litres Diesel; 2 million litres Petrol; 0.5 million litres Kerosene; and 0.5 million litres Jet A-1.

*The 2018 figures were reconciled and updated

2.15 DEVELOPMENT OF TECHNICAL STANDARDS

The ERB participated in the harmonization of two transportation standards that will be applicable to member states of the Southern Africa Development Community (SADC), Common Market for Eastern and Southern Africa (COMESA), and East African Community Regions (EAR). The harmonization of the transportation standards was intended to reduce technical barriers encountered in the cross border transportation of Petroleum products by road. The following were the standards reviewed;

- i. Transportation of dangerous goods by road; and
- ii. Cross Border Road Transport Management System (XB-RTMS)

In addition to the two road transportation standards, eight Petroleum Product Quality Standards were finalized after stakeholder engagement. The review of the standards started in 2018 and during the period under review, the draft standards were submitted to various stakeholders for public comments. The comments were incorporated in draft standards and await implementation.

2.16 FUEL MARKING PROGRAMME

The ERB continued to implement the fuel marking programme which commenced in 2018. Diesel, LSG, petrol and kerosene uplifts for domestic consumption from all Government depots were marked prior to distribution on the Zambian market. In addition, marking of fuel was also undertaken at selected OMC depots that were authorized to import finished petroleum products. A total of 1,533,517.93 m³ of fuel was marked during the period under review.

A countrywide sampling and testing of 354 operational service stations and 50 consumer sites (including those at the mines) was conducted in line with Energy Regulation (Petroleum Marking and Monitoring) SI No.69 of 2017 and the results showed a significant increase in the pass rate from 79 percent in 2018 to 96.97 percent in 2019. The increase in the pass rate showed that most of the fuel that was distributed in the country was from legitimate sources and of acceptable quality. Table 2-19 below shows the results of the fuel marking by province.

Table 2-19: Results of the fuel marking by province

Province	No of samples collected	No. of samples passed	No. of samples failed	% Pass rate
Muchinga	32	32	0	100.00
Luapula	27	27	0	100.00
Lusaka	365	360	5	98.63
Eastern	65	64	1	98.46
Southern	90	88	2	97.78
Copperbelt	314	305	9	97.13
Central	103	100	3	97.09
Northern	31	30	1	96.77
Western	28	27	1	96.43
North Western	67	55	12	82.09
Total	1,122	1,088	34	96.97

2.17 FOCUS AREAS IN THE PETROLEUM SUB-SECTOR IN 2019

2.17.1 Illegal fuel vending

In 2019, illegal fuel vending continued to pose a challenge in the petroleum sub sector. In order to curb this challenge, the ERB collaborated with law enforcement agencies in the seizure of illegal fuel valued at approximately ZMW 1,743,129 and prosecution of suspected illegal fuel vendors. Table 2-20 below shows the quantities of petroleum products seized from various locations.

Table 2-20: Quantities of petroleum products seized from various locations

LOCATION	PETROLEUM PRODUCT SEIZED	QUANTITY/ Litres			ESTIMATED VALUE (ZMW)
		Diesel	Petrol	Kerosene	
Solwezi	Diesel	6,195	0	0	96,580
Mufumbwe	Diesel	1,570	0	0	24,476
Mwilinunga (1 st operation)	Unleaded Petrol	0	2,940	0	51,803
	Diesel	7,140	0	0	111,313
Mwilinunga (2 nd operation)	Unleaded Petrol	0	15,330	0	270,115
Lusaka	Diesel	180	0	0	2,806
Kabangwe area (Chibombo)	Diesel	10,000	0	0	155,900
Chinsali District	Unleaded Petrol	0	2310	0	40,702
	Diesel	210	0	0	3,274
Mongu	Diesel	3,270	0	0	50,979
Luanshya	Diesel	6,510	0	0	101,491
Kapiri Mposhi	Diesel	840	0	0	13,096
	Kerosene	0	0	53,320	820,595
Totals		35,915	20,580	53,320	1,743,129

2.17.2 Security of supply of fuel in rural areas

The first and only filling station in Luwingu District commenced its operations on 16th August 2019 under the licence issued to a Zambian OMC by the ERB while the construction of the first and only retail site in Mporokoso had reached an advanced stage by December 2020. Both sites have been undertaken by the Government of the Republic of Zambia with the Luwingu site being leased to the said OMC. In 2020, it is anticipated that Government will continue with the development of rural sites with new areas identified in Lukulu for further development of retail sites to service the rural areas.

2.18 OUTLOOK IN THE PETROLEUM SUB-SECTOR

2.18.1 Private sector participation

In 2020, the Government pronouncement on Private Sector Participation in the procurement of petroleum products is expected to be finalised together with the enactment of the Petroleum Management Bill. The private sector participation in the procurement of petroleum products will mean that Government will no longer be involved actively in the procurement of national fuel requirement but rather play a policy role to ensure that this is done efficiently and effectively by the private sector.

2.18.2 INDENI equity partner

The acquisition of a strategic partner for INDENI is expected to be finalised and concluded in 2020. The strategic partner is expected to enhance INDENI operations through introduction of additional capital as well as increased technological capacity in order to improve efficiency of the refinery.

2.18.3 Rural filling stations

With the noted concern of high concentration of retail sites in urban areas, Government through the MoE has embarked on the development of retail service stations. During 2019, two retail sites, namely the Mporokoso and Luwingu were officially opened and leased out to OMCs to provide retail services in rural areas that were not serviced by private sector led investments. In 2020, it is anticipated that Government will continue with the development of rural sites with new areas identified in Lukulu for further development of retail sites to service the rural areas.

2.18.4 Liquefied Petroleum Gas

The use of LPG in Zambia has continued to be low in relation to other petroleum products despite LPG's positive attributes of its burning characteristics and environmental concerns. In response to this, the ERB conducted a research study on the use of LPG in Zambia in collaboration with the ZSA. This study addressed four main broad objectives as follows:

- i. Determination of the LPG market structure with regards to the forms of LPG businesses, their concentration, the size of firms and the nature of entry into the market;
- ii. Understanding of the conduct of the LPG market in terms of general behavior of the producers, suppliers and marketers as they interact with one another including their marketing channels;
- iii. Determination of households' perceptions of LPG use and the consumer demand for LPG in Zambia; and
- iv. Evaluation of the performance of LPG players by ascertaining their financial matrices such as profitability, liquidity, efficiency, and solvency.

During the period under review, the study was finalised and it is envisaged that the research findings will be disseminated through website publication and other media in 2020.

3.0 ELECTRICITY SUB-SECTOR

Zambia's electricity sub-sector comprises of the vertically Integrated Public Utility Company, ZESCO Limited, IPPs and Power Distribution Entities. These are responsible for the generation, transmission, distribution and supply of electricity. This section discusses the performance, key developments and outlook in the electricity sub-sector.



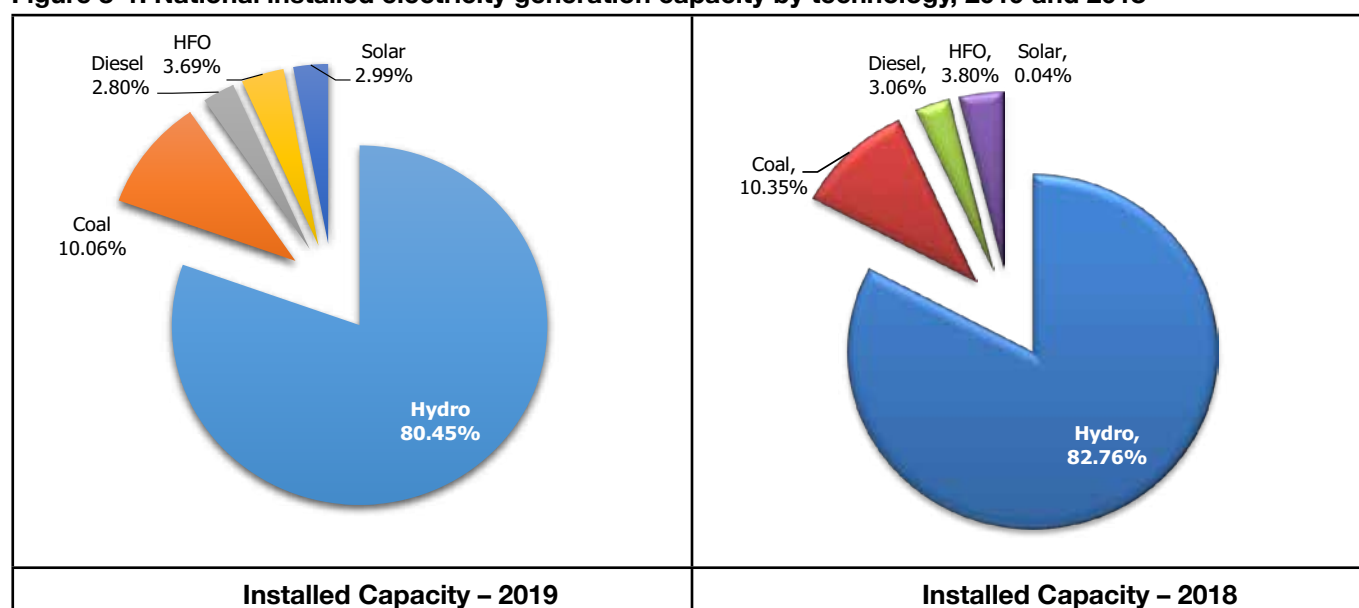
ZESCO Limited sub-station

3.1 ZAMBIA'S INSTALLED ELECTRICITY GENERATION CAPACITY

Zambia's electricity generation mix is predominantly hydro, accounting for 80.45 percent of installed capacity as of 2019. The remainder of the generation mix comprised of coal (10.06%); HFO (3.69%); diesel (2.80%); and solar (2.99%). Appendix 4 shows the installed electricity generation mix in Zambia during 2019, and the structure of the Electricity Supply Industry in Zambia is depicted in appendix 5.

During the year under review, new investments took place in the electricity sub-sector which increased national installed capacity by 2.9 percent to 2,981.23 MW, from 2,898.23 MW in 2018. The increase in installed capacity was due to the commissioning of two solar PV power plants (i.e. Bangweulu Power Company Limited with installed capacity of 54.3 MW and Ngonye Power Company Limited with an installed capacity of 34 MW) which are located at the Lusaka South Multi-facility Economic Zone. Figure 3-1 depicts a summary of the contributions of each generation technology to the national installed capacity in 2019 and 2018.

Figure 3-1: National installed electricity generation capacity by technology, 2019 and 2018



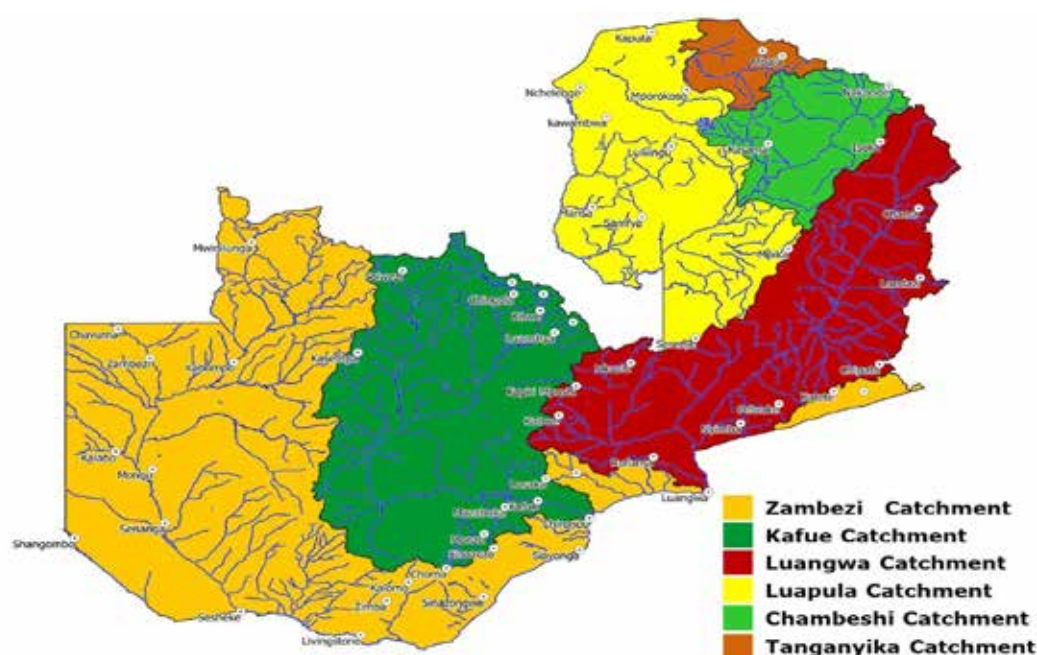
3.2 NATIONAL ELECTRICITY GENERATION

The national electricity generation reduced by 7.1 percent from 16,189 GWh in 2018 to 15,040 GWh in 2019. This was mainly on account of generation constraints from hydro power stations induced by low water levels. During the review period, the country experienced a reduction in water levels in major water reservoirs. For example, Kariba Dam experienced a reduction of water levels from 80.99 percent on 1st June 2018 to 30.86 percent on 1st June 2019. Consequent to this, the country experienced power deficits of up to 425 MW as at September, 2019.

3.2.1 Hydrological situation in Zambia, 2019

Zambia is hydrologically divided into six catchments, namely Zambezi, Kafue, Luangwa, Chambeshi, Luapula and Tanganyika as depicted in figure 3-2. The mean annual precipitation in Zambia ranges between 1,400 mm in the north and 700 mm in the south, with an average run off of 135 mm.

Figure 3-2: Catchment map of Zambia



Source: Water Resources Management Authority

Notably, most of Zambia's large hydro power plants namely; Kafue Gorge (990 MW), Kariba North Bank complex (1,080 MW), Victoria Falls (108 MW) and Itzhi Tezhi (120 MW) are located in the southern region of the country which is associated with an annual precipitation of 700 mm, on average. As such, it can be noted that the country's power generation has in the recent past been impacted by changing rainfall patterns which has resulted into low water levels in these reservoirs. Specifically, according to Zambia Meteorological Department during the 2018/2019 rainy season, Zambia's southern region continued to record below normal rainfall.

3.2.2 Hydrology performance, Lake Kariba



Kariba Dam

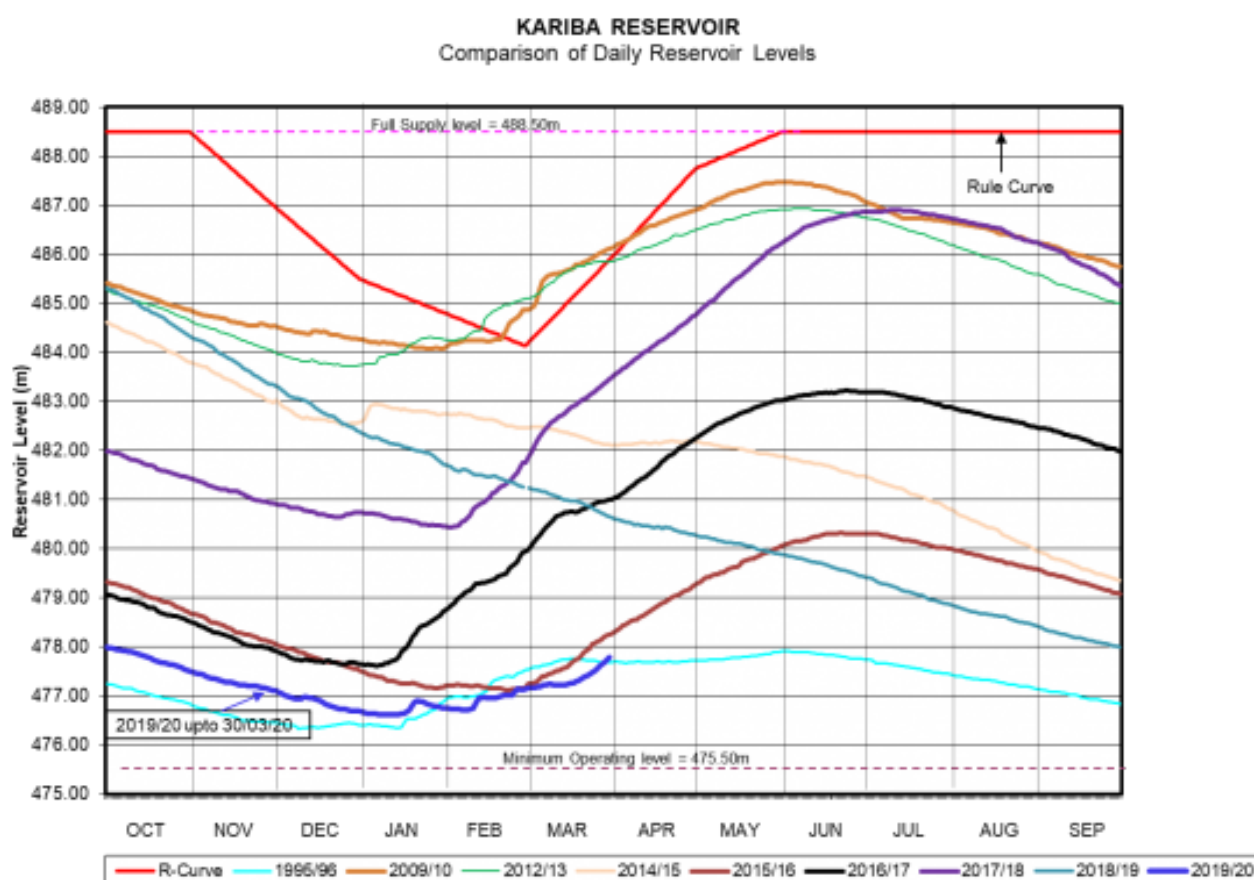
Lake Kariba is designed to operate between levels of 475.50m and 488.50m (with 0.70m freeboard) for hydropower generation while Kafue Gorge and Itzhi Tezhi reservoirs on the Kafue basin are designed to operate at the minimum level of 974.0 m and 1,006.0 m respectively. Victoria Falls on the Zambezi basin operates at a minimum level of 881.5 m. Table 3-1 shows the prevailing water levels in the major water reservoirs as at 30th December 2019 compared to the same time in 2018.

Table 3-1: prevailing water levels in the major water reservoirs as at 30th December 2019 compared to the same time in 2018

Main Water Reservoir	Dam Design Operational Levels [m]		Actual Dam Levels [m]	
	Min. Dam Level	Max. Dam Level	30 th December 2019	30 th December 2018
Kafue Gorge [KFG]	974.0	976.6	974.45	976.12
Kariba North Bank [KNB]	475.5	487.71	476.69	483.32
Victoria Falls [V/FALLS]	881.5	883.2	881.85	881.90
Itzhi-Tezhi [ITT]	1,006.0	1,030.5	1,014.66	1,025.20

Figure 3-3 depicts the water levels for Lake Kariba as monitored by Zambezi River Authority.

Figure 3-3: Water Levels for Lake Kariba 1995/96 – 2019/20 rainy seasons

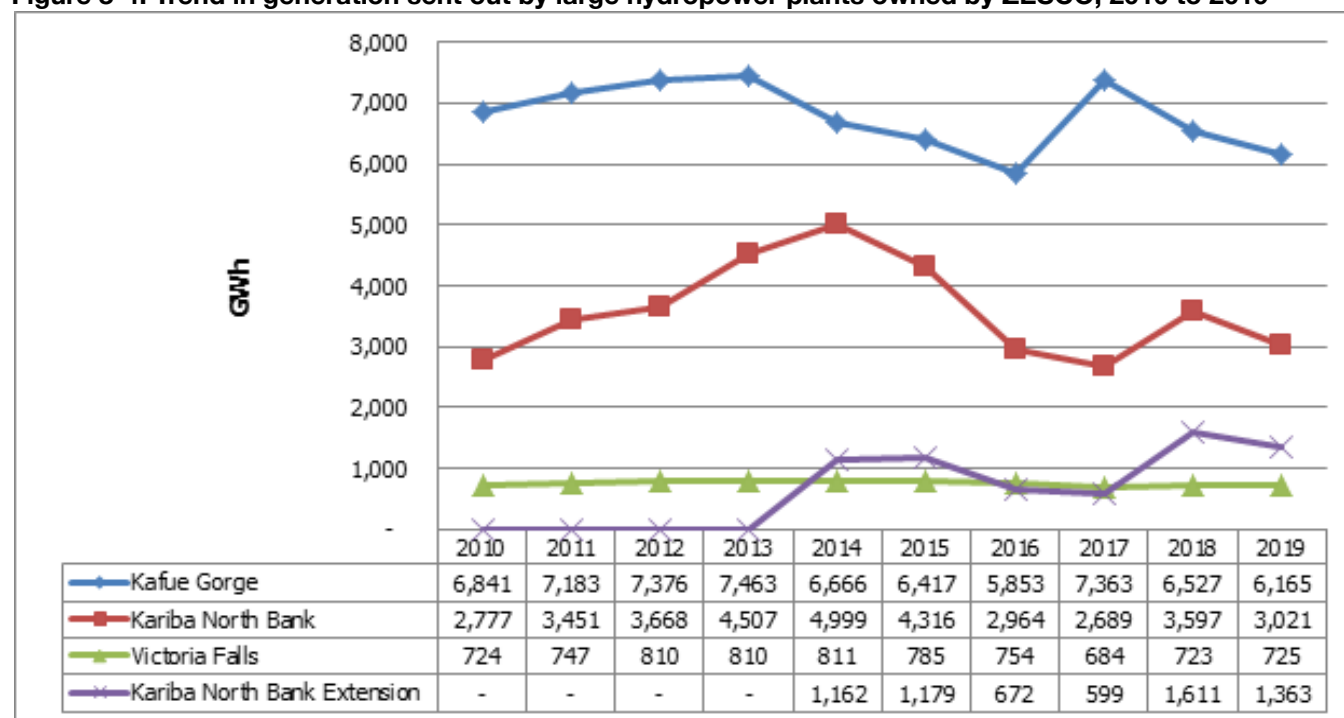


Source: Zambezi River Authority website

3.2.3 Electricity generation from large hydro power plants owned by ZESCO

In 2019, ZESCO owned four large hydro power plants namely; Kafue Gorge (990 MW), Kariba North Bank (720 MW), Kariba North Bank Extension (360 MW) and Victoria Falls (108 MW). The total generation sent out by ZESCO's large hydro power plants reduced from 12,458 GWh in 2018 to 11,274 GWh representing 9.5 percent reduction. The reduction was attributed to below normal rainfall experienced in the 2018/19 rainy season which resulted in low water levels in the main water reservoirs, as earlier mentioned. Figure 3-4 shows the trend in generation from ZESCO's large hydro power stations from 2010 to 2019.

Figure 3-4: Trend in generation sent out by large hydropower plants owned by ZESCO, 2010 to 2019



*KNBE was commissioned in 2014 hence the production figures presented are from 2014 to 2019

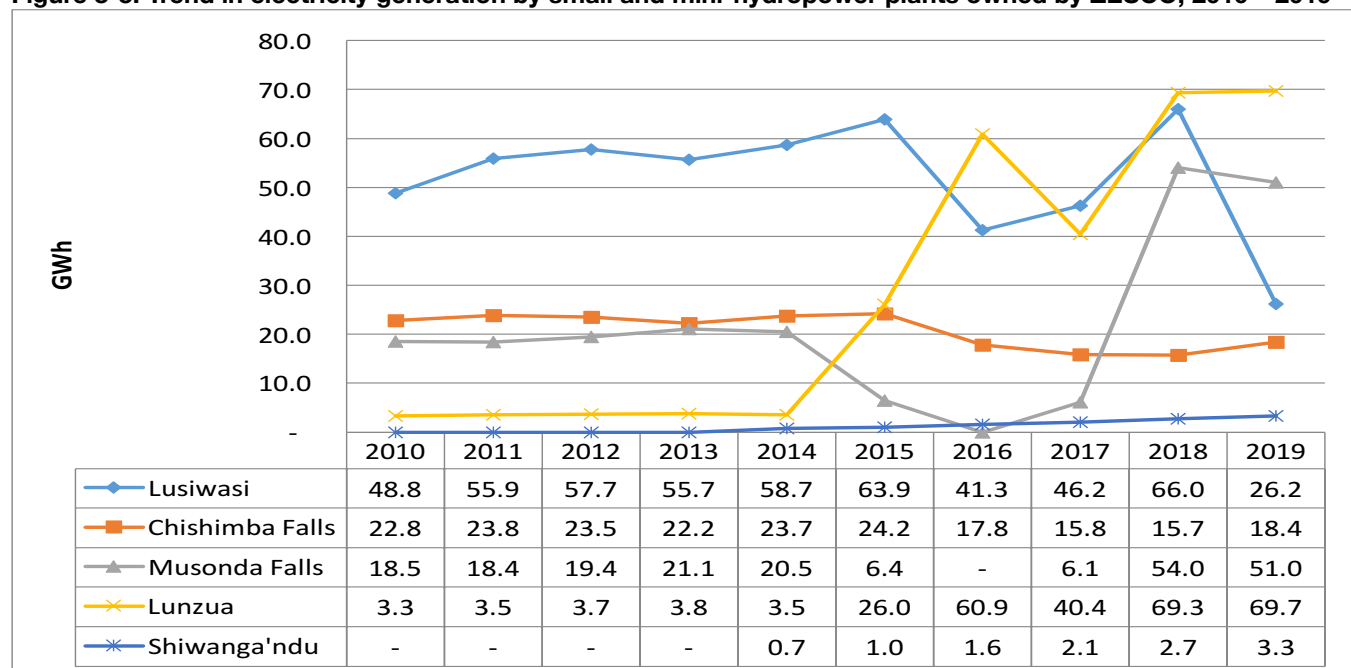
Kafue Gorge, Kariba North Bank and Kariba North Bank Extension, recorded noticeable reductions in generation in 2019 compared to 2018. Conversely, Victoria Falls Power Station (VPS) recorded a slight increase in its generation sent out from 723 GWh recorded in 2018 to 725 GWh, representing 0.28 percent.

3.2.4 Electricity generation from small and mini-hydropower plants owned by ZESCO

In the period under review, total electricity generation from small and mini hydro power plants owned by ZESCO reduced by 18.9 percent to 168.6 GWh in 2019 from 207.7 GWh in 2018. This was mainly attributed to a decline in generation sent out by Lusiwasi (60.3%) and Musonda Falls (6%).

Meanwhile, there was a marginal increase in electricity generation sent out by Lunzua, from 69.3 GWh to 69.7 GWh, representing 0.5 percent. Further Chishimba Falls recorded an increase in generation sent out from 15.7 GWh to 18.4 GWh, reflecting 17.1 percent, while Shiwan'gandu recorded a 21.1 percent increase from 2.7 GWh to 3.3 GWh. Figure 3-5 shows electricity generation sent out from small and mini hydro power plants owned by ZESCO for the period 2010 to 2019.

Figure 3-5: Trend in electricity generation by small and mini-hydropower plants owned by ZESCO, 2010 – 2019

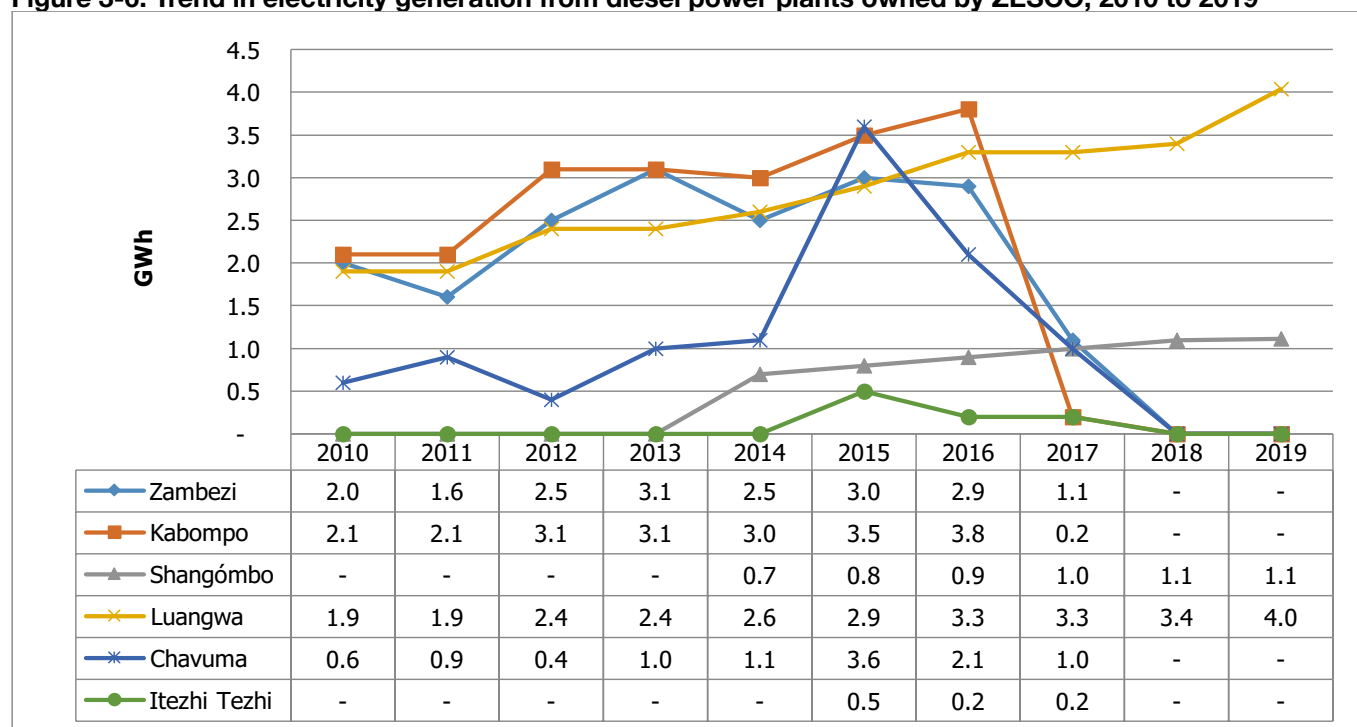


*Shangombo was commissioned in 2014 hence the production figures presented are from 2014 to 2019

3.2.5 Electricity generation from diesel power plants owned by ZESCO

In the past five years, the number of diesel power plants operated by ZESCO declined from six, in 2015 to two in 2019. This was mainly due to the continued connections of areas serviced by diesel plants to the national grid. In 2019, generation sent out from diesel power plants increased by 13.7 percent from 4.54 GWh in 2018 to 5.11 GWh in 2019. Figure 3-6 shows the trend in electricity generation sent out from diesel power plants operated by ZESCO from 2010 to 2019.

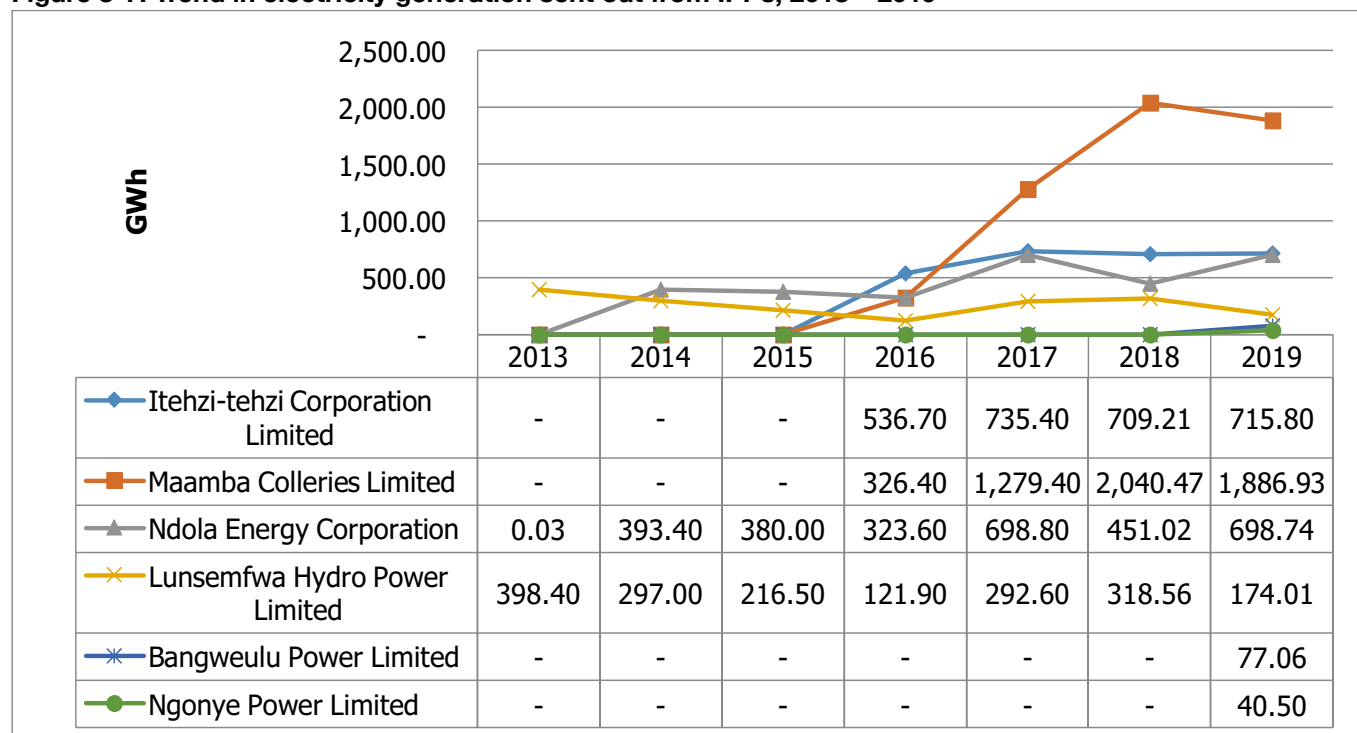
Figure 3-6: Trend in electricity generation from diesel power plants owned by ZESCO, 2010 to 2019



3.2.6 Electricity generation from Independent Power Producers

The number of IPPs increased from five in 2018 to seven in 2019, following the commissioning of Bangweulu (54.3 MW) and Ngonye (34 MW) solar power plants. The two solar power plants increased the share of solar in the electricity generation mix to 3 percent. Generally, total generation sent out by all IPPs increased by 73.77 GWh to 3,593.04 GWh in 2019 from 3,519.26 GWh in 2018 representing a 2.1 percent increase in electricity generation sent out. This is depicted in figure 3-7.

Figure 3-7: Trend in electricity generation sent out from IPPs, 2013 – 2019



Itezhi-Tehzi Power Corporation Limited (ITPC) and Ndola Energy Corporation Limited (NECL) increased their electricity generation sent out by 0.9 and 54.9 percent respectively. The increase was in response to generation constraints by ZESCO's large hydro power stations induced by low water levels, thereby increasing generation from HFO power plants.

However, Maamba Collieries Limited (MCL) and Lunsemfwa Hydro Power Company Limited (LHPC) recorded reductions in electricity generation by 7.5 percent and 45.4 percent, respectively. The reduction in generation from MCL was on account of forced unit outages caused by technical challenges; while for LHPC, the reduction was due to depleted water resource in the reservoir.

3.3 LOCAL AND REGIONAL POWER TRADING

3.3.1 Power Purchase Agreements

As part of its mandate to review and approve the Power Purchase Agreements (PPA) and Power Supply Agreements (PSA) to allow bilateral and local power trading, the ERB reviewed and approved the following PPAs/PSAs in 2019:

Table 3-2: Approved PPAs /PSAs in 2019

PPA and PSA Reviewed	Contracted Capacity	Outcome
Dangote Zambia Limited and Copperbelt Energy Corporation PLC	8 MW	Approved
ZESCO Limited and Enterprise Power - DRC	50 MW	Approved
ZESCO Limited and Societe Nationale d'electricite S.A - DRC	6.1 MW	Approved
ZESCO Limited and San HE Manufacturing Limited	35 MVA	Approved
ZESCO Limited and Mabiza Resources Limited	10 MVA	Approved
ZESCO Limited and Namibia Power Corporation (Pty) Limited	100 MW	Approved

3.3.2 Regional power trading

3.3.2.1 The Southern African Power Pool

The Southern African Power Pool (SAPP) is a regional power trading block comprising member states' power utilities in the SADC region. The SAPP was created in August 1995 through the signing of the Inter-Governmental Memorandum of Understanding (MOU). The aim was to optimize the use of available energy resources in the region and support one another during emergencies. The SAPP vision is to:

- Facilitate the development of a competitive electricity market in the Southern African region;
- Give the end user a choice of electricity supply;
- Ensure that the Southern African Region is the region of choice for investment by energy intensive users; and
- Ensure sustainable energy developments through sound economic, environmental & social practices.

The main objectives of the SAPP are to provide a forum for the development of a world class, robust, safe, efficient, reliable and stable interconnected electrical system in the southern African region; ensure harmonization; coordinate and enforce common regional standards of quality of supply as well as measurement and monitoring of systems performance. The SAPP facilitates power trading among the member utilities through both bilateral and competitive markets.

The SAPP established the Short-Term Energy Market in April 2001. From January 2004, the SAPP started the development of a competitive electricity market for the SADC region. The day-ahead market (DAM) was established in December 2009. In 2015 the SAPP trading Platform was upgraded with Forward Physical Markets and the Intra Day Market. Table 3-3 shows the SAPP members in 2020.

Table 3-3: Southern African Power Pool Member Countries

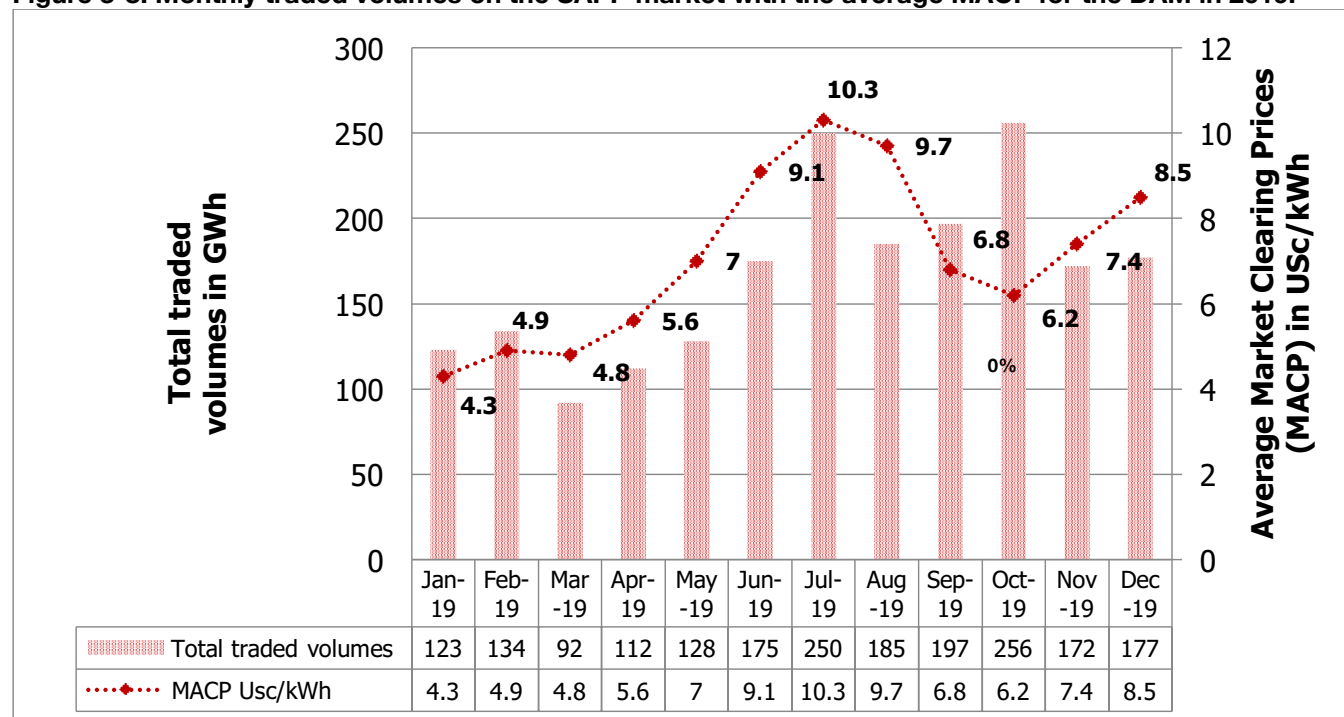
No.	Full Name of Utility	Abbreviation	Country
1	Botswana Power Corporation Ltd	BPC	Botswana
2	Electricidade de Mocambique	EDM	Mozambique
3	Hidroelectrica de Cahora Bassa	HCB	Mozambique
4	Mozambique Transmission Company	MOTRACO	Mozambique
5	Electricity Supply Corporation of Malawi	ESCOM	Malawi
6	NamPower Ltd	Nam Power	Namibia
7	Rede Nacional de Transporte de Electricidade	RNT	Angola
8	ESKOM Ltd	ESKOM	South Africa
9	Lesotho Electricity Corporation	LEC	Lesotho
10	Societe Nationale d'Electricite	SNEL	DRC
11	Eswatini Electricity Company	EEC	Eswatini
12	Tanzania Electricity Supply Company Ltd	TANESCO	Tanzania
13	ZESCO Ltd	ZESCO	Zambia
14	Copperbelt Energy Corporation Plc	CEC	Zambia
15	Lunsemfwa Hydro Power Company Ltd	LHPC	Zambia
16	Zimbabwe Electricity Supply Authority	ZESA	Zimbabwe
17	Ndola Energy Corporation Ltd	NECL	Zambia

3.3.2.2 Trade on the Southern African Power Pool



Trade on the SAPP market generally reduced from 2,132 GWh traded in the year 2018 to 2,005 GWh in 2019 representing a 5 percent decrease. The DAM continued to dominate the SAPP market trade. Peak trade was recorded in October 2019, when total traded volumes rose to 256 GWh at an average Market Clearing Prices (MACP) of USc 6.2/kWh. Meanwhile the average MACP reached its highest in July, 2019 at USc 10.3/kWh. For the rest of the year, traded volumes averaged 160 GWh at an average MACP of USc 7.05/kWh. Figure 3-8 shows the monthly traded volumes on the SAPP market with the average MACP for the DAM in 2019.

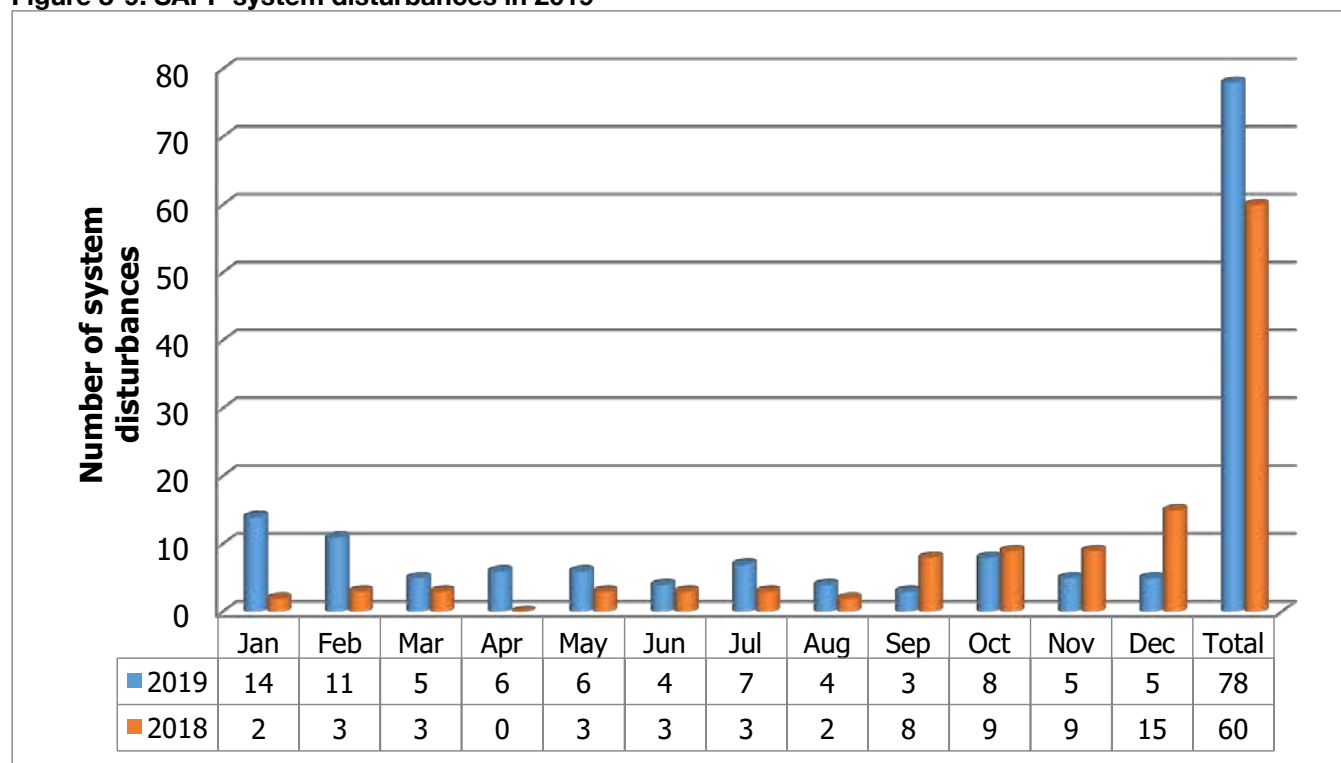
Figure 3-8: Monthly traded volumes on the SAPP market with the average MACP for the DAM in 2019.



3.3.2.3 SAPP system disturbances

The SAPP recorded an increase in the number of total system disturbances in 2019 to 78 from 60 recorded in 2018. Major disturbances were recorded in January, February, July and October 2019. The majority of the system disturbances were due to power oscillations especially in the central corridor (Botswana, Zimbabwe and Zambia). These disturbances interrupted energy interchange among SAPP members but also endangered performance of power equipment. Figure 3-9 shows the number of system disturbances by the SAPP in 2019.

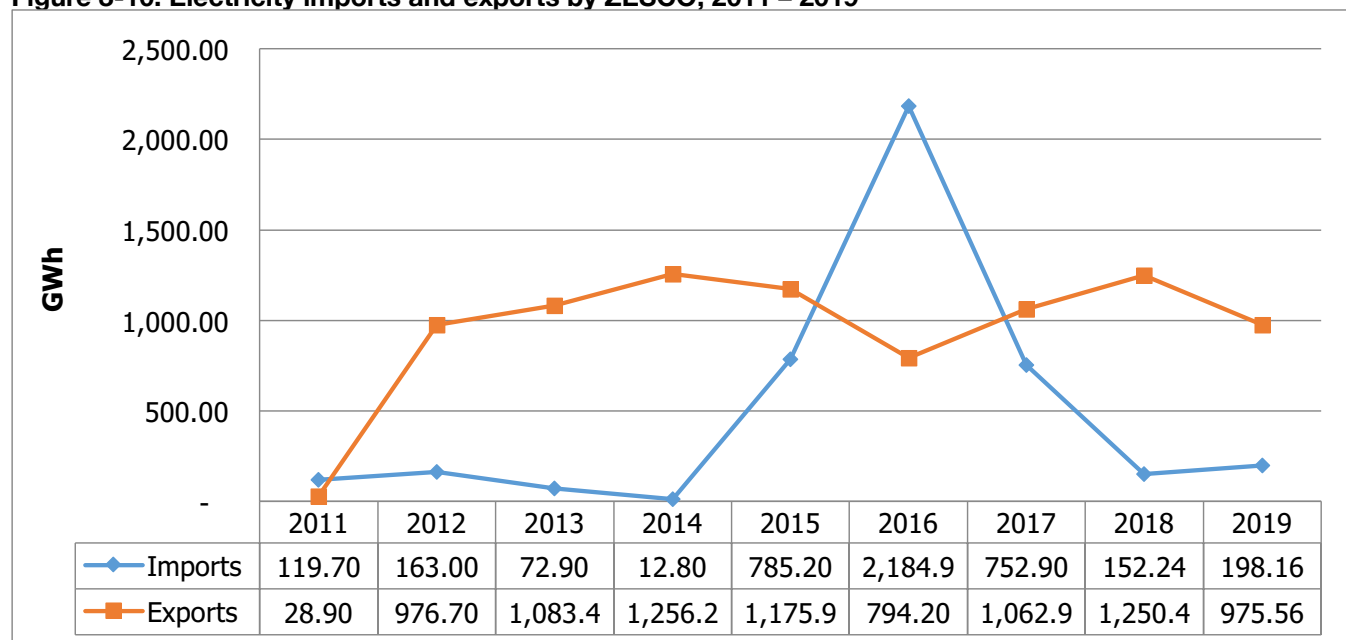
Figure 3-9: SAPP system disturbances in 2019



3.3.3 ZESCO electricity exports and imports

As a member of the SAPP, ZESCO was involved in cross border trading with other regional utilities through bi-lateral agreements and or the spot market. During 2019, ZESCO recorded a 22 percent reduction in exports from 1,250.4 GWh in 2018 to 975.6 GWh in 2019 due to the reduced electricity generation from most of its hydro power plants. Meanwhile, ZESCO's imports increased by 30 percent in 2019 from 152.2 GWh in 2018 to 198.2 GWh. Figure 3-10 shows the trend in ZESCO's electricity imports and exports from 2011 to 2019.

Figure 3-10: Electricity imports and exports by ZESCO, 2011 – 2019



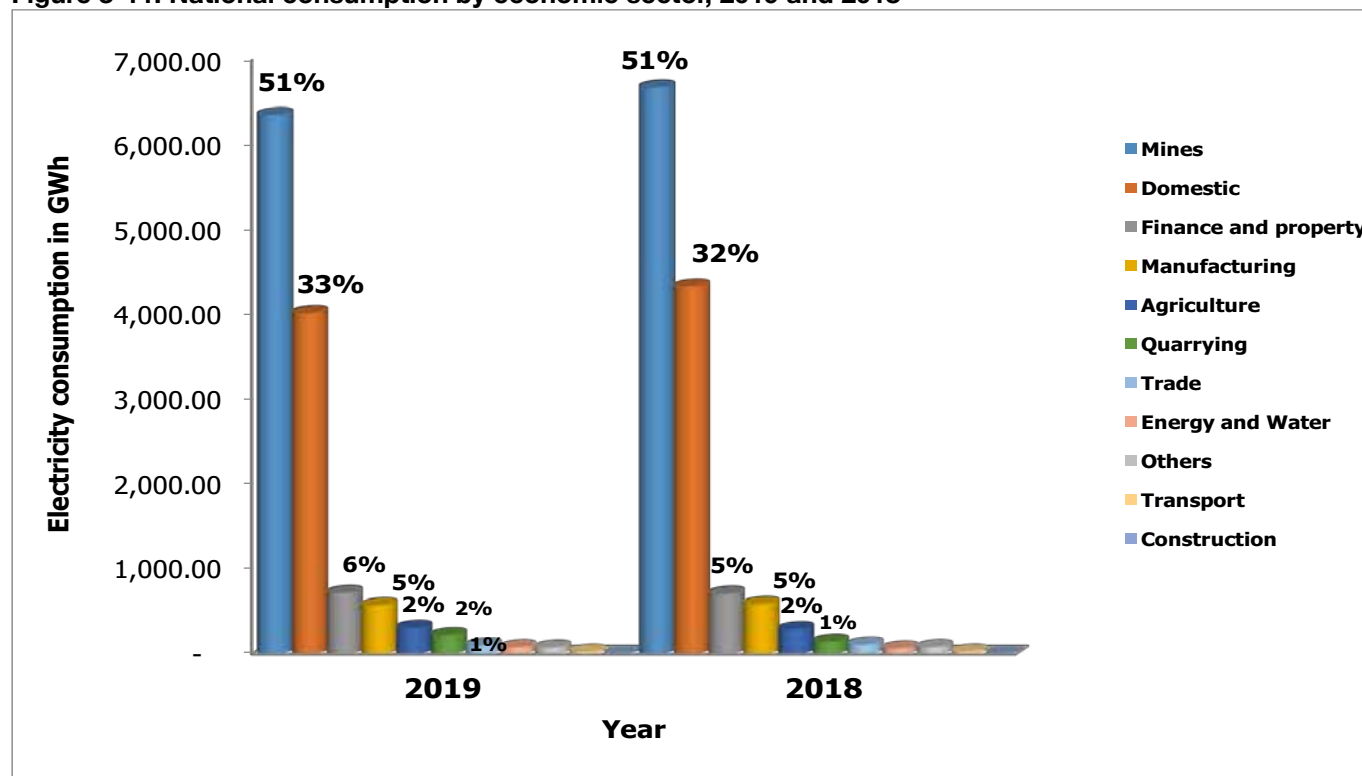
3.4 NATIONAL ELECTRICITY CONSUMPTION

During the period under review, total electricity consumed was 12,526 GWh which was a 4 percent reduction from the 13,080 GWh consumed in 2018. The reduction in total electricity consumption over this period was attributed to the decrease in generation occasioned by low water levels in the main reservoirs.

3.4.1 National electricity consumption by economic sector

The national electricity consumption by economic sector is depicted in figure 3-11.

Figure 3-11: National consumption by economic sector, 2019 and 2018



During the period under review, the mining sector accounted for the highest consumption of national electricity of 51 percent (6,359.44 GWh). The second energy intensive sector was the domestic sector which consumed 33 percent (4,022.54 GWh) of electricity. Meanwhile, the other sectors accounted for 16 percent (2,143.71 GWh) of the total national electricity consumption.

Generally, consumption from all the sub sectors reduced marginally consistent with the reduction in generation between 2018 and 2019. However, in order to minimise the adverse economic impact of the electricity shortage, the reduction in power supply to economic sectors was marginal and the burden was borne by residential customers resulting in longer hours of load shedding.

3.5 OPERATIONAL PERFORMANCE OF ELECTRICITY ENTITIES

This section discusses the performance of individual entities in the electricity sub sector during the year 2019.

3.5.1 ZESCO Limited



ZESCO sub-station transformer

The ERB continued monitoring ZESCO using the Key Performance Indicators (KPIs) framework. Table 3-4 shows ZESCO's average annual performance on the KPI framework from 2017 to 2019.

Table 3-4: ZESCO's annual performance from 2017 – 2019

No	Indicator	Weight (%)	Annual average performance (%)		
			2017	2018	2019
1	Metering Customers	10	10	5	9
2	Cash Management	20	6	7	6
3	Staff Productivity	15	14	15	15
4	Quality of Service Supply	20	10	13	10
5	System Losses	10	5	9	9
6	Power Generation	10	10	10	8
7	Safety	5	0	1	2
8	Customer Complaints	5	5	5	5
9	Equipment Failure	5	3	4	5
Total Score		100	63	69	69

Generally, over the three year regulatory period, ZESCO did not meet the minimum benchmark score of 75 percent. In 2019, ZESCO attained an **annual average performance score of 69 percent** against the **minimum benchmark score of 75 percent**. Therefore, the utility's performance was not satisfactory as per agreed benchmarks.

Specifically, the Utility did not perform well in Cash Management, Safety and Quality of Supply KPI indicators, in 2019. However, on average ZESCO met the agreed KPI targets on the following: customer metering, staff productivity, system losses, power generation, equipment failure and the customer complaints resolution²³ KPI indicators. See appendix 6 for details of ZESCO's annual KPI performance for the year 2019.

²³ The customer complaints reported in this KPI framework are those that are related to power outages

The three-year KPI performance monitoring framework for ZESCO expired on 31st December, 2019. It is noted that each successive framework enhances and builds upon the previous one. In this regard, the ERB, in consultation with ZESCO is reviewing the KPIs in order to make them robust and responsive to new developments in the Industry as well as to address identified challenges.

The new framework will cover the period January 2020 to December 2022. As a broad guiding principle, key considerations in designing the new KPI framework will include, but not limited to the following:

1. Consumer feedback received by the ERB through complaints;
2. Significance of the KPI in addressing consumer expectations;
3. Extent to which ZESCO has gone in achieving the targets set in the current framework that covered the period 2017 to 2019;
4. Relevance of the specific KPIs in addressing ZESCO's operational problems;
5. Significance and relevance in adhering to ERB License Conditions;
6. Relevance of the KPI in achieving Government policy objectives; and
7. Significance of the KPI in achieving strategic objectives.

It is also envisaged that the new framework will be enhanced through period primary data and processes verification audits to be undertaken by the ERB during the course of the three year period.

3.5.1.1 New KPIs framework for ZESCO

The current ZESCO KPI framework came to an end in December 2019; therefore the ERB has since developed a new KPI framework to run from January, 2020 to December 2022. The new framework comprises 11 thematic areas which include:

- 1) New customer metering;
- 2) Efficiency;
- 3) System losses;
- 4) Quality of service;
- 5) Power quality;
- 6) Power generation;
- 7) Safety;
- 8) Staff productivity;
- 9) Customer service;
- 10) Meter maintenance and reading; and
- 11) Financial ratios

The ERB has maintained a minimum benchmark score of 75 percent and the quarterly reporting procedure has also been maintained.

Technical Performance

In 2019, the ERB conducted technical compliance audits of ZESCO's electricity infrastructure covering 10 provinces in Zambia. The audits covered generation, transmission and distribution of infrastructure that is spread across the country. In 2019 a total of 415 facilities were sampled reflecting 9.6 percent increase compared to 375 facilities sampled in 2018. The audits were undertaken in line with the ERB's 2018-2021 Strategic Business Plan under, **Objective 1.3** *"to ensure that utilities achieve 93 percent compliance to technical standards for electricity infrastructure by 2021 through strengthening compliance monitoring and enforcement mechanisms."*

The overall average infrastructure compliance for all the facilities inspected across the country was found to be 81 percent compared to 76.7 percent in 2018. Despite an increase of 4.3 percentage points, the overall score was below the ERB compliance target of 89 percent, by December 2019. Table 3-5 shows the summary of ZESCO's electricity infrastructure compliance levels from 2016 to 2019.

Table 3-5: Overall average percentage compliance level by type of facility, 2016-2019

No.	Type of Facility	2016 % Compliance	2017 % Compliance	2018 % Compliance	2019 % Compliance
1.	Large Hydro Power Stations	94.90	95.26	95.0	93.0
2.	Transmission Substations>33kV	76.91	79.05	79.3	82.0
3.	Distribution Substations≤33kV	71.53	74.93	73.3	74.0
4.	Mini Hydro Power Stations	86.17	82.62	68.5	94.0
5.	Diesel Fueled Power Stations	70.93	64.04	67.1	64.0
ZESCO Overall Average Compliance level (%)		80.1	79.18	76.7	81.0
ERB SBP Compliance Target for ESI (%)		80.00	85.00	87.00	89.00

The main factors responsible for the failure to meet the ERB target in 2019 were related to the following:

- i. Healthy and Safety;
- ii. Environmental;
- iii. Maintenance;
- iv. Protection; and
- v. Security of supply.

3.5.2 Copperbelt Energy Corporation Plc

CEC is a Transmission Network Service Provider (TNSP) that owns and operates high-voltage transmission and distribution systems that supply electricity to Zambia's mining companies based on the Copperbelt. CEC's transmission network is also used to export/wheel electricity to the Democratic Republic of Congo (DRC).

The Company had a Bulk Supply Agreement (BSA) with ZESCO for the purchase of power to supply the mines. In 2019 CEC sold 3,137 GWh of electricity to its mining customers, this was a 14 percent reduction from the 3,672 GWh sold in 2018. The decrease in energy sales was mainly due to reduced load requirements for Mopani Copper Mines and Chambishi Metals.

Transmission losses averaged 2.1 percent in 2019 reducing by 0.2 percentage points from the year 2018. Energy generated from standby generators was 9.31 GWh which was 33 percent lower than 13.84 GWh in 2018. Table 3-6 shows CEC's performance from 2015 to 2019.

Table 3-6: CEC's performance, 2015 – 2019

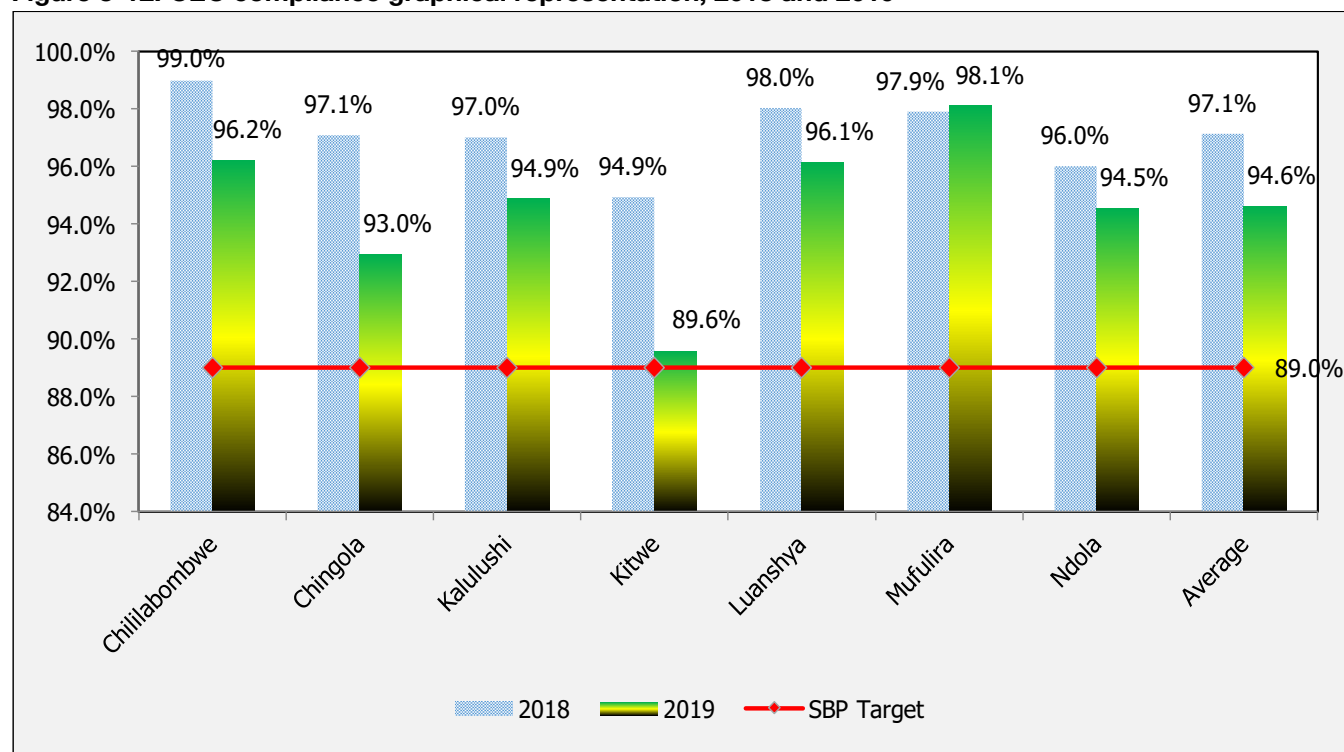
Business element	2015	2016	2017	2018	2019
Electricity sales to the mines	4,021 GWh	3,521 GWh	3,512 GWh	3,672 GWh	3,137 GWh
Power imports from SAPP	116.4 GWh	302.8 GWh	340.9 GWh	82.4 GWh	-
Transmission losses	2.9%	3.6%	3.0%	2.3%	2.1%
Standby Generation capacity	80 MW	80 MW	80 MW	80 MW	80 MW
Energy from standby generators	7.17 GWh	8.16 GWh	12.67 GWh	13.84 GWh	9.31 GWh
Solar plant capacity	-	-	-	1 MW	1 MW
Generation from solar	-	-	-	0.93 GWh	1.4 GWh

In addition to supplying power to the mines, CEC also supplies electricity to residential customers in the CEC Village. In 2019, CEC continued to generate power from its 1MW solar power plant with power output increasing to 1.4 GWh in 2019 from 0.93 GWh in 2018.

Technical performance

In 2019, the ERB conducted technical inspections of CEC electricity infrastructure covering transmission and Gas Turbine Alternators (GTA). The average compliance for the transmission facilities was found to be 94.60 percent in 2019 compared to 97.10 percent in 2018 while for the GTAs was 99.50 percent in 2019 compared to 98.50 percent in 2018. The overall percentage compliance was above the ERB set target of 89.00 percent by December 2019. The non-compliance noted were related to safety and maintenance. Figure 3-12 shows the compliance levels of CEC electricity infrastructure for 2019 in comparison to 2018.

Figure 3-12: CEC compliance graphical representation, 2018 and 2019



3.5.3 Ndola Energy Company Limited

In 2019, Ndola Energy Company Limited (NECL) supplied a total of 698.79 GWh to ZESCO compared to 451.0 GWh in 2018. The increase in the supply of power was attributed to adequate availability of HFO for power generation in 2019 compared to 2018.

Technical performance

NECL continued to perform well under technical compliance audits for both its Phase I and phase II power generation plants. NECL maintained a 100 percent score on the compliance level for the audited electricity infrastructure in 2019, as in 2018. This performance was above the ERB target of 89 percent for 2019.

Challenges

The major challenge faced by the company in 2019 was the cost it incurred for sending HFO samples for laboratory analysis outside Zambia because there are no suitable local independent fuel laboratories in the vicinity that can do qualified and reliable tests of HFO, thereby incurring additional costs for testing and also time delay to send samples and receive results.

Outlook

In 2020, NECL plans to construct 16,000 MT HFO storage tanks with auxiliary equipment in assurance of the supply of HFO.

3.5.4 Lunsemfwa Hydro Power Company Limited



Mulungushi hydro power station

During the period under review, electricity generation sent out by Lunsemfwa Hydro Power Company Limited (LHPC) reduced by 45 percent to 174.0 GWh compared to 318.5 GWh generated in the previous year. The reduction was on account of the depleted water resources in its water reservoirs.

Technical performance

In 2019, the ERB conducted technical audits of LHPC electricity infrastructure covering generation power stations (Lunsemfwa and Mulungushi) and transmission facilities²⁴. Table 3-7 depicts the percentage compliance of audited infrastructure from 2015 to 2019.

LHPC shut down its power plants in July 2019 due to depleted water resource in the reservoir and put the plants on care and maintenance. It was however noted that, LHPC met the ERB compliance target of 89.0 percent and scored 91.75 percent in 2019 compared to 94.25 percent in 2018.

Table 3-7: LHPC's facilities inspected and compliance levels, 2015-2019

Type of Facility	Compliance (%)				
	2015	2016	2017	2018	2019
Converter 66/33/11KV	62.00	94.30	80.90	94.00	93.00
Kabwe Step Down 66/88kV	62.60	90.51	83.04	100.00	88.00
Mulungushi Power Station	88.10	90.16	80.77	93.00	93.00
Lunsemfwa Power Station	89.70	78.28	89.74	90.00	93.00
LHPC Overall Average Compliance	75.60	88.31	83.61	94.25	91.75
ERB Compliance Target	80.00	85.00	85.00	87.00	89.00

²⁴ LHPC 66kV Line A and B infrastructure at Converter 66/33/11kV Substation. In addition the audit also covered Transformer T5 and its accessories at 88kV Kabwe Step Down Substation.

Challenges

The filling of Mita Hills reservoir remained a challenge for the company due to upstream water diversion in the Mkushi Farm block exacerbated by low rainfall that was received in the catchment area.

3.5.5 Maamba Collieries Limited



Maamba Collieries plant

MCL owned a 300 MW coal fired thermal power plant as at 31st December, 2019. During the period under review, MCL supplied 1,886.92 GWh of power to ZESCO which was a decrease of 7.5 percent from 2,040.73 GWh in 2018. The reduction was mainly due to the shutdown of one of its units towards the end of 2019 following a technical fault.

Technical Performance

The ERB conducted a technical compliance audit of MCL's facilities in 2019. The performance was 0.7 percentage point higher from 94.7 percent in 2018 to 95.4 percent in 2019.

Outlook

MCL plans to invest in a new mine pit called Kanzine for production of coal. Works for the new mine pit were scheduled to begin in June 2020. According to MCL, approximately US\$10 Million will be invested in a period of two years for mining activities for the new mine pit.

3.5.6 North-Western Energy Corporation Limited

NWEC is a Distribution Network Service Provider (DNSP) that purchases power from ZESCO and supplies to the mining townships of Lumwana, Kalumbila and Kabitaka. Furthermore, NWEC has a 15 year Distribution Licence issued in 2008 to distribute power up to 20 MW in the North-western Province of Zambia. Currently, NWEC utilizes the said capacity to meet the non-mine customer demand at its Lumwana (Barrick Mine), Kabitaka and Kalumbila - First Quantum Minerals (FQM) sites. Power is supplied through various substations established by NWEC.

During the period under review, NWEC purchased 39.7 GWh of electricity in 2019 compared to 36.2 GWh of electricity purchased in 2018, representing a 9.8 percent increase. In 2019, residential customer numbers increased by 2.11 percent from 3,167 in 2018 to 3,234 in 2019. Meanwhile commercial customer numbers had increased by 9.87 percent from 81 in 2018 to 89 in 2019.

Additionally, the utility supplies power to Me-Long Teng Grinding Media (Zambia) Limited (MELTZ) within the Kalumbila through a 10-year PSA that was signed in 2018. The industrial client, MELTZ (Zambia) Limited owns and operates a Ball Mill Plant with energy load between 8 MVA and 12 MVA. NWECC also plans to build its own thermal generation power plant in Ndola to ensure security of supply and contribute to the diversification of the energy mix in the country.

Technical Performance

In 2019 the ERB conducted the technical audits of NWECC electricity distribution and supply infrastructure. NWECC recorded the average compliance of 88.08 percent compared to 85.99 percent in 2018 and this was below the ERB compliance target of 89.00 percent.

Table 3-8 gives a summary of the infrastructure compliance of facilities audited in the period 2017 - 2019.

Table 3-8: NWECC's percentage compliance 2017-2019

Type of Facility/Substation	2017 % Compliance	2018 % Compliance	2019 % Compliance
Kansanshi (Kabitaka)	75.00	88.00	78.10
Lumwana	65.00	83.00	94.16
Kalumbila	80.00	87.00	91.97
Average % compliance	73.33	85.99	88.08
ERB Compliance Target	85.00	87.00	89.00

3.5.7 Kariba North Bank Extension Power Corporation Limited

Kariba North Bank Extension Power Corporation Limited (KNBE) is a Special Purpose Vehicle (SPV) that was established by ZESCO to operate a 360 MW peaking hydro power plant. During 2019, KNBE recorded a decrease in generation sent out from 1,611GWh in 2018 to 1,363 in 2019. Representing a 0.15 percentage points reduction.

Technical Performance

In 2019, following the technical compliance audits conducted by the ERB of KNBE facilities, the average compliance score was 88.50 percent compared to 93.31 percent in 2018. The performance of KNBE electricity infrastructure was however, below the ERB compliance target of 89.00 percent for 2019.

3.5.8 Itezhi Tezhi Power Corporation

Itezhi Tezhi Power Corporation (ITPC) is an IPP that has a long term power purchase agreement with ZESCO to supply up to 120 MW from its hydro power station. During 2019, ITPC, supplied 715.80 GWh, which was 0.9 percent higher than 709. 21 GWh recorded in 2018.

Technical performance

In 2019, the ERB conducted the technical inspections on the electricity infrastructure for ITPC. The compliance level was determined to be 93.5 percent in the period under review compared to 96.46 percent in 2018, indicating a 2.96 percentage point decrease. The performance of ITPC infrastructure was above the ERB compliance target of 89.00 percent for 2019 as depicted in the table 3-9 below.

Table 3-9: ITPC compliance rate of inspected facilities, 2017 - 2019

Type of Facility	2017 % Compliance	2018 % Compliance	2019 % Compliance
ITPC Hydro Electric Power Stations	85.19	94.92	93.00
220kV Switch Yard		98.00	94.00
ITPC Overall Average Compliance Level (%)	85.19	96.46	93.50
ERB Compliance Target for ESI	85.00	87.00	89.00

3.5.9 Zengamina Power Limited



ZPL Power House Sub-station.

Zengamina Power Limited (ZPL) owned and operated a 0.75 MW small hydro power plant and off-grid facility in Ikelenge District of North-Western Province. Since its commissioning in 2007, the company has supplied power to over 700 customers, including households, hospitals, schools, and small businesses. During the year 2019, the Company's net electricity generation was 2.2 GWh which was a 4 percent increase from 2.1 GWh recorded in 2018.

Technical Performance

In 2019, the ERB conducted a technical audit of ZPL's electricity infrastructure and the compliance percentage was determined to be 78.20 percent. This was below the ERB set target of 89.00 percent.

3.5.10 Dangote Industries Zambia Limited

Dangote Industries Zambia Limited (Dangote) owned and operated a 30 MW captive coal fired thermal Power Plant located in Masaiti District in the Copperbelt Province. The power plant was licensed by the ERB to generate electricity solely for the purpose of facilitating cement production at their cement plant.

Dangote has an Embedded Generation Licence valid for five years with effect from 30th June 2016. Dangote Power plant in conjunction with CEC is in the process of trying to connect to the national grid to enable it export the excess power generated and also import power when necessary.

Dangote and CEC have a wheeling agreement to facilitate power transmission to and out of the plant.

Technical Performance

In 2019, the ERB conducted the technical audits of Dangote electricity generation infrastructure and the compliance percentage was found to be 94.8 percent compared to 97.9 percent in 2018. This was above the ERB compliance target of 89.00 percent.

Table 3-10 depicts the compliance levels for Dangote infrastructure from 2016 to 2019.

Table 3-10 Dangote percentage compliance 2016-2019

Type of Facility/Substation	2016 % Compliance	2017 % Compliance	2018 % Compliance	2019 % Compliance
Dangote Power Plant	96.62	96.47	97.86	94.80
ERB Compliance Target	80.00	85.00	87.00	89.00

3.6 OPERATIONAL PERFORMANCE OF THE INTERCONNECTED POWER SYSTEM

The ERB, upon the recommendation of the Grid Code Technical Committee (GCTC), issued the Licence to Operate the Interconnected Power System in Zambia to ZESCO Limited in 2016. Since then, ZESCO has been performing the role of System Operator (SO) whose function includes ensuring safe and efficient operation of the IPS. Clause 4 of **the Electricity (Grid Code) Regulations SI 79, 2013** provides that the SO shall be responsible for system reliability, safety and security and shall establish as well as implement operational measures to cover the operation of the IPS under all system conditions.

The major system disturbances are normally caused by internal and external faults on the system. In 2019, the IPS experienced a total of 87 major system disturbances and faults compared to 27 recorded in 2018 as depicted in Appendix 7. ZS 387 – 2 B.5.1 define major supply interruptions as:

- Any single event that lead to loss of supply to 1,000 consumers or a large end-user consumer; and
- Forced interruption index greater than five system- minutes²⁵

3.7 NETWORK CONSTRAINTS

In 2019, the IPS experienced the following constraints:

- (N-1)²⁶ constraint: - Kabwe 330kV Pensulo line
- Generation plants outages and restrictions:
 - Kafue Gorge generators G5 and G6 / T3 outage for 117 Days;
 - MCL forced unit outages;
 - Kariba North Bank restricted generation due to low water levels and subsequent depletion of 2019 water allocation in quarter 4; and
 - Kafue Gorge generation limitation due to low water levels.

3.8 POWER QUALITY MANAGEMENT SYSTEM

In order to improve the provision of energy services and products to the consumers, the ERB developed the Power Quality Management System (PQMS). The framework objective is to provide a long term mechanism for continuous monitoring of the power quality performance of the Interconnected Power System (IPS) in Zambia. The PQMS framework, complimented by the PQDs will in the long term provide for compliance to Zambian Electricity Supply – Power Quality Reliability Standard (ZS 387).

As at 31st December 2019, 212 sites were monitored and reported to ERB against the total of 351 sites representing 60 percent sample size compared to 166 sites 48 percent in 2018.

In 2019, the annual overall average power quality performance of the network in Zambia was 77.1 percent, compared to 74.6 percent compliance recorded in 2018 and this represents a percentage increase of 2.5 percent. This was above the set target in the SBP for the period up to December 2019.

Further, during the period under review, most licensees were on course with the procurement and installation of PQ recorders.

²⁵ System Minutes = Energy not supplied in MWh/ Power at Peak

²⁶ N-1 constraint technically referred to as a provision of backup infrastructure for redundancy

Table 3-11 depicts the status of the implementation of PQMS and PQDs as at 31st December 2019.

Table 3-11: Implementation of the power quality management system and power quality directives, 2019

Licensee	Total Number of Recorders/ Sites required to be monitored	Total Number of Permanently installed PQ Recorders	Total number of Sites monitored as at 31 st December 2019	Percentage (%) of monitored sites as at 31 st December 2019
ZESCO	161	38	36	22
CEC Plc	172	163	163	95
LHPC	11	8	8	73
NDOLA ENERGY	3	3	3	100
MCL	2	2	2	100
ITPC	2	2	0	0
Total	351	216	212	60

As at 31st December 2019, the ESI in Zambia required 351 recorders out of which 216 (62%) had been installed. MCL and NECL had fully installed the recorders while ZESCO, CEC and LHPC had deficits on their networks. Notably, of the 216 recorders that had been installed, 212 were regularly monitored. The four (4) which were not monitored had unresolved technical challenges.

3.8.1 Power quality performance from 2015 to 2019

Zambia's ESI has continued to record improvement on the PQ performance which has increased from 64 percent in 2015 to 77.1 percent as at 31st December 2019. This has therefore provided a basis for engagements with the licensees so as to ensure improved and sustained PQ performance of the network for quality service delivery to consumers. Table 3-12 shows the status of Power Quality Performance from 2015 to 2019 of the IPS.

Table 3-12: Status of power quality performance of the IPS, 2015 to 2019

Year	Voltage Harmonics	Voltage unbalance	Voltage Dips	Interruptions	Voltage Regulation	Frequency	Average
2019 Compliance	93.6%	95.9%	49.3%	82.4%	66.9%	37.2%	77.1%
2018 Compliance	95.3% ²⁷	96.3%	39.7%	78.3%	62.5%	45.3%	74.6%
2017 Compliance	93.1%	96.9%	36.0%	70.5%	55.9%	50.5%	71.1%
2016 Compliance	85.0%	91.0%	24.0%	50.0%	58.0%	56.0%	61.0%
2015 Compliance	95.0%	97.0%	31.0%	54.0%	51.0%	53.0%	64.0%

The performance benchmarks are stipulated in the ZS 387

3.9 STATUS ON THE IMPLEMENTATION OF LOW POWER FACTOR SURCHARGE

Clause 2.2.1 of the *Electricity (Grid Code) Regulations, Statutory Instrument No. 79 of 2013* provides that the power factor at the point of supply or connection point shall be 0.92 lagging or better.

In 2019, stakeholder consultations on the implementation of Low Power Factor Surcharge mechanism were still on-going.

²⁷Please note this figure was revised following reconciliation.

3.10 THE ELECTRICITY (GRID CODE) REGULATIONS – STATUTORY INSTRUMENT NO. 79, 2013

The Electricity (Grid Code) Regulations was promulgated into law in 2013 and the ERB has been spearheading its implementation. The ERB served as interim secretariat for two years and handed over the role to SO ZESCO in 2017 in accordance with the provisions of Section 2.4 of the Grid Code.

In 2019, the ERB approved and reconstituted the third (3rd) tenure of the Grid Code Technical Committee (GCTC) as provided for under Section 2.2 of the Governance Chapter of the Electricity (Grid Code) Regulations SI No. 79 of 2013.

3.11 ZAMBIAN DISTRIBUTION GRID CODE

The Distribution Grid Code (“Distribution Code”) was developed by ERB in consultation with stakeholders in the ESI in Zambia. The Distribution Code is implemented as a licence condition and provides a general description of the technical connection requirements for large embedded generating systems. The Code further seeks to avoid undue discrimination between Distribution Network Service Providers (DNSPs) and other participants.

In 2019, the ERB continued to serve as interim secretariat to the Distribution Grid Code Review Panel (DGCRP), the implementing Committee. The DGCRP established the joint expert working group with the GCTC to spearhead development of the requirements for Renewable Energy Integration to enhance chapter 7 of the Distribution Code.

Further, to complement this work, the Government of Zambia engaged a consultant to undertake a study to determine the quantum of Variable Renewable Energy Sources (VRES) which can be integrated into the grid. The study also includes evaluating the adequacy of our transmission system capacity to accommodate the integration of these VRES. The study will be concluded in 2020.

The Panel also commenced the revision of the Code whose completion is scheduled for 2020. Other activities include formation of funding mechanism of the Committee and drafting the Constitution.

3.12 IMPLEMENTATION OF WIRING OF PREMISES STANDARD – ZS 791

The Zambian Standard ZS 791 Code of Practice for Wiring of Premises provides the rules for the design, selection, erection, inspection and testing of electrical installations. The rules are intended to provide for the safety of persons, livestock and property against dangers and damage which may arise in the reasonable use of electrical installations and to provide for the proper functioning of these installations.

In 2019, the ERB established the Expert Working Group comprising ESI stakeholders for the implementation of **ZS 791 Standard: Wiring of Premises – Code of Practice**. The expert team commenced work on the development of a Practical Guide for easy application of the ZS 791.

It is envisaged that this Standard shall be made mandatory and would in turn minimise the accidents in the dwelling places. The envisaged output of this Standard shall include certification of wiremen by Engineering Institution of Zambia (EIZ). Every new connection application shall be certified by the competent person who will undertake the wiring.

3.13 KEY PERFORMANCE INDICATORS FRAMEWORK FOR NON-STATE OWNED ENTERPRISES

Following the development of a KPI framework for Non State Owned Enterprises (NSOEs) in 2018, the ERB in the period under review commenced performance monitoring of the framework under a pilot phase. The framework comprises nine (9) KPIs which include among others; customer metering, provision of ancillary customer services, customer complaints resolution, outage management and service restoration. These are depicted in appendix 8. The KPIs for NSOEs are adopted to focus on provision of quality energy services and other customer related parameters. The ERB plans to roll out this framework in the year 2020.

3.14 COST OF SERVICE STUDY

The ERB successfully re-launched the Electricity Cost of Service Study (COSS) on 3rd December, 2019 with financing from the AfDB. The ERB engaged Energy Market and Regulatory Consultants (EMRC) as Consultants to undertake the study within 12 months. The main aim of the study is to determine the economic cost of supply of electricity for generation, transmission, distribution and supply. The Consultant is expected to undertake the following key tasks as outlined in the Terms of Reference:

- i. Review of structure and conduct of the power sector;
- ii. Electricity demand forecasts;
- iii. Medium to long-term least cost expansion plan;
- iv. Determination of economic cost of supply, structure and levels of tariffs;
- v. Life-line tariff mechanism, analysis of existing tariffs, and adjustment to economic based tariffs;
- vi. Review of financial performance of ZESCO and preparation of projections;
- vii. Determination of transmission wheeling charges;
- viii. Assessment of the ERB's approach to tariff review;
- ix. Tariff adjustment roll-out strategies; and
- x. Technical Capacity Enhancement.

It is envisaged that at the end of this study, the Consultant would determine the electricity cost reflective tariffs and develop a tariff migration plan. Appendix 9 presents a summary of the Terms of Reference.

3.15 TARIFF REVIEWS IN 2019

During the period under review, the ERB reviewed and determined tariff applications from ZESCO, Zengamina and NWECC, respectively.

3.15.1 ZESCO tariff adjustment, 2019

During the year, ZESCO applied for a tariff adjustment on its domestic consumers (excluding mining and PPA based consumers) at an average rate of 113 percent. ZESCO cited the following specific reasons as drivers for the tariff application:

- i. That the macro-economic factors had worsened and adversely affected the operations of the Utility.
- ii. The additional revenue from the tariff adjustment will be used for system expansion.
- iii. The rising cost of power from IPPs; and
- iv. The suspension of the COSS.

The ERB issued a Public Consultation Paper (PCP) inviting the public to make written submissions on the tariff application. The ERB held its public hearings in Lusaka, Kitwe and Livingstone.

The ERB undertook a review of ZESCO's tariff application and established that the utility had a justifiable rate case to warrant the review. The analysis of ZESCO's tariff application was premised on principles of Revenue Requirement, that is, revenues of the regulated Utilities have to cover the utility's operating expenses, taxes and depreciation, and ensure a fair rate of return (profit) on assets utilised for production and supply of electricity and energy services. On the basis of ZESCO's financial information, the ERB determined ZESCO's revenue requirement to meet part of the current O&M cost and earn a reasonable return. This will sustain ZESCO as a going concern and also allow it to partially meet its current debt obligations.

In view of the foregoing, the ERB approved ZESCO's application to upwardly adjust tariffs by an average of 113 percent. The tariff award would enable ZESCO to partially meet the cost of power purchases from IPPs and support investments especially in new power generation projects such as Kafue Gorge Lower. Table 3-13 indicates the specific increments or adjustments awarded per customer category.

Table 3-13: Tariff adjustments awarded per customer category

No	Customer Category	Average increment awarded (%)
1	Residential	106
2	Large Power	73
3	Small Power	75
4	Distributor	New category
5	Commercial	170
6	Services	143
Total Weighted Average		113

Further, the ERB approved a new tariff structure for ZESCO customers. The key features of the new structure were as follows:

- Reduction of the R1 consumption band or lifeline tariff from 200 kWh to 100 kWh;
- Restructuring of R2 consumption band from a consumption level of above 200 kWh into a middle consumption band of between 101 kWh to 300 kWh;
- Re-introduction of an upper consumption band R3 for consumption above 300 kWh;
- Removal of fixed charge for both residential and commercial customers;
- Splitting the commercial tariff band into two, C1 for consumption 1- 200 kWh and C2 for consumption above 201 kWh; and
- Introduction of a bulk power distribution tariff.

The full details of the new tariff structure are provided in appendix 10.

3.15.2 North Western Energy Corporation tariff review

During the period under review, NWECC applied for a tariff adjustment of an average of 116 percent across its various customers including residential, commercial, services and maximum demand. NWECC proposed to align its residential tariff structure to the ZESCO residential and commercial tariff structure. Further, the company also applied to introduce a new tariff category for maximum demand customers. The proposed tariff structure for NWECC customers is as shown in appendix 11. The breakdown of the tariff adjustment per customer category is outlined in table 3-14.

Table 3-14: Summary of NWECC's proposed tariff adjustment per customer category

No	Customer Category	Proposed average increment (%)
1	Residential	37
2	Commercial	170
3	Services	143
4	Maximum Demand	New Introduction
Total Weighted Average		116

According to NWECC, the reasons for the proposed tariff adjustment were as follows:

- Rising cost of electricity purchases from ZESCO;
- Changes in the macro-economic environment as indicated by the rising inflation and deteriorating exchange rate between the Kwacha and major currencies; and
- The need for expansion of its distribution system network.

The decision is expected to be rendered in 2020

3.15.3 Zengamina Power Limited tariff adjustment

On 10th December 2019, the ERB received an application from ZPL to adjust the electricity tariffs from a weighted average of 60 percent per year for the next three years. ZPL also applied for approval to adjust connection fees from the current K650 for every connection to K1,250, K2,000 or a subsidized actual cost depending on the distance from the nearest connection point. The decision is expected to be rendered in 2020

According to ZPL, the Utility had not been charging its customers cost reflective tariffs since the hydro power plant was commissioned. Therefore, this had resulted into huge commercial losses which was making the business unsustainable.

3.16 LEGISLATIVE REVIEWS AND ENHANCEMENT OF REGULATORY ENVIRONMENT

3.16.1 New Energy Regulation and Electricity Acts

During the year 2019, the new Energy Regulation and Electricity Bills were presented for second reading in Parliament. The new Bills are aimed at enhancing the regulatory framework of the Energy Regulation Board and facilitate increased investment in the electricity sub-sector. The objectives of the two bills are expected to be as follows:

3.16.1.1 The Energy Regulation Bill

- To provide for the licensing of enterprises in the energy sector;
- To continue the existence of the Energy Regulation Board and re-define its functions;
- To re-constitute and revise the functions of the Board;
- To repeal and replace the Energy Regulation Act, 1995; and
- To provide for matters connected with, or incidental to, the foregoing.

Once enacted into law, the bills will provide for the following:

- Increased oversight by the ERB;
- Time frame for issuance of licenses;
- Multi-Year Tariff regime;
- An automatic cost pass through tariffs mechanism;
- Open-access regime operationalisation; and
- Provide for service providers to undertake and facilitate power trading.

3.16.1.2 The Electricity Bill

- To regulate the generation, transmission, distribution and supply of electricity so as to enhance the security and reliability of the supply of electricity;
- To provide for the sale and purchase of electricity within and outside the Republic;
- To facilitate the achievement of the efficient, effective, sustainable development and operation of electricity infrastructure;
- To provide the roles and responsibilities of various participants in the electricity sector;
- To facilitate adequate levels of investment in the electricity sector;
- To provide for a multi-year tariff framework;
- To promote transparency in the identification and allocation of risks, costs and revenues within and between participants in the electricity sector;
- To ensure the protection and safety of consumers of electricity and the public;
- To repeal and replace the Electricity Act, 1995; and
- To provide for matters connected with, or incidental to, the foregoing.

3.17 OUTLOOK IN THE ELECTRICITY SUB SECTOR

3.17.1 Electricity generation

Generally, the outlook for the electricity industry in Zambia is positive both in the short and long term. Table 3-15 shows some electricity power generation stations that were in construction in 2019 and are scheduled to be commissioned in the near future:

Table 3-15: status of electricity power generation stations that are expected to be commissioned in 2020

Electricity generation plant	Technology	Capacity	Expected commissioning year	Status of completion as at the end of 2019
Kafue Gorge Lower	Hydro	750MW	2020	80%
Upgrade of Chishimba Falls power station	Hydro	9MW	2020	Under EPC procurement
Lusiwasi Upper	Hydro	15MW	2022	96%
GET FIT Solar plants	Solar	120MW	2020	-

3.17.2 Kafue Gorge Lower Hydro Power Station


Kafue Gorge Lower plant under construction

In order to address the current power deficit, the state power utility, ZESCO established an SPV, Kafue Gorge Lower power development corporation (KGLPC) to spearhead the construction of the 750 MW hydro power plant at an estimated cost of US\$2.2 billion. As of December, 2019, the project was 80 percent complete and the construction is scheduled to be completed during 2020.

Once commissioned, it is envisaged that the current power deficit being experienced in the country will be cushioned.

3.17.3 Performance monitoring of licensees

In order to enhance monitoring of the performance of its licencees in the electricity sub-sector, the ERB extended the use of KPIs to NSOEs. In 2019, the ERB commenced piloting the new KPI framework for NSOE with NWECC. The framework would be rolled out to other NSOE utilities in 2020. Further, the KPIs would also be rolled-out to mini-grids in a light handed manner under the new regulatory regime for mini-grids.

4.0 RENEWABLE ENERGY SUB-SECTOR



Solar plant

4.1 GETFIT RENEWABLE ENERGY PROGRAMME

In order to diversify Zambia's electricity generation mix and also address the current power deficits the country has been experiencing over the past few years, the MoE in collaboration with KfW Development Bank of Germany, jointly developed and are implementing the Global Energy Transfer Feed-In-Tariffs (GETFiT) programme under the framework of the Renewable Energy Feed in Tariff Strategy, this programme is aimed at facilitating private sector investment in small and medium-scale renewable energy Independent Power Projects in Zambia.

Furthermore, following the finalization of the REFITs with the ERB in 2018, the MoE and GETFIT Zambia are in the process of finalising the tender process and award for the 100 MW small hydro tender.

4.1.1 GETFIT Solar Projects

In April 2019, the MoE's Permanent Secretary, announced the award of six Solar PV IPP projects, to three entities, totalling 120 MWac under the GET FiT Zambia Solar PV Tender. The tender was run as a reverse bid auction with ZESCO as the off-taker and selecting the most technically sound projects based on the lowest bid price. The outcome of the tender set a new benchmark for Solar PV tariffs in Zambia. The lowest successful bid came in at 3.999 USDc/kWh and the weighted average bid price of all six successful projects at 4.41 USDc/kWh with 10 percent of these tariffs being indexed to the US Producer Price Index. The tender initially had a targeted outcome of a total of 100 MWac, but due to the favourable results, MoE allowed an additional 20 MWac. It is expected that the developers will commence the construction of the solar plants during 2020. A summary is presented in table 4-1.

Table 4-1: GETFIT Solar Projects, summary of the price outcome

NRank	Company	Installed Capacity (MWac)	Bid Price (\$/kWh)
1	Building Energy - Bulemu West	20.0	3.99
2	Building Energy - Bulemu East	20.0	3.99
3	Globeleq Aurora Sola One	20.0	4.52
4	Globeleq Aurora Sola Two	20.0	4.52
5	CEC_Innovent Garneton North Solar	20.0	4.8
6	CEC_Innovent Garneton South Solar	20.0	4.8
	Total Award - Weighted Ave	120.0	4.410

The second component, of the GET FIT Zambia, which is the 100 MW Small Hydropower programme also commenced during this period under review. The initial phase of the tender process was the prequalification procedure, which was launched in January 2019. This was followed by the Feasibility Study Rights (FSR) issuance process by the Ministry of Energy. The FSR would form the basis for the entities to subsequently participate in the GET FIT Zambia Small Hydro Tender Request for Proposal (RfP), which may be implemented over two rounds. The first round, Round 1 of the RfP, is planned to be launched in 2020 and will target procurement and award of up to 50 MW. This component will also be implemented through public tender processes, but instead of the price being determined through a reverse auction it will be based on the REFITs determined by the ERB in 2018, following a stakeholder consultation process. The REFITs range from 1 MW to 20 MW. Table 4-2 shows the tabulation of the REFITs, including the interval REFITs which were determined on the basis of extrapolation.

Table 4-2: Recommended REFITs

Plant Size (MW)	1 MW	2 MW	3 MW	4 MW	5 MW	6 MW	7 MW	8 MW	9 MW	10 MW
Tariffs (USc/kWh)	11.45	10.83	10.52	10.21	10.21	10.06	9.97	9.91	9.86	9.83

Plant Size (MW)	11 MW	12 MW	13 MW	14 MW	15 MW	16 MW	17 MW	18 MW	19 MW	20 MW
Tariffs (USc/kWh)	9.48	9.14	8.70	8.15	7.82	7.80	7.79	7.78	7.77	7.76

Beyond 2019, the major activities will be the determination of the REFITs for the shallow grid connection component and the finalisation of the standardised project agreements, PPA, Grid Connection Agreement and Implementation Agreement, in preparation for the RfP Launch. The standardised agreements developed for the Solar PV tender, will be used as the basis for this. A second window for the feasibility study rights issuance process has also been opened for additional candidates to qualify for eventual subsequent rounds of the SHP, and this is expected to be concluded in early 2020.

4.2 DEVELOPMENT OF A REGULATORY FRAMEWORK FOR RENEWABLE ENERGY – OFF GRID AND MINI GRID REGULATORY FRAMEWORK

With the continued support of the European Union through the Increased Access to Electricity and Renewable Energy Production (IAEREP) programme, in 2019 the ERB finalized the mini-grid regulatory framework. The package of the approved regulations includes licensing, grid encroachment, tariff and technical requirements for three categories of mini-grids: below 100kW, up to 1 MW and larger than 1 MW.

The rationale of the mini-grid regulatory framework is to enhance the ease of doing business in the electricity sub-sector for private companies intending to invest in rural areas, by applying light-handed regulations to small mini-grid operators.

In 2019, the mini-grid regulations were piloted and will thereafter be implemented for a series of demonstration mini-grid projects. The approved regulations can be found and downloaded from the ERB's website.

Apart from the mini-grid regulatory framework, ERB and IAEREP are collaborating on operationalizing the net-metering regulations and the possible integration of the regulations into the Distribution Grid Code. It is anticipated that the updated regulations shall be finalised during 2020. To complement the regulatory framework for mini-grids, the ERB in collaboration with ZABS with support of the IFC developed mini-grid standards. Further, to ensure ease of access to information on off-grid space, the IFC supported the ERB and developed the Off-grid web portal which was launched by the Minister of Energy on 14th August 2019.

4.3 IDC SCALING SOLAR POWER PROJECTS 2019

The Board of IDC in 2019 approved the Alternative Renewable Energy Investment Programme (AREIP) as complementary to the Scaling Solar Program and a means to provide a longer term framework within which IDC can find partners to co-invest in the energy sector. AREIP in essence would maintain the entire applicable standard in the scaling Solar Programme except that it would allow for reduced requirements and not standards.

4.3.1 Bangweulu Power Company

Bangweulu Power Company (BPC) is a jointly owned entity by IDC and Neoen S.A.S of France which owns and operates a 54.3 MW grid connected solar power plant in the Lusaka South Multi-Facility Economic Zone (LSMFEZ). The solar power plant was commissioned on 11th March 2019. During the period under review, BPC supplied 71.97 GWh of electricity to ZESCO under a 25 year PPA. During the period under review the plant annual availability was at 99 percent while the plant performance average ratio was at 83.51 percent.

4.3.2 Ngonye Power Company

Similarly, Ngonye Power Company (NPC) is also an entity owned by IDC and Enel Green Power S.P.A of Italy. The company owns a 34 MW solar energy power plant located in the LSMFEZ. NPC signed a 25 year PPA with ZESCO in 2018 and the company later commenced commercial operations on 19th May, 2019. During the year 2019 NPC supplied 40.5 GWh of electricity to ZESCO.

During the period under review, the plant annual availability was at 95.42 percent while the plant performance average ratio was at 76.19 percent.

5.0 LICENSING IN THE ENERGY SECTOR

According to the Energy Regulation Act, chapter 436 of the laws of Zambia as read together with the ERB Licensing Regulations, one of the core functions of the ERB, as a sector regulator is to issue licences to enterprises engaged in entrepreneurial activities in the energy sector. A Diagrammatic presentation of the licensing process is outlined in appendix 12. Meanwhile, as key players in the energy sector the licensees have the following obligations:

- i) Ensuring compliance with applicable standards, regulations and guidelines;
- ii) Not engaging in any activities that compromise or may compromise the proper implementation of the licensed activity or may impede any licensed activity of other licensees;
- iii) Ensuring management of the licensed activity in a manner consistent with the principles of ensuring economic and technical expedience, the objective of achieving reasonable costs and highest quality of service for clients;
- iv) Not engaging in any form of “anti-competitive trade practices” as defined in the Competition and Consumer Protection Act No. 24 of 2010 as may be amended from time to time;
- v) Complying with Quality Control and Monitoring Guidelines;
- vi) Submitting to the ERB in such manner and interval, as may be prescribed by the ERB such reports and procedures for ensuring compliance with conditions of this licence;
- vii) Not showing undue preference to, or exercising undue discrimination against any particular person or persons of any class or description as regards any aspect of the provision of energy, fuel or any service under the licence; and
- viii) Payment of licence fees in accordance with the Act, among others.

5.1 TYPES OF LICENCES ISSUED BY THE ERB

The ERB issues 15 types of licences in the petroleum/fossil fuels sub-sector, eight in the electricity sub-sector and one in the renewable energy sub-sector; each with varying tenures. Table 5-1 shows the types of licences issued by the ERB and their respective durations.

Table 5-1: Types of licences issued by the ERB and their durations

S/N	Licence Type	Duration (Years)
ELECTRICITY		
1	Generation of Electricity	30
2	Transmission of Electricity	30
3	Supply of Electricity	5
4	Distribution of Electricity	15
5	System Operators Licence	5
6	Generation, Distribution and Supply of Electricity to a Local System	20
7	Generation of Electricity for Own Use	5
8	Embedded Generation of Electricity for Own Use	5
PETROLEUM / FOSSIL FUELS		
1	Importation of Petroleum Feedstock	5
2	Importation of Lubricants	3
3	Pipeline Transportation Of Petroleum Feedstock	5
4	Refining of Petroleum Feedstock	15
5	Terminal storage of Petroleum Products	10
6	Combined Licence to Distribute, Import and Export Petroleum Products	5
7	Retail of Petroleum Products	5
8	Road Transportation Of Petroleum Products	3
9	Blending and Packaging of Lubricants	10
10	Wholesale marketing of Petroleum Products	1.5
11	Retail of Petroleum Products (LPG)	5
12	Transportation of LPG	3
13	Combined Licence to Distribute, Import and Export LPG	5
14	Filling of LPG in Cylinders	5
15	Transportation of Coal	5
RENEWABLE ENERGY		
1	Manufacture, Import, Supply, Installation and Maintenance of Solar Energy Systems	5
OTHER TYPES OF LICENCES/PERMITS		
1	Construction Licence	1
2	Investment Endorsement	1

5.2 LICENSING OF UNDERTAKINGS

During 2019, 184 applications were duly lodged²⁸; 162 being initial applications²⁹ and 22 being renewal of licence.

5.2.1 Provisional Licences and Temporary Permits

The ERB issues Provisional Licences valid for a period of six months to all applicants whose applications are duly lodged. These are issued to allow the applicant to temporarily commence operations while a Notice of Intention to Issue a Licence is placed in the Government Gazette, before Board approval is given for the issuance of a Standard Licence.

Further, entities applying for the inclusion of a new site to their Licence for the Retail of Petroleum Products are issued a temporary permit to allow them to operate the site as they wait for gazetting and Board approval.

Table 5-2 shows the provisional licences/temporary permits issued in 2019 against those issued in 2018.

Table 5-2: Provisional licences issued, 2018-2019

No	Provisional Licence/Temporary Permit	2018	2019
1.	Blending and Packaging of Lubricants	1	0
2.	Distribute, Import and Export Liquefied Petroleum Gas (LPG)	2	43
3.	Distribute, Import and Export Petroleum Products	19	19
4.	Electricity Supply	1	0
5.	Generate, Distribute and Supply Electricity (Off-Grid Electricity Licence)	1	0
6.	Generation of Electricity	1	3
7.	Importation of Lubricants	14	25
8.	Manufacture, Wholesale Importation and Installation of Solar Energy Systems	18	27
9.	Retail of Liquefied Petroleum Gas (LPG)	1	1
10.	Retail of Petroleum Products	3	1
11.	Retail Site Inclusions	5	6
12.	Road transportation of petroleum products	27	18
Total issued		127	143

A total of 143 provisional licences were issued in 2019, compared to 127, issued in 2018, representing 12.6 percent increase.

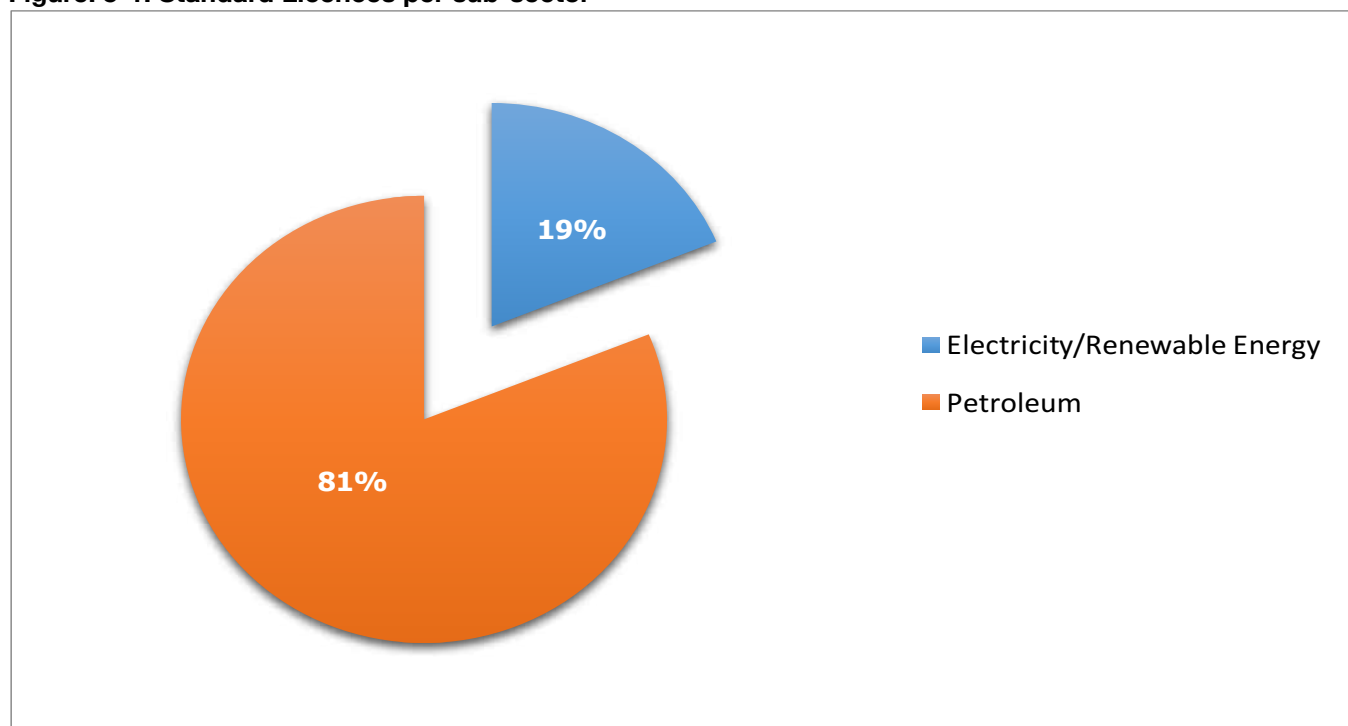
5.2.2 Standard Licences

A total of 156 Standard Licences were issued in 2019. Of these, 31 were in the electricity and renewable energy sub-sectors, while 125 were in the petroleum sub-sector. 131 of these were initial applications and 25 were for renewal of existing licences. Figure 5-1 shows the number of licences issued in 2019 by sub-sector.

²⁸ Duly lodged applications refer to applications for which all required Application Forms and supporting documents have been submitted and the Application Fee has been paid.

²⁹ Initial applications refer to first time applications.

Figure: 5-1: Standard Licences per sub-sector



Notably, the number of standard licences issued during 2019 increased by 36.8 percent to 156 compared to 114 issued during 2018. This is depicted in table 5-3.

Table: 5-3 Standard Licences per type, 2018 - 2019

No	Type of Licence	Number of Licences Issued	
		2018	2019
1.	Bio Ethanol Production	0	0
2.	Blending and Packaging of Lubricants	1	1
3.	Distribute, Import and Export of Liquefied Petroleum Gas	3	39
4.	Distribute, Import and Export of Petroleum Products	27	17
5.	Generation of Electricity	2	3
6.	Importation of Lubricants	9	38
7.	Manufacture, Wholesale Importation and Installation of Solar Energy Systems	26	28
8.	Retail of Liquefied Petroleum Gas	2	1
9.	Retail of Petroleum Products	5	5
10.	Road Transportation of Petroleum Products	28	24
Total Licences issued		114	156

As depicted in table 5-3 above, there was a significant increment in the number of standard licenses issued for the importation of lubricants between 2018 and 2019. This was accredited to the enforcement undertaken by the ERB in collaboration with the Zambia Revenue Authority (ZRA). The ZRA has now made it mandatory for importers of lubricants to have a valid import license. Further, the number of licenses for the distribution, importation and Export of LPG also increased between 2018 and 2019 following the lifting of the suspension of issuance of this type of licence by the ERB, supported by high demand for LPG in Zimbabwe which accounted for the highest LPG exports in value. Other countries which imported high quantities of LPG included Kenya and Rwanda.

5.2.3 Investment Endorsements

The ERB issues an Investment Endorsement (IE) as a pre-approval of certain electricity infrastructure based on defined criteria. The IE guarantees a project developer that a license will be issued upon completion of the project subject to meeting prescribed conditions.

Table 5-4 below shows a list of IE that were issued by the ERB in 2019:

Table: 5-4: Investment Endorsements and their status

Applicant	Technology
Bulemu Solar East Limited	Solar
Copperbelt Energy Corporation Energy	Solar
Globeleq Aurora Sola One Limited	Solar
Antraa Energy Zambia Limited (Extension)	Hydro

5.3 OUTLOOK ON LICENSING

The new assented Energy Regulation Bill is set to come into effect in 2020. The Bill seeks to harmonise the licensing process in the energy sector by introducing a single licensing system, in accordance with the Business Regulatory Act of 2014, aimed at enhancing ease of doing business in the sector.

The Bill further facilitates the business process by stipulating that the ERB shall, within sixty days of receipt of a complete application, grant or reject the application and inform the applicant of its decision, failure to which, the application shall be deemed to have been granted.

6.0 CONSUMER AFFAIRS

The ERB is mandated under section 6 of the Energy Regulation Act Cap 436 of the Laws of Zambia to receive and investigate complaints from consumers arising from services and products provided by licensees operating in the Energy Sector. Section 6, (b and c) states that “The Board shall:

- (a) *Receive and investigate complaints from consumers on price adjustments made, or services provided, by any undertaking, and regulate such adjustments and services by the attachment of appropriate conditions to licences held by undertakings; and*
- (b) *Receive and investigate complaints concerning the location or construction of any common carrier or any energy or fuel facility or installation or the carrying out of any works by any undertaking, and regulate such location and construction by the attachment of appropriate conditions to licences held by undertakings.”*

6.1 COMPLAINTS HANDLING

During the year under review, the ERB received a total of 289 complaints through the Toll Free Line (8484), walk-in clients, e-mails, letters, mobile office outreach programmes and ERB switchboard lines. From that figure, a total of 110 complaints were resolved, representing a resolution rate of 38.06 percent, falling below the institutional KPI of 80 percent for 2019. Table 6-1 below gives a breakdown of the complaints received by type and subsector.

Table 6-1: Complaints resolution rate per sub-sector, 2019

Sub-Sector	Received	Resolved	Resolution Rate (%)
Electricity	212	63	29.71
Petroleum	77	47	61.03
Renewable Energy	0	0	0
Total	289	110	38.06

During the period under review, the electricity sub-sector resolution rate was very low, compared to the resolution rate for the petroleum sub-sector. The major complaint in the electricity sector was delayed new connection complaints which continued to remain unresolved by the service provider, ZESCO. During 2019, the ERB brought this issue to the attention of ZESCO management who made commitments to resolve the complaints. ZESCO stated that the delayed new service connections were on account of non-cost reflective connection charges. Further, this type of complaint was also addressed through the enhancement of the KPI framework which requires that ZESCO scores above the agreed target and their performance being tied to any future tariff awards. Going forward, the ERB has undertaken to pay particular attention to complaints regarding delayed new service connections so as to clear the backlog and also reduce on new similar complaints.

The unresolved complaints under petroleum were mainly on account of failure by complainants to provide relevant evidence to aid the investigation process, such as late reporting of complaints related to quality of petroleum products and absence of proof of purchase, amongst others.

As part of the complaints resolution process, the ERB holds complaints hearings in instances where complainants and licensees fail to reach an amicable conclusion to a grievance. These mediation meetings may be convened where the parties involved (the service provider and complainant) are called before the ERB (mediator), with a view to providing an opportunity for both parties to be heard by the regulator. However, it should be noted that the ERB has no mandate to determine compensation, meaning that if no agreement is reached at mediation, the parties may seek redress through the courts of law. In this regard a total of seven complaints hearings were held in 2019 and all were from the electricity sub-sector and those hearings involved 19 complaints.

For this process to be streamlined, the ERB has directed through the licences issued that all licensees should develop and maintain an internal Complaints Handling Procedure which outlines the steps to be followed once a complaint has been reported. To further enhance this requirement, licence conditions stipulate that all accidents/incidents are reported to the ERB within 48 hours and certain complaints fall under this category.

A complaint is considered resolved under the following circumstances:

- i) When addressed by the licensee to the satisfaction of the complainant;
- ii) When the complainant withdraws the complaint;
- iii) When the ERB makes a determination or an amicable agreement has been reached between the complainant and the licensee;
- iv) When enforcement action has been taken against the licensee; and
- v) When a complaint not falling under the mandate of the ERB is forwarded to the responsible institution.

Details of the complaints handling procedure are depicted in appendix 13.

6.2 OUTLOOK ON CONSUMER AFFAIRS

Complaints resolution in the year 2020 has a KPI target of above 85 percent. In order to achieve this target, ERB will going forward intensify enforcement action against erring licensees. In addition, the pricing methodology, the electricity tariff calculator and various processes and guidelines have been published on the ERB website, www.erb.org.zm to address some of the complaints received regarding pricing of petroleum products and electricity tariffs.

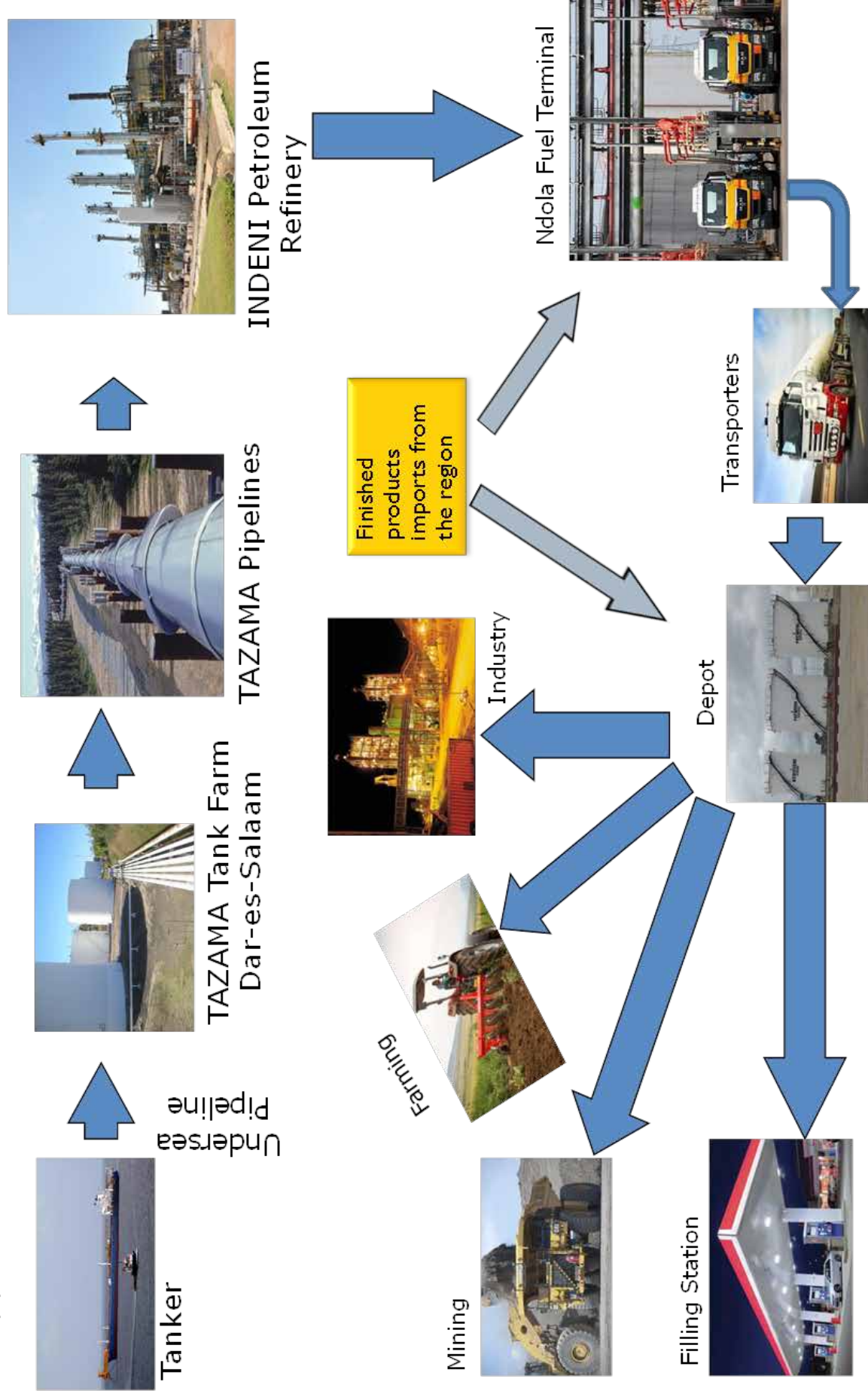
Regarding stakeholder engagements, ERB had established Consumer Watch Groups (CWGs) in 2009 in selected parts of the country to help the Regulator resolve some consumer complaints and disseminate information to stakeholders. In 2016, the CWGs were dissolved due to some operational challenges. However, the Energy Regulation Act of 2019, is expected to provide for the creation of Consumer Councils (CCs) which will assist to receive, investigate and resolve complaints on behalf of ERB. Where the CCs will fail to resolve the complaints, such matters would be referred to the ERB for consideration and determination.

LIST OF APPENDICES

Appendix 1: Retail sites network by location - 2019

No.	Province	District	No. of Retail Sites	No.	Province	District	No. of Retail Sites
1	Central	Chibombo	5	33	Lusaka	Kafue	6
2	Central	Kabwe	9	34	Lusaka	Luangwa	1
3	Central	Kapiri Mposhi	6	35	Lusaka	Lusaka	128
6	Central	Mkushi	4	36	Lusaka	Nampundwe	1
7	Central	Mumbwa	2	37	Lusaka	Rufunsa	1
8	Central	Serenje	4	38	Muchinga	Chinsali	2
9	Copperbelt	Chambishi	1	39	Muchinga	Isoka	1
10	Copperbelt	Chililabombwe	6	40	Muchinga	Mpika	5
11	Copperbelt	Chingola	7	41	Muchinga	Nakonde	1
12	Copperbelt	Kalulushi	3	42	Northern	Kasama	5
13	Copperbelt	Kitwe	30	43	Northern	Luwingu	1
14	Copperbelt	Luanshya	6	44	Northern	Mbala	2
15	Copperbelt	Mpongwe	1	45	Northern	Mpulungu	2
16	Copperbelt	Mufulira	4	46	North-Western	Kabompo	1
17	Copperbelt	Ndola	35	47	North-Western	Kalumbila	3
18	Eastern	Chadiza	1	48	North-Western	Kasempa	1
19	Eastern	Chipata	7	49	North-Western	Manyinga	1
20	Eastern	Katete	2	50	North-Western	Solwezi	6
21	Eastern	Lundazi	2	51	North-Western	Zambezi	1
22	Eastern	Mfuwe	1	52	Southern	Chisekesi	1
23	Eastern	Nyimba	3	53	Southern	Choma	7
24	Eastern	Petauke	3	54	Southern	Kalomo	1
25	Eastern	Sinda	1	55	Southern	Livingstone	8
26	Luapula	Kawambwa	1	56	Southern	Mazabuka	5
27	Luapula	Mansa	5	57	Southern	Monze	2
28	Luapula	Mwense	1	58	Southern	Siavonga	2
29	Luapula	Nchelenge	1	59	Southern	Sinazongwe	1
30	Lusaka	Chilanga	3	60	Western	Kaoma	3
31	Lusaka	Chirundu	1	61	Western	Mongu	4
32	Lusaka	Chongwe	5	62	Western	Senenga	1

Appendix 2: Petroleum value chain



Appendix 3: Components of the Cost Plus Model

Since 2008, the ERB uses the CPM to determine wholesale and pump prices for petrol, diesel, low sulphur gasoil and kerosene. The model operates in such a way that all the attendant costs incurred along the petroleum supply chain from the port of discharge in Dar-es-salaam to INDENI refinery where the feedstock is processed up to the NFT where the product is stored and sold are taken into account.

a. The Wholesale Price Build up

The different cost elements up to the wholesale price include:

i. Cost-Insurance-Freight

The Cost-Insurance-Freight (CIF) of the petroleum feedstock cargo is the landed cost of the cargo at the port of Dar-es-Salaam. The quantities of the constituent components of the petroleum feedstock, which include crude oil, condensate, naphtha and diesel, are multiplied by the unit costs to derive the total monetary cost of the feedstock.

The information is obtained from the supplier invoices which is based on the contract between Government and the oil supplier and ultimately used to develop a profitability statement.

ii. Ocean Losses

The normally acceptable loss incurred in the loading and offloading of petroleum feedstock and petroleum products from a vessel are set to 0.00%.

iii. Wharfage

The Tanzania Harbour Authority levies a statutory charge on the importation of petroleum products. At present, this is 1.25% of the CIF Dar-es-Salaam cost.

iv. Insurance

The insurance costs are set at 0.11% of CIF. The insurance covers the cost of insuring the feedstock from the Dar-es-Salaam to Ndola.

v. TAZAMA Storage Fee

TAZAMA charges US\$2/MT to the importer for any petroleum feedstock quantities that are stored at the Dar-es-Salaam tank farm on the last day of the month. The amount was agreed upon between TAZAMA and Government.

vi. TAZAMA Pumping Fee

TAZAMA charges US\$49.00/MT to the importer for transporting petroleum feedstock through the pipeline from the Dar-es-Salaam tank farm to the Refinery in Ndola.

vii. TAZAMA Pipeline Losses

Consumption and losses for TAZAMA are currently set at 1.00%.

viii. Agency Fee

The Government appointed TAZAMA as agent to discharge specific duties in the procurement of petroleum feedstock. The Agency fee is currently US\$5/MT, the fee is agreed between the Government and agent. The key function of the agent, amongst others, is to ensure compliance by the supplier to the terms and conditions of the supply contract.

ix. Processing Fee

INDENI charges a processing fee of US\$55.38/MT to the importer for refining (processing) petroleum feedstock.

x. Refinery Losses

Some petroleum feedstock quantities are lost during the refining process due to:

- a. Normal processing losses;
- b. Consumption, as some quantities are consumed as fuel in the process; and
- c. The consumption and losses figure are set at 5.0%.

xi. Terminal Losses

These are terminal losses as prescribed by international norms. A loss level of 0.5% is allowed for petrol whilst a loss level of 0.5% has been allowed for kerosene and jet A-1, 0.3% for diesel and Heavy Fuel Oil (HFO) covering handling and storage losses. A loss of 1% is provided for liquefied petroleum gas (LPG).

b. The Retail Pump Price Build-up

The specific cost elements of the pump price as at 31st December, 2019 are discussed below:

i. Terminal Fee

The NFT charges a fee of K0.063/litre on petrol, diesel and kerosene uplifts at the terminal.

ii. Marking Fee

The price of petrol, diesel, kerosene and LSG incorporates a cost line referred to as the Marking Fee of K96.99/M³ or 9.70 ngwee/litre. The Marking Fee covers the cost of the chemicals used to mark petroleum products, the taxes on the chemicals and the staff costs of implementing the fuel marking programme.

iii. Excise Duty

The applicable excise duties inclusive of road levy are K2.07/litres on Petrol, K0.66/litre on Diesel, K0.66/litre on LSG and 0% on Kerosene.

iv. Transport Cost

The transport cost is the transport charge that is applied in all towns to equalize the pump prices to the national uniform pump price.

v. OMC Margin

The ERB determines the OMC margin. This refers to the amount of money an OMC can make on each unit of petrol, diesel, kerosene and LSG they distribute. The OMC margin covers the costs of the OMC and allows the OMC to earn a reasonable return on its assets. The current ERB determined OMC margin is K0.89/litre. The OMC margin is reviewed on a regular basis by the ERB using the revenue requirement methodology i.e. a regulatory best practice for regulation of utilities.

vi. Dealer Margin

The ERB determines the dealer margin. This refers to the amount of money a service station owner can make on each unit of petrol, diesel, kerosene and LSG they retail. The dealer margin covers the costs of the dealer and allows the dealer to earn a reasonable return on its assets. Currently, the ERB determined dealer margin is K0.65/litre. The dealer margin is reviewed on a regular basis by the ERB using the revenue requirement methodology i.e. a regulatory best practice for regulation of utilities.

vii. Strategic Reserves Fund

The Strategic Reserves Fund (SRF) cost-line of K0.15/litre is currently applicable to petrol, diesel and kerosene. The SRF cost-line is collected from consumers through OMCs for the purpose of:

- a. Stabilizing fuel prices.
- b. Purchasing of Strategic Petroleum Reserves (SPRs). However, the SPRs have never been procured due to inadequate storage infrastructure. The MoE is currently building fuel depots.
- c. Developing petroleum infrastructure particularly, construction of storage depots for the SPRs.

viii. ERB License Fees

The ERB licence fees are set at 0.7% of the OMC's turnover. The fee has in the past been the principal source of funding for the ERB, however the funding mechanism was changed as the institution is now funded through Government grants effective from 1st January 2013.

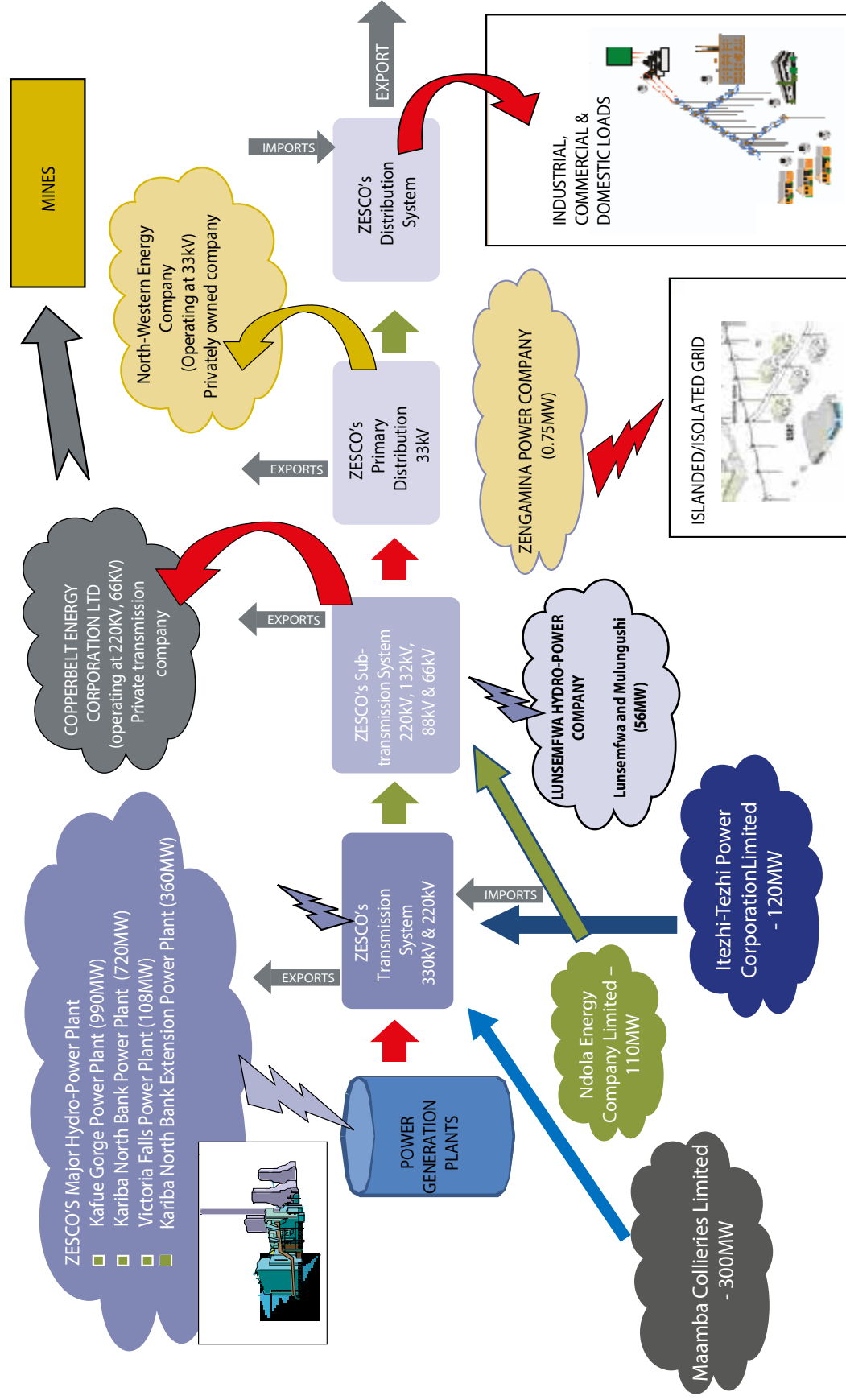
ix. Value Added Tax

The current applicable Value Added Tax (VAT) on petrol and diesel is 16%. There is no VAT applied on domestic kerosene

Appendix 4: Installed electricity generation mix in Zambia in 2019

Licensee's Name	Station	Technology	Installed Capacity (MW)	Proportion of contribution to the installed capacity (%)
ZESCO Limited	Kafue Gorge	Hydro	990.00	33.21
	Kariba North	Hydro	720.00	24.15
	Kariba North Extension	Hydro	360.00	12.08
	Victoria Falls	Hydro	108.00	3.62
	Lunzua River	Hydro	14.80	0.50
	Lusiwasi	Hydro	12.00	0.40
	Chishimba Falls	Hydro	6.00	0.20
	Musonda Falls	Hydro	10.00	0.34
	Shiwang’andu	Hydro	1.00	0.03
Itezhi-tezhi Power Corporation	Itezhi-tezhi	Hydro	120.00	4.03
Zengamina Limited	Ikelengi	Hydro	0.70	0.02
Lunsemfwa Hydro Power Company	Mulungushi	Hydro	32.00	1.07
	Lunsemfwa	Hydro	24.00	0.81
	Total Hydro		2,398.50	80.45
Maamba Collieries Limited	Maamba Power Plant	Coal	300.00	10.06
	Total Coal		300.00	10.06
Copperbelt Energy Corporation Generation Plants	Luano	Diesel	40.00	1.34
	Bancroft	Diesel	20.00	0.67
	Kankoyo	Diesel	10.00	0.34
	Maclaren	Diesel	10.00	0.34
ZESCO Limited Generation Plants	Luangwa	Diesel	2.60	0.09
	Shang’ombo	Diesel	1.00	0.03
	Total Diesel		83.60	2.80
Ndola Energy Generation Plants	Ndola	Heavy Fuel Oil	110.00	3.69
	Total Heavy Fuel Oil		110.00	3.69
Rural Electrification Authority Generation Plants	Samfya	Solar	0.06	0.00
Copperbelt Energy Corporation	Kitwe	Solar	1.00	0.03
Muhanya Solar Limited	Sinda Village	Solar	0.03	0.00
Ngonye Power Limited	LSMFEZ	Solar	34.00	1.14
Bangweulu Power Company Ltd	LSMFEZ	Solar	54.00	1.81
Solera Power	Luangwa bridge	Solar	0.01	0.00
Standard Microgrid	Kafue	Solar	0.02	0.00
Mugurameno	Chirundu	Solar	0.01	0.00
	Total Solar		89.13	2.99
Grand Total			2,981.23	100.00

Appendix 5: Structure of the Electricity Supply Industry in Zambia



Appendix 6: ZESCO's annual KPIs performance for the year 2019

No.	KPI and Weight (%)	Sub KPI	Target	Annual average Performance	Comment
1.	Metering Customer (10%)	Quotation Time	ZESCO is required to issue quotations for all types of connections within 30 days from the date of application;	Quotations were issued within 15 days on average.	Target achieved
		Connection Time	ZESCO is required to make standard residential connection to supply within 30 days upon payment	Standard connections were done within 26 days on average.	Target achieved
		Customer Metering Percentage Score 10% Indicator was fully achieved			
2.	Cash Management (20%)	Mining Customers debtor days	ZESCO is required to reduce mining days to not more than 60 days.	ZESCO's mining debtor days stood at 288 days as at 31 st December 2019.	Target NOT achieved
		Export Customer debtor days	ZESCO is required to reduce export debtor days to not more than 60 days.	ZESCO's export debtor days stood at 107 days as at 31 st December 2019.	Target NOT achieved
		Domestic Customer Debtor Days	ZESCO is required to reduce domestic (residential, commercial and maximum demands customers) debtor days to not more than 60 days	ZESCO's domestic debtor days stood at 80 days as at 31 st December 2019.	Target NOT achieved
		GRZ Customer Debtor Days	ZESCO is required to reduce GRZ debtor days to not more than 90 days.	ZESCO's GRZ debtor days stood at 987 days as at 31 st December 2019.	Target NOT achieved
		Cash Management Percentage Score 7% Indicator was NOT achieved however the utility was awarded some score for effort made in reducing export debtor days			
3.	Staff Productivity (15%)	Corporate Customer-Employee Ratio	ZESCO is required to maintain a Corporate customer-employee ratio of 100:1 or better.	ZESCO achieved a Corporate Customer-employee average ratio of 126:1.	Target achieved
		Lusaka Division Customer-Employ ratio	ZESCO is required to maintain a Lusaka Division customer-employee ratio of 100:1 or better.	ZESCO achieved a Lusaka Division customer-employee average ratio of 242:1.	Target achieved
		Copperbelt Division Customer-Employ ratio	ZESCO is required to maintain a Copperbelt Division customer-employee ratio of 100:1 or better.	ZESCO achieved a Copperbelt Division customer employee average ratio of 206:1.	Target achieved
		Northern Division Customer-Employ ratio	ZESCO is required to maintain a Northern Division customer-employee ratio of 75:1 or better.	ZESCO achieved a Northern Division customer-employee average ratio of 149:1.	Target achieved
		Southern Division Customer-Employ ratio	ZESCO is required to maintain a Southern Division customer-employee ratio of 100:1 or better.	ZESCO achieved a Southern Division customer-employee average ratio of 173:1.	Target achieved
		Staff Costs	ZESCO is required to Reduce staff costs to 30% or less as a share of total operations and maintenance costs (O&M).	ZESCO's annual staff costs stood at 18% of total O&M costs.	Target achieved
		Staff productivity Percentage Score 15% Indicator was fully achieved.			

No.	KPI and Weight (%)	Sub KPI	Target	Annual average Performance	Comment
4.	Quality of Service Supply (20%)	SAIDI ³¹	ZESCO is required to maintain a System Average Interruption Duration Index (SAIDI) of 27 hours or less.	ZESCO recorded an annual average SAIDI of 70.4 hours per customer	Target NOT achieved
		SAIFI ³²	ZESCO is required to maintain the System Average Interruption Frequency Index (SAIFI) of 5 times or less.	ZESCO recorded an annual average SAIFI of 13.7 times.	Target NOT achieved
		CAIDI ³³	ZESCO is required to maintain the Customer Average Interruption Duration Index (CAIDI) at 6 hours or less	ZESCO recorded an annual average CAIDI of 7.3 hours.	Target NOT achieved
		ASAI ³⁴	ZESCO is required to maintain the Average System Availability Index (ASAI) at 90% or better.	ZESCO recorded annual quarterly average ASAI of 90%.	Target achieved
		Quality of Service Percentage Score 5.00% Indicator was not fully achieved.			
5.	System Losses (10%)	Transmission Losses	ZESCO is required to maintain transmission losses at 6% or better.	ZESCO recorded annual average transmission losses of 5%.	Target achieved
		Distribution Losses	ZESCO is required to maintain distribution losses at 12% or better.	ZESCO recorded annual average distribution losses of 11%.	Target achieved
		System Losses Percentage Score 10% Indicator fully achieved			
6.	Power Generation (10%)	Unit capability factor (UCF) ³⁵ for large hydro plants	ZESCO is required to maintain a generation UCF for large hydro power plants at 80% or better.	ZESCO recorded annual average UCF of 93% for large hydro power plants.	Target achieved
		UCF for small hydro plants	ZESCO is required to maintain a generation UCF for mini hydro power plants at 60% or better.	ZESCO recorded annual average UCF of 72% for small hydro power plants.	Target achieved
		Power generation percentage Score 10% Indicator was not fully achieved			
7.	Safety (5%)	Fatality	ZESCO is required to ensure that no fatalities are experienced on account of negligence.	ZESCO recorded one (1) fatality in 2019.	Target NOT achieved
		Lost time injury	ZESCO is required to ensure that no Life-Threatening Injuries (LTIs) occur on account of negligence.	ZESCO recorded a total of nine (9) LTIs in Quarter 4 of 2019.	Target NOT achieved
		Safety Percentage Score 0% Indicator was not achieved.			

³¹ SAIDI refers to the average outage duration for each customer served.

³² SAIFI refers to the frequencies of interruptions per customer.

³³ CAIDI refers to the average duration of a power supply outage.

³⁴ ASAI refers to availability of a given power system.

³⁵ UCF refers to the ratio of actual to potential output of a given power plant.

No.	KPI and Weight (%)	Sub KPI	Target	Annual average Performance	Comment
8.	Customer Complaint Resolution (5%)	Complaint resolution rate	ZESCO is required to maintain a total customer complaint resolution rate of 90% or better for power outage related complaints	ZESCO recorded annual average customer complaint resolution rate of 95%.	Target achieved
		Replacement of faulty meters	ZESCO is required to replace faulty meters within 5 days after a complaint is reported.	ZESCO recorded annual average duration of two (2) days for replacement of faulty meters.	Target achieved
	Customer complaints Percentage Score 5% Indicator fully achieved.				
9.	Equipment Failure (5%)	Distribution transformer replacement rate	ZESCO is required to replace distribution transformers as a proportion of total number of distribution transformers in service/month at a rate of 0.1% or less.	ZESCO recorded an annual average distribution transformer replacement rate of 0.0%.	Target achieved
		Meters replacement rate	ZESCO is required to replace meters as a proportion of total meters in service at a rate of 0.25% or less.	ZESCO recorded an annual average meters replacement rate of 0.0%.	Target achieved
	Equipment Failure Percentage Score 5% Indicator was not fully achieved				
Total annual average percentage Score 67%					

Appendix 7: Major System Disturbances recorded in 2019

No.	Description of Disturbance
1.	On Wednesday, 2 nd January 2019 at 10:51hrs the IPS experienced a system disturbance due to the tripping of 330kV Kafue Town – Muzuma line on distance protection. The IPS was normalized by 11:55hrs.
2.	On Wednesday, 9 th January 2019 at 13:43hrs the IPS experienced a system disturbance due to the tripping of 33kV feeders at Kalumbila Mine. The IPS was normalised by 14:15hrs.
3.	On Thursday, 10 th January 2019 at 11:01hrs the IPS experienced a system disturbance due to the tripping of 330kV MCL - Muzuma lines 1 and 2 on distance protection. The IPS was normalised by 11:49hrs.
4.	On Tuesday, 15 th January 2019 at 16:16hrs the IPS experienced a system disturbance due to the tripping of the Kalumbila Mine mills. The IPS was normalised by 17:00hrs.
5.	On Sunday, 20 th January, 2019 at 11:03hrs the IPS experienced a system disturbance due to the tripping of 33kV Solwezi line at Kansanshi substation due to a cut jumper. The IPS was normalised by 11:35hrs.
6.	On Friday, 25 th January, 2019 at 11:03hrs the IPS experienced a system disturbance due to the tripping of Bancroft Main substation 11kV feeders. The IPS was normalised by 11:15hrs.
7.	On Sunday, 27 th January, 2019 at 16:04hrs the IPS experienced a system disturbance due to the tripping of units G1, G2, G3, G4 at Kafue Gorge after synchronizing G5 to the grid using 330kV CB390. The IPS was normalised by 17:10hrs.
8.	On Tuesday, 5 th February, 2019 at 11:56hrs the IPS experienced a system disturbance due to the tripping of generators 1, 2, 3 and 4 machine circuit breakers on differential protection at Kafue Gorge Power Station. Tripping occurred after closing 330kV bus coupler CB130 at KFG switchyard. The IPS normalised at 12:34hrs.
9.	On Thursday, 7 th March, 2019 at 14:20hrs the IPS experienced a system disturbance due to the tripping of 66kV CSS - Luangwa line on overcurrent protection, attributed to lightning activities. The line was restored at 14:29hrs.
10.	On Monday, 18 th March, 2019 at 18:54hrs the IPS experienced a system disturbance due to the tripping of generators 4, 5 and 6 machine circuit breakers at Kariba North Bank Power Station. The machines were made available at 21:30hrs.
11.	On Wednesday, 27 th March, 2019 at 08:24hrs the IPS experienced a system disturbance due to the Tripping of 132/33/11kV Transformer T2AB Bank and 132/11kV Transformer T1B LV CB 1TX0 at Coventry substation.
12.	On Monday, 01 st April, 2019 at 21:02hrs the IPS experienced a system disturbance due to tripping of the 220kV Michelo – Karavia line 1 & 2 and 220kV Luano - Karavia line. The IPS was normalised at 21:08hrs.
13.	On Monday, 01 st April, 2019 at 23:59hrs the IPS experienced a system disturbance due to tripping of the 220kV Michelo – Karavia line 1 & 2 and 220kV Luano - Karavia on DOP caused by the blocking and de-blocking of converter No.1 at Kolwezi in the SNEL network. The IPS was normalised at 00:05hrs.
14.	On Tuesday, 02 nd April, 2019 at 20:16hrs the IPS experienced a system disturbance due to tripping of 220kV Michelo – Karavia line 1 & 2 and 220kV Luano - Karavia line. The IPS was normalised at 13:34hrs.
15.	On Friday, 5 th April, 2019 at 02:36hrs the IPS experienced a system disturbance due to loss of load in the SNEL network following the tripping of the 120kV Kasapa –Likasi line on differential protection. The IPS was normalised at 21:05hrs
16.	On Saturday, 6 th April, 2019 at 16:05hrs the IPS experienced a system disturbance due to tripping of the 220kV Michelo – Karavia line 1 & 2 and 220kV Luano - Karavia on DOP caused by the tripping of converter No.1 at Kolwezi in the SNEL network. The IPS was normalised at 16:09hrs

Appendix 7: Major System Disturbances recorded in 2019 *(Continued)*

No.	Description of Disturbance
17.	On Wednesday, 10 th April, 2019 at 02:58hrs the IPS experienced a system disturbance due to the loss of generation of about 385MW in the ZESA network after the tripping of all the machines at Hwange Power Station. The IPS was normalised at 03:23hrs.
18.	On Wednesday, 10 th April, 2019 at 12:10hrs the IPS experienced a system disturbance due to loss of load in the SNEL network. The IPS was normalised at 12:27hrs.
19.	On Thursday, 11 th April, 2019 at 20:16hrs the IPS experienced a system disturbance due to the tripping of converter No.1 at Kolwezi in the SNEL network. The IPS was normalised at 19:17hrs.
20.	On Monday, 15 th April, 2019 The IPS experienced a system disturbance due to the tripping of generators 3 & 4 machines, due to loss of communication with controllers at Kariba North Bank Power Station. The IPS was normalised at 18:47hrs.
21.	On Thursday, 18 th April, 2019 at 13:23 hrs the IPS experienced a system disturbance due to tripping of the 220kV Michelo – Karavia line 1 & 2 on DOP caused by the tripping of converter No.1 at Kolwezi in the SNEL network. The IPS was normalised at 13:30hrs.
22.	On Thursday, 18 th April, 2019 at 15:35hrs the IPS experienced a system disturbance due to tripping of the 220kV Michelo – Karavia line 1 & 2 on DOP caused by the tripping of converter No.1 at Kolwezi in the SNEL network. The IPS was normalised at 15:45hrs.
23.	On Friday, 19 th April, 2019 at 08:49hrs the IPS experienced a system disturbance Loss of load in the SNEL network following the tripping of the 120kV Sila – Tembo line in the SNEL network. The IPS was normalised at 09:12hrs.
24.	On Friday, 19 th April, 2019 at 20:16hrs the IPS experienced a system disturbance due to tripping of the 220kV Michelo – Karavia line 1 & 2 on DOP caused by the tripping of converter No.1 at Kolwezi in the SNEL network. The IPS was normalised at 13:21hrs.
25.	On Saturday, 27 th April, 2019 at 13:32hrs the IPS experienced a system disturbance due to tripping of the 220kV Michelo – Karavia line 1 caused by the tripping of converter No.1 at Kolwezi in the SNEL network. The IPS was normalised at 13:37hrs.
26.	On Saturday, 04 th May, 2019 at 22:59hrs the IPS experienced a system disturbance due to tripping of the 120kV Sila – Tembo line as a result the SNEL network lost about 121MW of load. The IPS was normalised at 23:15hrs
27.	On Monday, 06 th May 15:13Hrs at 15:13hrs the IPS experienced a system disturbance due to loss of about 112MW of load at Kalumbila mine. The IPS was normalised at 15:26hrs.
28.	On Friday, 10 th May, 2019 at 22:42hrs the IPS experienced a system disturbance due to tripping of the 220kV Panda - Fungulume line in the SNEL network due to vandalism. The IPS was normalised at 23:09hrs
29.	On Sunday, 12 th May, 2019 at 12:35hrs the IPS experienced a system disturbance Blocking and de-blocking of the DC converter at Inga Power Station in the SNEL network. The IPS was normalised at 12:48hrs.
30.	On Tuesday, 14 th May, 2019 at 13:096hrs the IPS experienced a system disturbance due to blocking and de-blocking of the DC converter at Inga Power Station in the SNEL network. The IPS was normalised at 13:15hrs.
31.	On Wednesday, 15 th May, 2019 at 13:29hrs the IPS experienced a system disturbance due to tripping of the 220kV Panda - Fungulume line in the SNEL network due to vandalism of the copper conductors. The IPS was normalised at 13:50hrs.

Appendix 7: Major System Disturbances recorded in 2019 *(Continued)*

No.	Description of Disturbance
32.	On Wednesday, 15 th May, 2019 The IPS experienced a system disturbance due to short circuit on 33kV East Feeder in Kansanshi Mine. The short circuit was caused by Monkey. 330kV Luano – Kansanshi line.
33.	On Thursday, 16 th May, 2019 at 10:59hrs the IPS experienced a system disturbance due to blocking and de-blocking of the DC converter at Inga Power Station and Kolwezi in the SNEL network, this was attributed to bush fires under the DC link. The IPS was normalised at 11:03hrs.
34.	On Thursday, 16 th May, 2019 at 13:49hrs the IPS experienced a system disturbance due to blocking and de-blocking of the DC converter at Inga Power Station and Kolwezi in the SNEL network, this was attributed to bush fires under the DC link. The IPS was normalised at 14:00hrs.
35.	On Friday, 17 th May, 2019 at 13:09hrs the IPS experienced a system disturbance due to blocking and de-blocking of the DC converter 1 at Kolwezi in the SNEL network. The IPS was normalised at 13:15hrs.
36.	On Monday, 20 th May, 2019 The IPS experienced a system disturbance due to short circuit on 33kV East Feeder in Kansanshi Mine. The short circuit was caused by Monkey. 330kV Luano – Kansanshi line.
37.	On Friday, 24 th May, 2019 at 18:44hrs the IPS experienced a system disturbance due to tripping of the 220kV Panda - Karavia line in the SNEL network. The IPS was normalised at 19:24hrs.
38.	On Monday, 27 th May, 2019 at 19:15hrs the IPS experienced a system disturbance due to tripping of the 220kV Karavia – Kasepa line in the SNEL network. CEC – SNEL interconnector power flow swung from 59.6MW exports to 16.8MW imports. The IPS was normalised at 19:26hrs.
39.	On Saturday, 01 st June, 2019 at 18:22hrs the IPS experienced a system disturbance due to due to loss of 400MW of generation at HCB in Mozambique. The IPS normalised at 18:41hrs.
40.	On Sunday, 2 nd June, 2019 at 14:06hrs the IPS experienced a system disturbance due to tripping of the 120kV Likasi - Kambovu line in the SNEL network. The IPS was normalised at 14:15hrs.
41.	On Sunday, 2 nd June, 2019 at 16:11hrs the IPS experienced a system disturbance due to tripping of the 220kV Panda - Karavia line in the SNEL network. The IPS was normalised at 16:20hrs
42.	On Sunday, 2 nd June, 2019 at 16:54hrs the IPS experienced a system disturbance due to blocking and de-blocking of the DC converter in the SNEL network. The IPS was normalised at 17:55hrs.
43.	On Sunday, 2 nd June, 2019 at 11:17hrs the IPS experienced a system disturbance due to tripping of the 120kV Nsete - Kolwezi line in the SNEL network due to bush fires. The IPS was normalised at 11:29hrs.
44.	On Tuesday, 04 th June, 2019 at 11:06hrs the IPS experienced a system disturbance due to blocking and de-blocking of the DC converter 1 at Kolwezi in the SNEL network. This was attributed to bush fires. The IPS was normalised at 11:11hrs.
45.	On Wednesday, 05 th June, 2019 at 12:25hrs the IPS experienced a system disturbance due to blocking and de-blocking of the DC converter at Inga Power Station and Kolwezi in the SNEL network. This was attributed to bush fires. The IPS was normalised at 14:03hrs.
46.	On Thursday, 06 th June, 2019 at 13:43hrs the IPS experienced a system disturbance due to blocking and de-blocking of the DC converter 1 at Kolwezi in the SNEL network. The IPS was normalised at 14:02hrs.
47.	On Friday, 07 th June, 2019 at 12:25hrs the IPS experienced a system disturbance due to tripping of the 220kV Michelo - Karavia line 1 & 2 on directional over power. The IPS was normalised at 12:50hrs.

Appendix 7: Major System Disturbances recorded in 2019 *(Continued)*

No.	Description of Disturbance
48.	On Sunday, 09 th June, 2019 at 15:09hrs the IPS experienced a system disturbance due to blocking and de-blocking of the DC converter in the SNEL network. The IPS was normalised at 15:35hrs.
49.	On Monday, 10 th June, 2019 at 09:58hrs the IPS experienced a system disturbance due to tripping of the 120kV Likasi - Kambovu line in the SNEL network. The IPS was normalised at 10:13hrs.
50.	On Tuesday, 11 st June, 2019 at 06:02hrs the IPS experienced a system disturbance due to the tripping of 330kV bus coupler at HCB Songo in Mozambique. The IPS normalised at 06:15hrs.
51.	On Tuesday, 11 th June, 2019 at 09:28hrs the IPS experienced a system disturbance due to tripping of the 120kV Likasi - Kambovu line in the SNEL network. The IPS was normalised at 09:49hrs.
52.	On Thursday, 13 th June, 2019 at 11:36hrs the IPS experienced a system disturbance due to the loss of about 1000MW on the Eskom network. The IPS normalised at 11:50hrs.
53.	On Thursday, 13 th June, 2019 at 12:46hrs the IPS experienced a system disturbance due to loss of about 107MW of load at Kalumbila mine. The IPS normalised at 12:55hrs.
54.	On Tuesday, 18 th June, 2019 at 12:17hrs the IPS experienced a system disturbance due to blocking and de-blocking of the DC converter 1 at Kolwezi in the SNEL network. The IPS was normalised at 12:20hrs.
55.	On Sunday, 23 th June, 2019 at 15:25hrs the IPS experienced a system disturbance due to blocking and de-blocking of the DC converter 1 at Kolwezi in the SNEL network. The IPS was normalised at 15:40hrs.
56.	On Tuesday, 25 th June, 2019 at 01:14hrs the IPS experienced a system disturbance due to tripping of the 400kV Insukamini – Phokoje line and 220kV Marvel – Francistown line in the ZESA network. The IPS normalised at 01:30hrs.
57.	On Wednesday, 26 th June, 2019 at 17:17hrs the IPS experienced a system disturbance due to tripping of the 220kV Panda – Shitulu line in the SNEL network attributed to bush fires. The IPS was normalised at 17:47hrs.
58.	On Wednesday, 26 th June, 2019 at 19:15hrs the IPS experienced a system disturbance due to loss of load on the SNEL network. The IPS was normalised at 19:30hrs.
59.	On Thursday, 27 th June, 2019 at 15:02hrs the IPS experienced a system disturbance due to blocking and de-blocking of the DC converter 1 at Kolwezi in the SNEL network. The IPS was normalised at 15:10hrs.
60.	On Saturday, 29 th June, 2019 at 00:25hrs the IPS experienced a system disturbance due to tripping of the 220kV Panda – Shitulu line in the SNEL network. The IPS was normalised at 00:40hrs.
61.	On Saturday, 29 th June, 2019 at 12:19hrs the IPS experienced a system disturbance due to blocking and de-blocking of the DC converter 1 at Kolwezi in the SNEL network. The IPS was normalised at 12:38hrs.
62.	On Thursday, 1 st August, 2019 at 10:51hrs the IPS experienced a system disturbance due to the tripping of 330kV Bus Coupler at Songo, HCB, in Mozambique. The IPS normalised at 11:39hrs
63.	On Wednesday, 14 th August, 2019 at 14:52hrs the IPS experienced a system disturbance due to the tripping of 500kV Inga – Kolwezi DC link, in the SNEL network. The IPS was stabilized by 15:30hrs with most loads restored by 16:26hrs.
64.	On Friday, 16 th August, 2019 at 15:44hrs the IPS experienced a system disturbance due to the Blocking and de-blocking of the DC converter number 1 at Kolwezi. The IPS was normalised at 15:59hrs.

Appendix 7: Major System Disturbances recorded in 2019 *(Continued)*

No.	Description of Disturbance
65.	On Monday, 26 th August, 2019 at 00:32hrs the IPS experienced a system disturbance due to the tripping of the Generators at Nseke Power station in the SNEL network. The IPS stabilised at 00:47hrs.
66.	On Wednesday, 18 th September, 2019 at 11:50hrs the IPS experienced a system disturbance due to the tripping 220kV Panda – Likasi line on overvoltage in the SNEL network. The IPS was normalised at 12:01hrs.
67.	On Wednesday, 18 th September, 2019 at 15:53hrs the IPS experienced a system disturbance due to the blocking and de-blocking of the DC converter number 1 at Kolwezi, in the SNEL network. The IPS was normalised at 15:57hrs.
68.	On Sunday, 6 th October, 2019 at 13:47hrs the IPS experienced a system disturbance due to the tripping of the converter at Nseke Power Station at Kolwezi, in the SNEL network. The IPS was normalised at 14:37hrs.
69.	On Sunday, 6 th October, 2019 at 17:30hrs the IPS experienced a system disturbance due to the tripping of the Bus Coupler at Songo at HCB. The IPS normalised at 17:38hrs.
70.	On Saturday, 12 th October, 2019 at 21:08hrs the IPS experienced a system disturbance due to the loss of two generators at Koni Power Station, in the SNEL network. The IPS was normalised at 21:42hrs.
71.	On Monday, 14 th October, 2019 at 22:02hrs the IPS experienced a system disturbance due to the tripping of a generator at Nseke Power Station at Kolwezi, in the SNEL network. The IPS was normalised at 22:22hrs.
72.	On Thursday, 17 th October, 2019 at 06:04hrs the IPS experienced a system disturbance due to the tripping of 330kV Luano – Kansanshi line on distance protection. The IPS normalised at 07:31hrs.
73.	On Thursday, 24 th October, 2019 at 01:47hrs the IPS experienced a system disturbance due to the blocking and de-blocking tripping of converter no.1 at Kolwezi, in the SNEL network. The IPS was normalised at 01:53hrs.
74.	On Friday, 25 th October, 2019 at 00:47hrs the IPS experienced a system disturbance due to the blocking and de-blocking tripping of converter no.1 at Kolwezi, in the SNEL network. The IPS was normalised at 01:02hrs.
75.	On Tuesday, 29 th October, 2019 at 12:41Hrs the IPS experienced a system disturbance due to the tripping of the 330kV Lusaka West – Kafue West line. The IPS was normalised by 12:47hrs.
76.	On Tuesday, 29 th October, 2019 at 21:21hrs the IPS experienced a system disturbance Due to the tripping of the Bus Coupler at HCB Caborabasa on under-frequency, in Mozambique. The IPS normalised at 21:29hrs.
77.	On Monday, 11 th November, 2019 at 14:39hrs the IPS experienced a system disturbance due to the tripping of the 330kV Nambala – Kalumbila line 2. The IPS normalised 15:23hrs.
78.	On Monday, 25 th November, 2019 at 12:34hrs the IPS experienced a system disturbance due to the tripping of the 330kV Kafue Town – Kafue West line. The IPS was normalised 12:50hrs.
79.	On Monday, 18 th November, 2019 at 03:28hrs the IPS experienced a system disturbance due to the tripping of the 330kV Bus Coupler at HCB and 400kV Insukamini – Phokoje line, in the ZESA network. The IPS normalised at 03:40hrs.
80.	On Friday, 22 nd November, 2019 at 09:19hrs the IPS experienced a system disturbance due to the blocking and de-blocking tripping of converter number 2 at Kolwezi, in the SNEL network. The IPS was normalised at 09:30hrs.

Appendix 7: Major System Disturbances recorded in 2019 *(Continued)*

No.	Description of Disturbance
81.	On Saturday, 23 rd November, 2019 at 05:11hrs the IPS experienced a system disturbance due to the tripping of the 220kV Luano – Karavia line. The IPS was normalised at 05:14hrs.
82.	On Sunday, 24 th November, 2019 at 16:00hrs the IPS experienced a system disturbance due to the tripping of the 220kV Pande –Shikulu line, in the SNEL network. The IPS was normalised at 16:12hrs.
83.	On Monday, 26 th November, 2019 at 20:22hrs the IPS experienced a system disturbance due to loss of load in the SNEL network. The IPS was normalised at 20:45hrs.
84.	On Wednesday, 28 th November, 2019At 22:12hrs the IPS experienced a system disturbance due to the tripping of the 400kV Phokoje – Matimba line and 400kV Insukamini –Phokoje line. The IPS normalised at 22:50hrs.
85.	On Saturday, 07 th December, 2019 at 20:16hrs the IPS experienced a system disturbance due to the tripping of the 220kV CSS – Frontier line on differential Protection in the CEC network. The IPS was normalised 20:50hrs.
86.	On Monday, 09 th December, 2019 at 18:13hrs the IPS experienced a system disturbance due to the tripping of the 330kV Marvel – Francistown line and 400kV Insukamini –Phokoje line. The IPS was normalised at 19:46hrs.
87.	On Thursday, 12 th December, 2019 at 17:59hrs the IPS experienced a system disturbance due to the tripping of 33kV Village feeder at Lumwana Mine, which led to Kansanshi and Lumwana mine losing load of about 80MW and 26MW of respectively. The IPS was normalised at 18:15hrs.

Appendix 8: Approved KPIs for NSOEs

No.	SCOPE/THEMATIC AREA	SPECIFIC KPIs
1.	Financial performance indicators (ratios)	Monitoring the following financial ratios: i. Liquidity ratios ii. Profitability ratios iii. Solvency ratios iv. Efficiency/Cost management v. Sustainability ratios
2.	System Losses	i. Transmission losses (6%) ii. Distributional losses (10%)
3.	Customer Metering	i. All customers to be metered; i. Percentage of customers on pre-paid meters; ii. Replacement of faulty meters; iii. Billing complaints received; iv. Standard Customer connection time; v. Non-Standard Customer connection time.
No.	SCOPE/THEMATIC AREA	SPECIFIC KPIs
4.	Customer Service Office	i. Existence of customer service office and officer(s), and a dedicated contact number; ii. Information/Tariff display; iii. Complaint resolution Procedure.
5.	Customer Complaints Resolution Rate	i. Complaint resolution rate; and ii. Complaints escalated to the regulator.
6.	Number and Frequency of outages	Monitoring of SAIDI, SAIFI and CAIDI
7.	Service Restoration Time	Licensee required to restore service within stipulated time.
8.	Replacement of faulty equipment (Asset Reliability)	i. Replaced meters as a percentage of installed meters; ii. Replacement of distribution/supply transformers as a percentage of the total number of transformers.
9.	Safety	i. Maintain zero fatality on a quarterly basis; ii. Maintain zero Lost Time Injury (LTI) on a quarterly basis.
10.	Quality of Service (QoS)	Network Availability for transformers and lines: i. 95% for network > 66kV nominal ii. 85% for network ≤ 66kV nominal
11.	Power Generation	Unit Capability Factor (UCF): i. Large Hydro Power Plants ≥ 80% ii. Small Hydro Power Plants ≥ 60% iii. Thermal Power Plants ≥ 50%
12.	Electricity Infrastructure Compliance Level	Infrastructure compliance level of > 80%

Appendix 9: Summary Terms of Reference for the Cost of Service Study

The study has ten (10) major deliverables as hereby highlighted:

1. Review of structure and conduct of the power sector

The study will undertake a comprehensive assessment of the structure and conduct of the power sector including the existing legal and regulatory framework. The review will be undertaken with the view to identifying deficiencies in the current institutional, legal and regulatory framework that pose constraints to the development of the electricity sub-sector.

2. Electricity demand forecasts

The study will review the current electricity demand forecast undertaken by Japan International Cooperation Agency (JICA), in 2010, on behalf of the Ministry Of Energy and prepare a revised demand forecast for the next 20 years.

3. Medium to long-term least cost expansion plan

On the basis of the outcome of the demand forecast, the consultant will develop the long-term least-cost expansion plan covering generation, transmission and distribution to meet the projected maximum demand forecast for 20 years. The plan will integrate renewable energy generation and developments in the Southern African Power Pool (SAPP).

4. Determination of economic cost of supply, structure and levels of tariffs

Building on the demand forecast and least cost expansion plan, the study will involve the determination of the Long Run Marginal Cost (LRMC) of generation, the average Incremental Cost (AIC) of transmission, and the AIC of distribution and supply. Based on the foregoing, the appropriate structure and level of tariff will be determined for each consumer category, reflecting the economic cost of supply to the category.

5. Life-line tariff mechanism, analysis of existing tariffs, and adjustment to economic based tariffs

The study will determine the level of electricity requirement for low income households for basic use and propose an appropriate life-line tariff. Further, the study will provide recommendations on alternative options through which the life-line tariff could be administered smartly.

6. Review of financial performance of ZESCO and preparation of projections

The study will also carry out a detailed review of ZESCO's cost structure and level. The study will benchmark ZESCO's costs with the cost of efficient utilities with similar operating conditions as ZESCO and indicate areas of improvements to acceptable efficient performance standards.

7. Determination of transmission wheeling charges

In readiness for the envisaged reforms such as the introduction of the open access regime, the study will involve developing a methodology for the determination of transmission wheeling charges in order to facilitate for third party access to the transmission infrastructure.

8. Assessment of the ERB'S approach to tariff review

The ERB currently uses the revenue requirement methodology in determining tariffs. The study shall undertake a review of this approach in relation to alternative best practice approaches to tariff regulation.

9. Tariff adjustment roll-out strategies

The study shall develop a comprehensive roll-out plan that outlines alternative strategies for a smooth migration of tariffs to cost reflective levels for all customer categories.

10. Capacity building

The study will also involve a capacity building programme to provide training for the technical staff of ERB, department of energy, ZESCO limited, Copperbelt Energy Corporation et cetera in order to ensure that future studies are undertaken in-house by the Zambians.

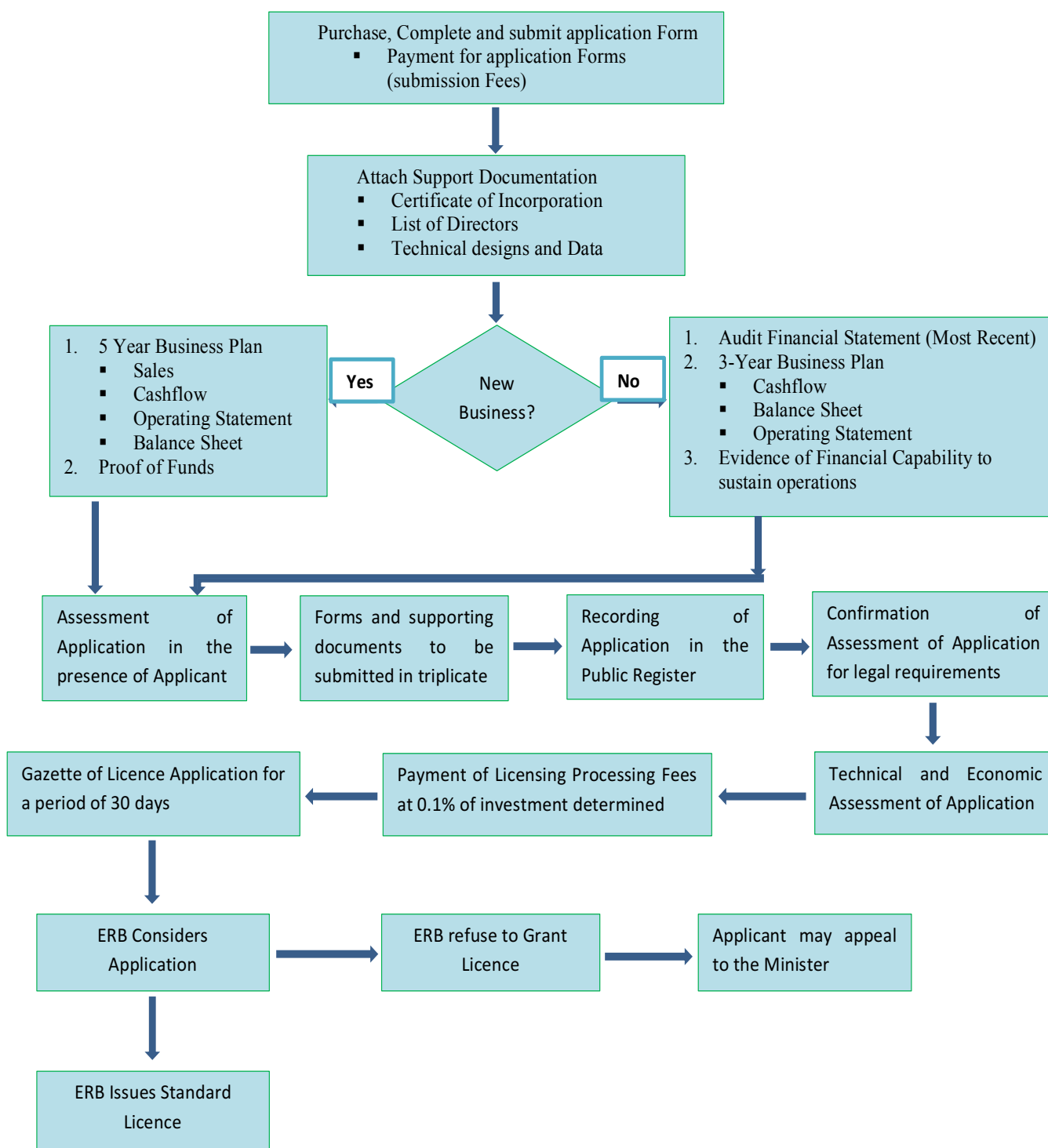
Appendix 10: ZESCO new tariff structure

Customer category	Tariff components	Current tariff	Approved Tariffs Effective 1 st January 2020
1. METERED RESIDENTIAL (Prepaid) (capacity 15 kVA)			
R1 – Consumption from 1 - 100 kWh in a month	Energy charge/kWh	0.15	0.47
R2 – Consumption between 101kWh - 300 kWh in a month	Energy charge/kWh	0.89	0.85
R3 – Consumption above 300kWh	Energy charge/kWh	Nil	1.94
	Fixed Monthly Charge	18.23	Abolished
2. Commercial Tariffs (capacity 15kVA)			
C1 – Consumption up to 200kWh	Energy charge/kWh	0.54	1.07
C2 – Consumption above 200kWh	Energy charge/kWh	Nil	1.85
	Fixed Monthly Charge	96.41	Abolished
3. Social Services			
Schools, Hospital, Orphanages, churches, water pumping & street lighting	Energy charge K/kWh	0.49	1.19
	Fixed Monthly Charge	83.84	203.73
4. Maximum Demand Tariffs			
MD1- Capacity between 16 - 300 kVA	MD Charge (K/kVA/Month)	24.45	42.79
	Energy Charge (K/kWh)	0.35	0.61
	Fixed Monthly Charge (K/ Month)	239.44	419.02
	Off Peak MD Charge (K/KVA/ Month)	12.22	21.39
	Off Peak Energy Charge (K/ kWh)	0.26	0.46
	Peak MD Charge (K/KVA/ Month)	30.56	53.48
	Peak Energy Charge (K/kWh)	0.44	0.77
MD2- Capacity 301 to 2,000 kVA	MD Charge (K/kVA/Month)	45.73	80.03
	Energy Charge (K/kWh)	0.3	0.53
	Fixed Monthly Charge (K/ Month)	478.84	837.97
	Off Peak MD Charge (K/KVA/ Month)	22.87	40.01
	Off Peak Energy Charge (K/ kWh)	0.23	0.39
	Peak MD Charge (K/KVA/ Month)	57.17	100.03
	Peak Energy Charge (K/kWh)	0.37	0.66

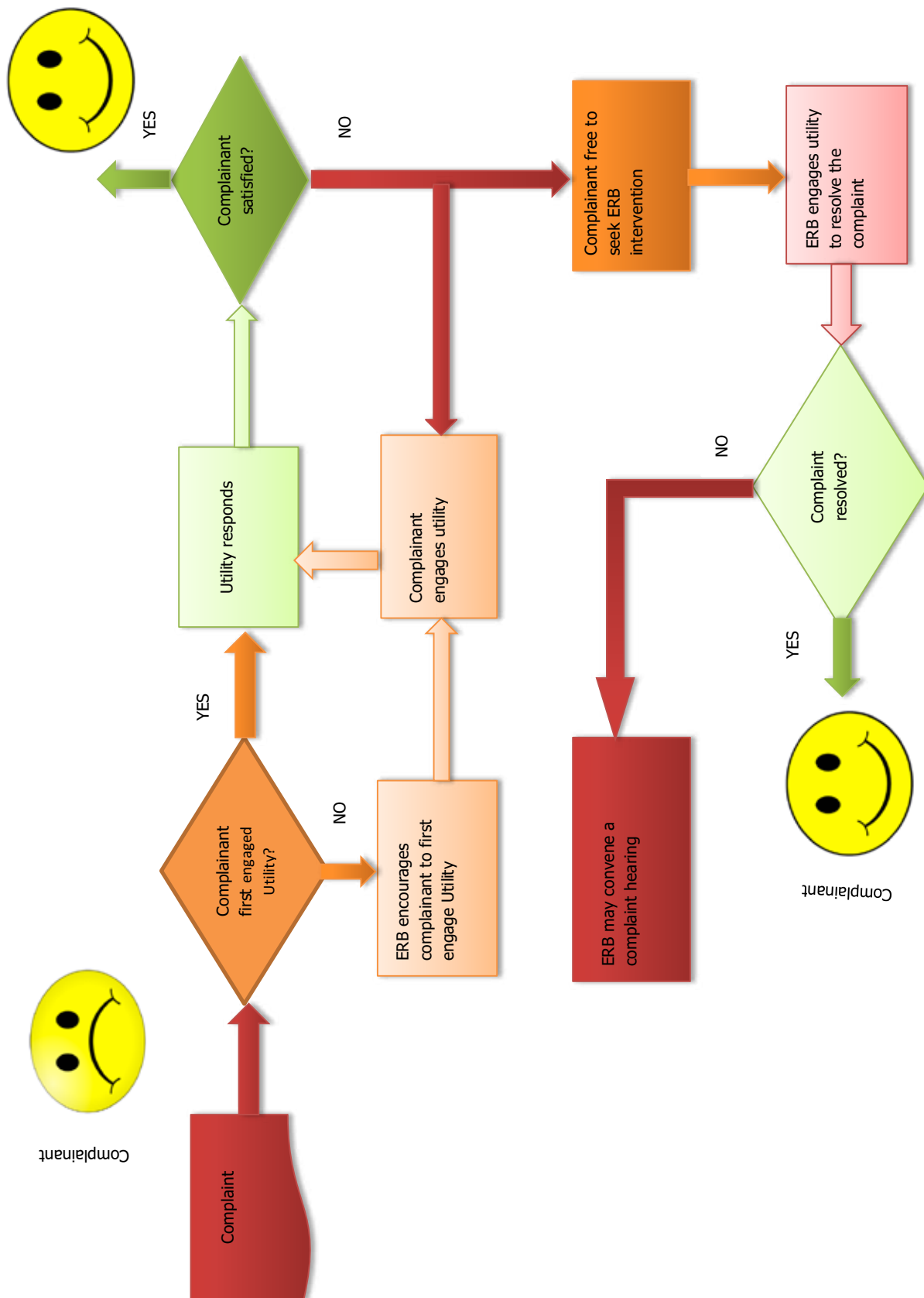
Appendix 11: Revised tariff structure for NWEK

Description	Current Tariffs (K)	Recommended Tariffs (K)	Percentage Change (%)
Residential Customers			
R1 (1-100kWh)	0.35	0.47	34
R2 (101-300 kWh)	0.89	0.85	-4
R3 (Above 300 kWh)	N/A	1.94	118
Monthly Fixed Charge	18.23	Abolished	-
Commercial Customer (Consumption Capacity up to 15KVA)			
C1 (1-200 kWh)	0.71	1.07	51
C2 (Above 200 kWh)	N/A	1.85	161
Capacity Charge	45.72	Abolished	-
Monthly Fixed Charge	131.25	Abolished	-
Social Services Customers			
Energy Charge	0.71	1.19	68
Monthly Fixed Charge	131.25	203.73	55
Maximum Demand Customers (Above Consumption Capacity of 15KVA) (newly introduced)			
MD Charge (K/kVA/Month)	N/A	42.79	New Band
Energy Charge (K/kWh)	N/A	0.61	New Band
Fixed Monthly Charge (K/Month)	N/A	419.02	New Band
Off Peak MD Charge (K/KVA/Month)	N/A	21.39	New Band
Off Peak Energy Charge (K/kWh)	N/A	0.46	New Band
Peak MD Charge (K/KVA/Month)	N/A	53.48	New Band
Peak Energy Charge (K/kWh)	N/A	0.77	New Band

Appendix 12: ERB licensing process flow chart



Appendix 13: ERB complaints handling procedure



Annex 1: Imports of petroleum feedstock cargoes, 2016 – 2019

Cargo Name	Month	Tonnage (MT)
MT. Argos	March 2016	90,000.00
MT Sigma Puma	May 2016	92,569.00
MT. Afra Oak	June 2016	83,970.00
MT Leyla K	September 2016	102,330.00
MT Desh Mahima	December 2016	105,018.00
Total		483,887.06
MT. Desh Mahima II	March 2017	105,506.22
MT Desh Garima	May 2017	104,802.36
MT Desh Mahima III	July 2017	105,094.44
MT Desh Garima II	September 2017	102,129.44
MT Desh Garima III	December 2017	102,610.90
Total		520,143.36
MT. Desh Mahima IV	January 2018	103,700.68
MT Desh Mahima V	March 2018	104,125.92
MT Desh Samman	May 2018	104,099.81
MT Desh Seruksha	July 2018	103,215.69
MT Desh Mahima VI	September 2018	102,610.08
MT. Desh Samman II	November 2018	100,688.68
Total		618,440.86
MT Desh Samman III	January 2019	102,916.04
MT. Desh Samman IV	March 2019	102,799.17
MT Fos Picasso	May 2019	105,078.95
Sahara Cargo 3	June 2019	102,124.99
MT Stride	August 2019	97,643.87
MT Al Jalaa	October 2019	100,154.56
MT. Alba	December 2019	93,939.52
Total		704,657.11

Annex 2: ERB electricity tariff determination methodology

The ERB uses the Revenue Requirement Methodology otherwise known as the Cost of Service methodology in its tariff determination process. Revenue Requirement means the revenue that a regulated utility needs to earn in a test year in order to provide adequate service to its customers and earn a fair return for its shareholders. Typical formula of RR is as presented as follows:

$$RR = O + D + T + r \cdot RB$$

Where;

RR = Revenue Requirement;

OMA = Operating Expenses, maintenance and administration expense;

D = Depreciation and amortization expense;

T = Income Tax Expenses;

r = allowed rate of return on Rate Base (Fixed Asset plus working Capital);

RB = rate base (or regulatory asset base – RAB = (OC - AD);

OC = original cost of assets when placed in service;

AD = accumulated depreciation on assets since placed in service; and

*R*RB = return on rate base or cost of capital;*

In reviewing tariff applications, the ERB's use of the RR methodology is also premised on the following key regulatory principles:

- i. *Recovery of prudently incurred costs by the Utility – only just and reasonable costs incurred wholly and exclusively for the provision of electricity are allowed in the tariff determination process ;*
- ii. *Recognition of used and useful Utility assets – only assets currently used by the utility to provide electricity to its customers are included in the Rate Base;*
- iii. *Financial sustainability of the Utility – the applicable tariffs should enable the utility cover both capital and operational costs as well as earn a reasonable return;*
- iv. *The need to attain cost reflective tariffs – the Government's National Energy Policy (NEP) advocates for cost reflective pricing of all energy services;*
- v. *Delivery of quality service – tariff increases must be accompanied by noticeable improvements in the quality of services provided; and*
- vi. *Social considerations for the indigent customers – accessibility and affordability for the poor (R1 as proxy for lifeline tariff).*

The above are internationally accepted tariff determination principles.

Head Office
Plot No. 9330, Mass Media
Off Alick Nkhata Road,
P. O. Box 37631,
Lusaka, Zambia.
Tel: 260-211-258844 - 49
Fax: 260-211-258852

Copperbelt Office
Plot No. 332
Independence Avenue
P.O. Box 22281
Kitwe, Zambia
Tel: +260 212 220944
Fax: +260 212 220945

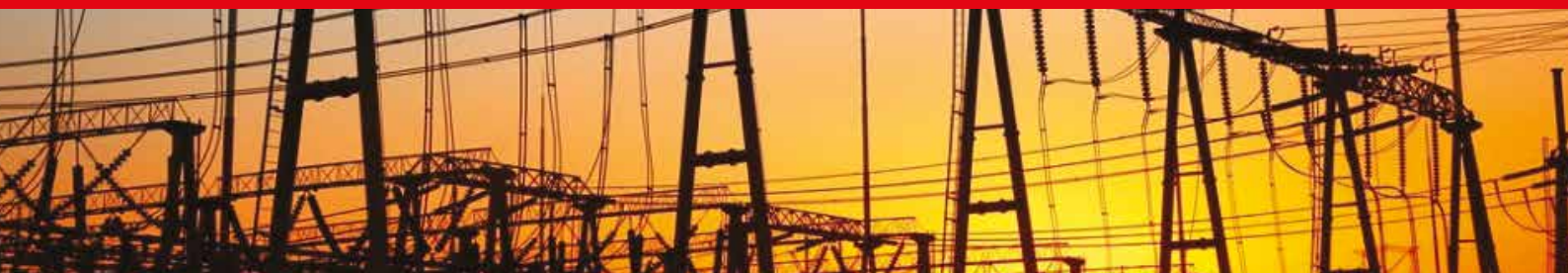
Livingstone Office
Plot No. 708
Chimwemwe Road
Nottie Broadie
P.O. Box 60292
Livingstone, Zambia
Tel: +260 213 321562-3
Fax: +260 213 321576

Chinsali Office
Plot No. 76
Mayadi
P.O. Box 480052
Chinsali, Zambia
Tel: +260 214 565170
Fax: +260 214 565171

E-mail: erb@erb.org.zm

| Website: www.erb.org.zm

Toll Free Line 8484



We safeguard your interests