ENERGY
REGULATION
BOARD

ENERGY SECTOR REPORT 2016


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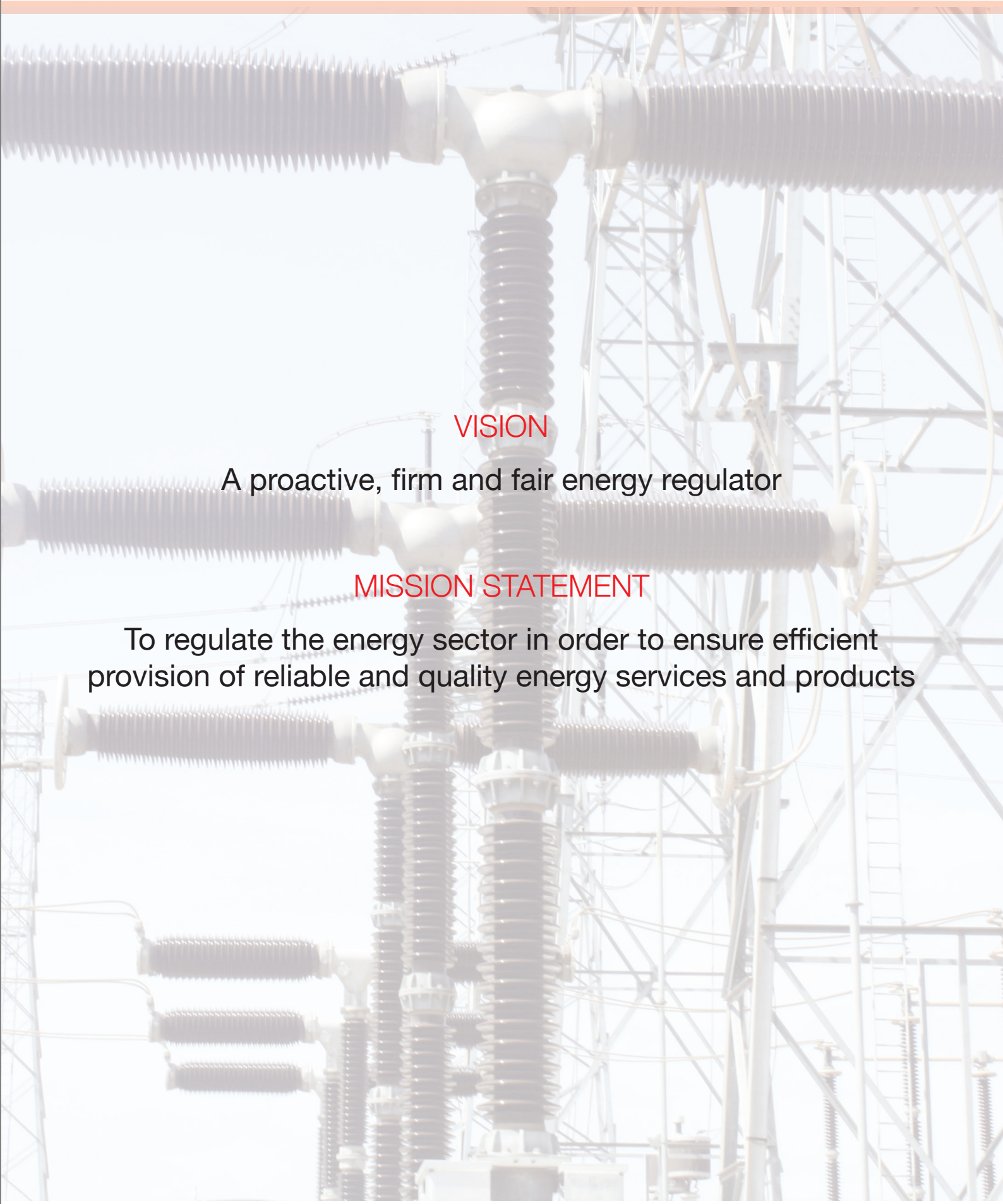
PREMIUM



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

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ABBREVIATIONS

BSA	Bulk Supply Agreement
CEC	Copperbelt Energy Corporation Plc
CPM	Cost-Plus Pricing Model
CoSS	Cost of Service Study
DZS	Draft Zambian Standards
ERB	Energy Regulation Board
ESI	Electricity Supply Industry
GRZ	Government of the Republic of Zambia
HFO	Heavy Fuel Oil
IDC	Industrial Development Corporation
INDENI	INDENI Petroleum Refinery Limited
IPP	Independent Power Producer
KNBEPC	Kariba North Bank Extension Power Corporation Limited
KPI	Key Performance Indicator
LHPC	Lunsemfwa Hydropower Company Limited
LPG	Liquefied Petroleum Gas
MCL	Maamba Collieries Limited
MYTF	Multi-Year Tariff Framework
NECL	Ndola Energy Company Limited
NFT	Ndola Fuel Terminal
NWEC	North Western Energy Corporation Limited
OMC	Oil Marketing Company
PPA	Power Purchase Agreement
PQMS	Power Quality Management System
REFiT	Renewable Energy Feed-in-Tariff
SADC	Southern Africa Development Community
SAPP	Southern Africa Power Pool
SRF	Strategic Reserve Fund
SI	Statutory Instrument
TAZAMA	TAZAMA Pipelines Limited
ZABS	Zambia Bureau of Standards
ZPL	Zengamina Power Limited
ZESCO	ZESCO Limited

UNITS OF MEASUREMENT

bbl	Barrel of oil (159 litres)
GWh	Giga-Watt hour (1,000 MWh)
ZMW	Zambian Kwacha
km	Kilometre
kV	Kilo Volt
kVA	Kilo Volt Amperes (1,000 Volt Amps)
kW	Kilo Watt
kWh	Kilo Watt Hour
MVA	Mega Volt Amperes
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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Lunsemfwa Hydropower Company Limited
Maamba Collieries Limited
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 Sugar Company Limited
Zengamina Power Limited
ZESCO Limited

FOREWORD

The Energy Sector Report is an annual publication of the Energy Regulation Board (ERB) which focuses on sectorial achievements as well as challenges experienced. The report also highlights future prospects and opportunities of the energy sector. This edition of the Energy Sector Report continues to account for successes and challenges experienced in 2016.

In 2016, the electricity sub-sector recorded an increase of 17.3 percent in electricity generation capacity to 2,828 MW from 2,411 MW a year earlier. The increase was attributed to the commissioning of new power plants, namely: Maamba coal (300 MW) and Itezhi Tezhi power plants (120 MW) which reduced hydropower generation dominance to 84.5 percent, from 94.1 percent recorded in 2015. The sector also made progress as seven (7) grid extension and three (3) solar projects were commissioned under the rural electrification programme. Further, Mwinilunga diesel power plant was decommissioned in September 2016 following the connection of Mwinilunga District to the national electricity grid.

During the period under review, the ERB approved several power purchase agreements and development the Zambia Distribution Code; which is a code intended to complement Statutory Instrument No. 79 of 2013, the Electricity (Grid Code) Regulations. The Distribution code is intended to facilitate non-discriminatory access to the electricity distribution network in Zambia. In addition, the energy sector revised and published several Zambian standards on renewable energy (solar): use of batteries, charge controllers, lighting devices, design and installation of photovoltaic systems. In its quest to regulate the quality of solar energy products imported into the country, the sector also revised the licensing criteria for the licence to manufacture, wholesale, importation and installation of solar energy systems.

The electricity sub-sector also experienced challenges in 2016 as hydropower generation continued to dominate power generation and accounted for at 84.5 percent. The dominance of hydropower generation puts the country at risk due to changes in climatic conditions; such as global warming leading to insufficient rainfall and drought. These challenges pose a risk of inadequate water resources available for hydropower generation. Unfortunately, this risk graduated into reality in 2016 as the consequence of insufficient water resources manifested in loadshedding averaging eight (8) hours a day and, in an increase in power imports by 178.26 percent, to 2,184 GWh, from 785.2 GWh, in 2015.

Despite the challenges experienced, the future outlook for the electricity sub-sector is positive as the sector has embarked on a programme to develop a technical Key Performance Indicators (KPIs) framework for licencees that are non-state owned enterprises, starting with: Copperbelt Energy Corporation Plc, Ndola Energy Corporation Limited, Maamba Collieries Limited and Lunsemfwa Hydropower Company Limited. The objective of the framework is to assess the technical operational performance of non-state owned licencees. The implementation of the KPI framework is expected to commence in the 1st quarter of 2017. The sub-sector is also poised to increase national electricity generation capacity by 131 MW from Heavy Fuel Oil and the Scaling Solar programme under the Industrial Development Corporation (IDC). Ndola Energy Corporation Limited is expected to contribute 55 MW from the expansion of its Heavy Fuel Oil plant while Bangweulu Power Company Limited and Ngonye Power Company Limited under the IDC Scaling Solar programme are each expected to contribute 47.5 MW and 28.2 MW from solar energy respectively. Further, the sub-sector is expected to finalise the development of the Multi-Year Tariff Framework, conclude the Cost of Service Study and review the Energy Regulation and Electricity Acts.

In the petroleum sub-sector, an incentive based regulation framework for TAZAMA Pipelines Limited (TAZAMA) and INDENI Petroleum Refinery Limited (INDENI) was successfully developed. The purpose of the framework is to link the KPI performance to the award of a tariff adjustment by using it to either award or penalize the state owned enterprise whenever they made an application for a tariff adjustment. The framework therefore provides an incentive for TAZAMA or INDENI to comply with the KPI's as scores now became instrumental in the level of tariff awarded. The sub-sector also successfully developed a pricing framework on light handed regulation for LPG.

In August 2016, the Mongu Fuel Depot was commissioned at a total cost of US$27 million. The fuel depot was the fourth to be commissioned by the Government of the Republic of Zambia (GRZ). Consequently, the sub-sector remodeled the transport differentials to support operations where fuel could be uplifted from any of the existing fuel depots or any new fuel depot and transported to any retail service station in any district of the country. The sub-sector also successfully recorded improvements in national compliance rates on retail sites. The national compliance rate for the retail sites was 87.7 percent, which was an improvement by 1.3 percentage points over an initial score of 86.4 percent in an earlier inspection conducted during the year. The improvement in the score was mainly attributed to the technical hearings conducted after the initial inspections. Additionally, the sub-sector revised the grading criteria for service stations by including a function on consumer compliance rating that included service factors such as the availability of compressed air pressure among other things. Previously, the technical compliance rate was the only score used to grade the infrastructure.

In 2016, the petroleum sub-sector also experienced challenges in the supply of fuel when the Ministry of Energy rejected a contaminated consignment of the petroleum feedstock. Consequently, the country experienced a disruption in fuel supplies. In order to bridge the gap, the sub-sector issued and implemented Statutory Instrument No. 21 of 2016, which authorised selected Oil marketing Companies (OMCs) to import 200,000 m^3 of diesel and 110,000 m^3 of petrol duty free. Out of the authorised quantity, a total of 76,464 m^3 or 69.51 percent of petrol and 132,601 m^3 or 66.30% of diesel were imported by the Oil Marketing Companies. In order to guarantee security of supply, the Ministry of Energy and contracted services of other OMCs. The sub-sector also removed the subsidy on fuel, which enhanced the procurement of fuel by ensuring that there was sufficient revenue for procuring fuel supplies but unfortunately disadvantaged everyone, especially the poor in expected inflation.

Beyond 2016, the petroleum sub-sector is expected to transform the way it conducts its procurement of national fuel supplies. The sub-sector is expected to divorce GRZ from the procurement of national fuel supplies as the private sector takes up the responsibility of procuring and financing of national fuel requirements. This measure is expected to improve the efficiency in the procurement of finished petroleum products. Additionally, the GRZ through the IDC is expected to conduct a situational analysis of state owned enterprises such as: INDENI and TAZAMA. The objective of this exercise is to improve service delivery and efficiency of state owned enterprises by assessing the viability of the enterprises with a view to recapitalizing only enterprises that would be found to be viable.

Langiwe H. Lungu (Ms.)

EXECUTIVE DIRECTOR

May 2017

1.0 INTRODUCTION

In 2016, the world economy grew by 2.2 percent, the slowest rate of growth since the financial crisis of 2009. Since 2012, the world economy has been growing at an average annual growth rate of 2.5 percent, much lower than the average of 3.4 percent observed in the decade prior to the financial crisis. The lower growth in the global economy had been attributed to the slow pace of global investment, declining world trade growth, weakening productivity growth and high levels of debt. Additionally, the low commodity prices also intensified these factors in many commodity exporting countries since mid-2014, while conflict and geopolitical tensions continue to weigh on economic prospects in several regions[1].

In the global oil market, crude oil prices were not spared from the low commodity prices experienced starting mid-2014. Since then, oil prices have declined and have remained relatively low. In 2016, crude oil prices remained subdued, averaging an estimated US$43/bbl compared to US$52/bbl in 2015. This was mainly on account of excess supply due to high production by several major oil producers, including the member States of the Cooperation Council for the Arab States of the Gulf and the Russian Federation. Furthermore, the persistent uncertainty over the strength of global growth also weighed on investor sentiments, generating high volatility in the oil market. In January 2016, the lifting of sanctions on Iran exacerbated concerns over a widening supply excess in the oil market. Investor sentiments worldwide were also adversely affected by a sharp decline in global equity markets. These developments contributed to the decline of the Brent oil price to a 12 year low of US$26/bbl on 20th January 2016[1].

Economic growth in the Sub-Saharan Africa region was estimated to have slowed to a rate of 1.5 percent in 2016, the slowest pace in over two decades, owing to low international oil prices and other factors. The economies of South Africa and oil exporting countries, which contribute two-thirds of regional output, accounted for most of the slowdown. This was mainly on account of the effects of low commodity prices and consequently resulting in severe economic and financial stress for oil exporting countries like Nigeria, Chad and Angola. Similarly, metal exporters struggled with low prices as well with growth declining in the Democratic Republic of Congo and Mozambique[2]. Meanwhile, agricultural exporters, such as Ivory Coast and Ethiopia, registered economic growth.

The developments in the global economy as mentioned earlier greatly impacted on the performance of the local economy. The Zambian economy in 2016 experienced slower growth after almost a decade of accelerated progress, averaging 6.36 percent, between 2007 and 2015. Preliminary estimates indicated that the national Gross Domestic Product grew by 3.4 percent in 2016, which was similar to 2.9 percent growth attained in 2015. This was on account of external and domestic challenges. On the external front, the fall in commodity prices on the international market as well as the adverse weather linked to the El Nino weather pattern over the past two agricultural seasons affected the performance of the economy. On the domestic front, key challenges included the electricity deficit on account of low water levels in the main reservoirs and a weakening Kwacha against the United States Dollar.

On the macroeconomic front, inflation in 2016 declined steadily for the most part of the year from a peak of 22.90 percent in February 2016 to close the year at 7.5 percent. In 2016, inflation rate averaged 18.21 percent compared to 10.04 percent in 2015. During the period under review, the Kwacha to the United States Dollar exchange rate averaged about K10/US$ for the period April to December 2016. This was after a decline from an average of ZMW11.32/US$ experienced between January to March 2016. The average lending rates by commercial banks in 2016 averaged 28.06 percent with a peak of 29.46 percent in December 2016 and a low of 25.84 percent in January 2016.

[1] https://www.un.org/development/desa/dpad/publication/world-economic-situation-and-prospects-2017/
[2] http://www.worldbank.org/en/region/afr/brief/global-economic-prospects-sub-saharan-africa

Since 2015, Zambia had been experiencing low power generation due to mainly the low rainfall experienced during the 2014/2015 rainy season. The resultant deficit rose from about 560 MW in April 2015 to 1,000 MW in December 2015. The power supply improved in mid-2016, owing to the commissioning of new generation power plants (Maamba Coal power plant, 300 MW and the Itezhi-Tezhi 120 MW hydropower), increased power imports and an increase in hydropower generation as a result of better rains experienced in 2016/2017 rainy season. By the end of 2016 the deficit had reduced to 526 MW.

In 2016, the total installed capacity from ZESCO Limited (ZESCO) and Independent Power Producers (IPPs) was 2,827 MW, while the available capacity was 2,730 MW as at 31st December 2016. ZESCO stated that the mining customers remained the largest single consumers of power taking up about 52 percent of demand while the balance was shared between retail and export consumers.

As part of the process to move to cost reflective pricing in the electricity sub-sector, the Energy Regulation Board (ERB had commenced and made progress in the procurement of a consultant to conduct the electricity Cost of Service Study (CoSS) with funding from the African Development Bank. The main objective of the CoSS was to establish the cost of generating, transmitting, distributing and supplying power to various customer categories and at various supply points in the industry.

Meanwhile, in the petroleum sub-sector, demand for petroleum products declined by 7.1 percent in 2016. In January, the country experienced an interruption of fuel supply following the rejection of contaminated petroleum feedstock by the Government of the Republic of Zambia (GRZ). In order to mitigate the crisis, GRZ issued Statutory Instrument (SI) No. 21 of 2016 which waived import duty for selected OMCs to import diesel and petrol. In order to guarantee security of supply, GRZ also engaged three (3) additional suppliers of finished petroleum products to complement national fuel supplies. In October 2016, GRZ announced the removal of the subsidy on fuel which marked the transition to cost reflective pricing in the petroleum sub-sector.

Additionally, in August 2016, the Mongu Fuel Depot was commissioned at a total cost of US$27 million. This is a fourth depot to be commissioned by GRZ since 2013. The fuel depot will assist in meeting the strategic and operational needs for the Western Province and other surrounding areas. The depot will help to meet GRZ objective of enhancing security of supply.

The report is arranged in four (4) sections as follows: section one introduces the report while section two (2) discusses the key developments and challenges in the electricity sub-sector. Section three (3) and four (4) highlight the key developments and challenges in the petroleum sub-sector and, consumer and public affairs, respectively.

2.0 ELECTRICITY SUB-SECTOR

This section discusses the Zambian electricity sub-sector and in particular, the installed capacity, power generation by ZESCO, IPP's, electricity consumption by different economic sectors and power exports and imports.

Power transmission lines

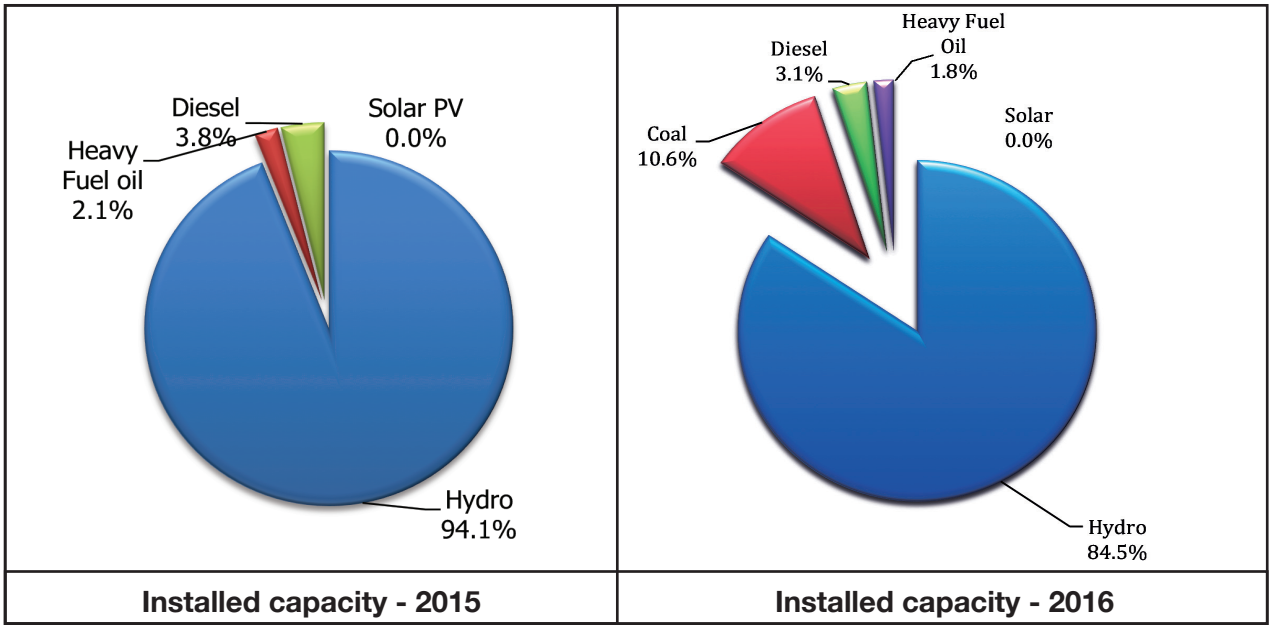
2.1 National installed electricity generation capacity

The national installed capacity increased by 17.3 percent to 2,827 MW (see Appendix 1) in 2016, from 2,411 MW a year earlier. The increase was due to the commissioning of two (2) power plants namely: Maamba coal power and Itezhi-Tezhi hydro power plants with rated capacities of 300 MW and 120 MW, respectively.

In 2016, the Electricity Supply Industry (ESI) generation capacity continued to be largely driven from hydro power, which accounted for 84.5 percent (2,388.3 MW) of the total national installed capacity. Power generation from coal was second at 10.6 percent (300 MW), followed by diesel at 3.1 percent (88.6 MW), while Heavy Fuel Oil (HFO) accounted for 1.8 percent (50 MW) and solar photovoltaic (PV), less than 0.1 percent (0.06 MW).

Figure 2-1 shows the national electricity installed capacity by technology as at 31st December 2016 and 2015.

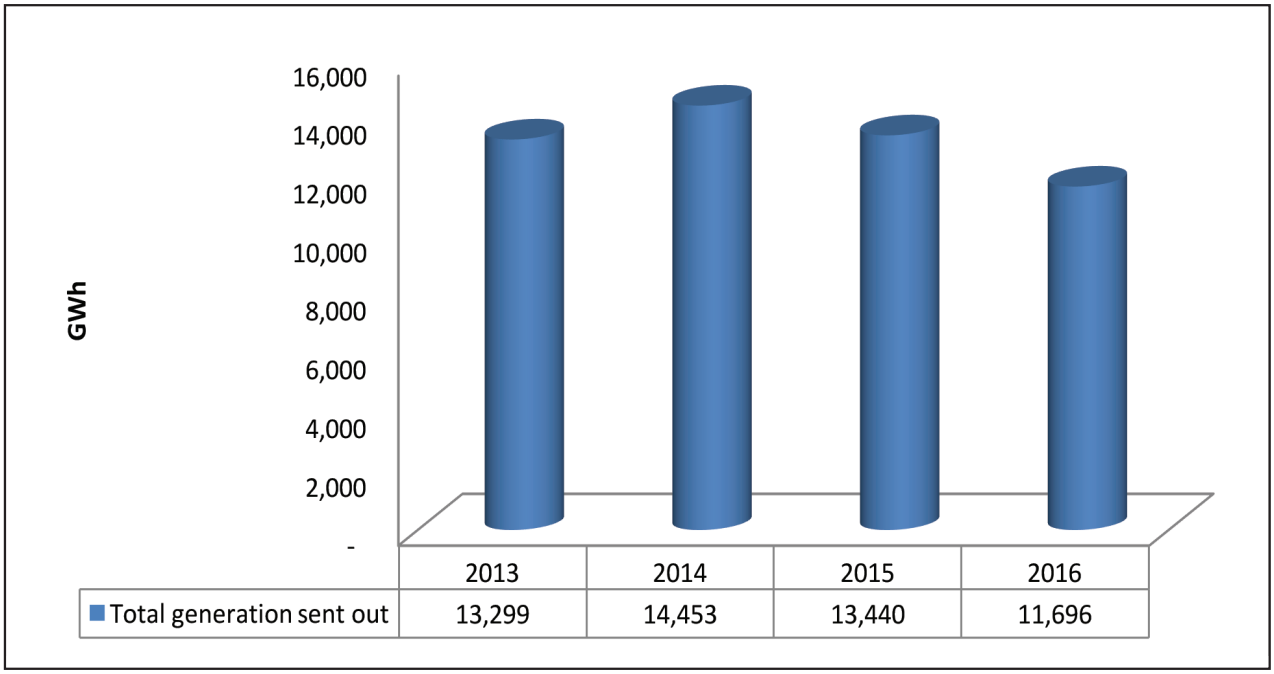
Figure 2-1: National installed electricity generation capacity by technology, 2016 & 2015



2.2 National electricity generation

In 2016, national electricity generation sent out reduced by 13.0 percent, to 11,696 GWh from 13,440 GWh recorded in 2015. The reduction in electricity generation was on account of the continued poor rainfall experienced during the 2014/2015 and 2015/2016 rainy seasons which resulted in low water levels. Figure 2-2 shows the trend in national electricity generation.

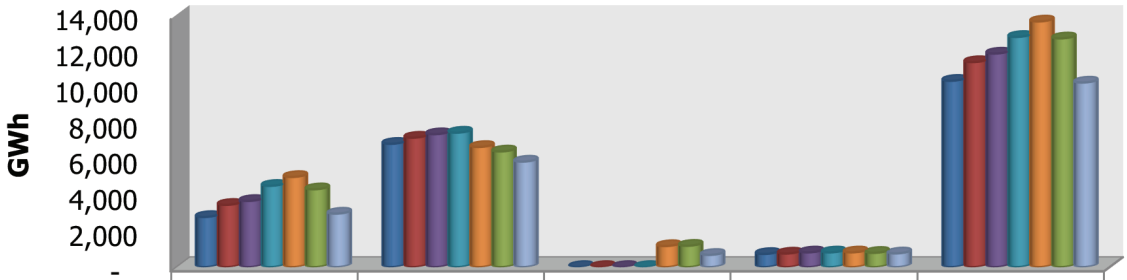
Figure 2-2: Trend in national electricity generation, 2013 – 2016



2.3 Electricity generation from large hydro power plants owned by ZESCO

In 2016, ZESCO owned four (4) large hydro power plants; Kafue Gorge (990 MW), Kariba North Bank (720 MW), Kariba North Bank Extension (360 MW), and Victoria Falls (108 MW). Figure 2-3 shows the trend in electricity generation from ZESCO's large hydro power plants for the years 2010 to 2016.

Figure 2-3: Trend in electricity generation, large hydropower plants owned by ZESCO, 2010 - 2016



	Kariba North	Kafue Gorge	Kariba North Bank Extension	Victoria falls	Total
2010	2,777	6,841	-	724	10,342
2011	3,451	7,183	-	747	11,381
2012	3,668	7,376	-	810	11,854
2013	4,507	7,463	-	810	12,780
2014	4,999	6,666	1,162	811	13,638
2015	4,316	6,417	1,179	785	12,697
2016	2,964	5,853	672	754	10,244

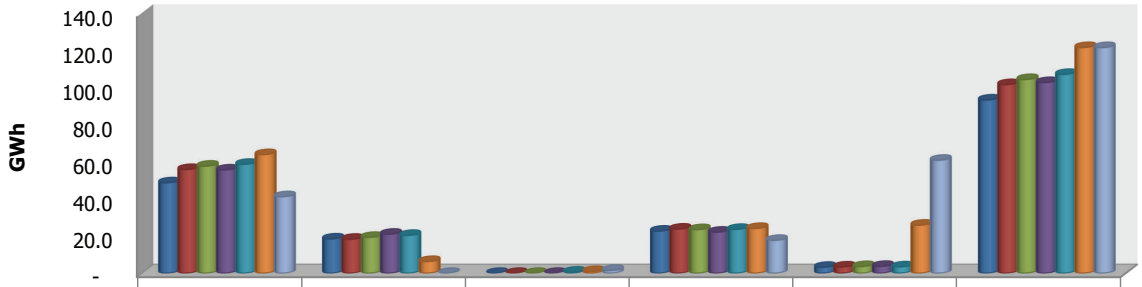
Electricity generated from ZESCO's large hydro power plants declined significantly by 19.3 percent, to 10,244 GWh in 2016, from 12,697 GWh recorded in 2015. The decline in generation was on account of the continued poor rainfall experienced during the 2014/2015 and 2015/2016 rainy seasons which consequently resulted in low water levels in dams.

As depicted in Figure 2-3, during the year under review, Kariba North Bank Extension and Kariba North Bank power plants recorded the highest decline in generation at 43 percent and 31.3 percent, respectively. Kafue Gorge and Victoria Falls power plants also recorded reduction in generation of 8.8 percent and 3.9 percent, respectively.

2.4 Electricity generation from small and mini hydropower plants owned by ZESCO

In 2016, total electricity generation from small and mini hydropower plants owned by ZESCO remained static. Figure 2-4 shows electricity generation sent out from small and mini hydropower plants owned by ZESCO for the period 2010 to 2016.

Figure 2-4: Electricity generation from small and mini hydropower plants owned by ZESCO, 2010 - 2016



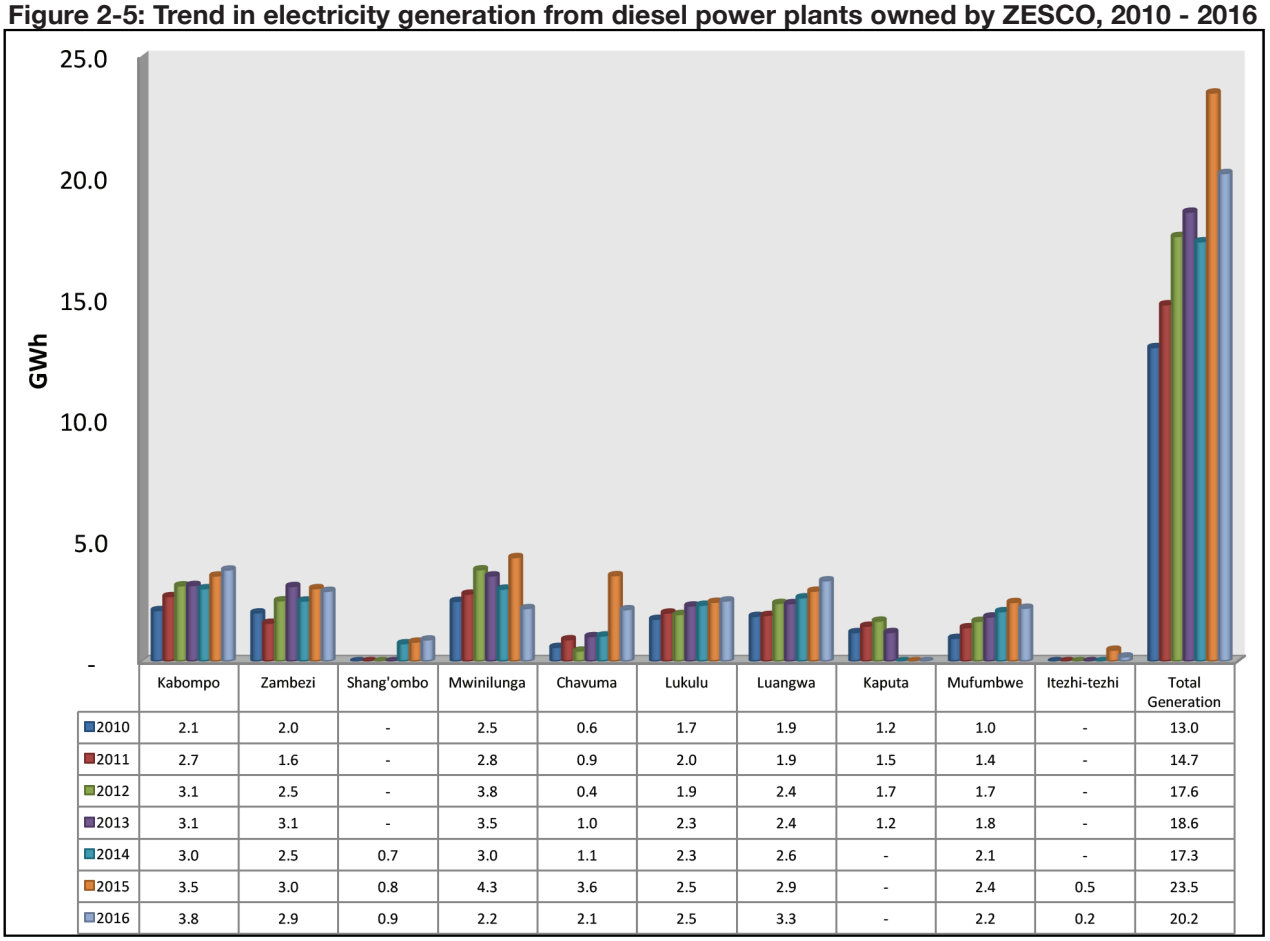
	Lusiwasi	Musonda falls	Shiwang'andu	Chishimba falls	Lunzua	Total Generation
2010	48.8	18.5	-	22.8	3.3	93.3
2011	55.9	18.4	-	23.8	3.5	101.6
2012	57.7	19.4	-	23.5	3.7	104.3
2013	55.7	21.1	-	22.2	3.8	102.7
2014	58.7	20.5	0.7	23.7	3.5	107.1
2015	63.9	6.4	1.0	24.2	26.0	121.5
2016	41.3	-	1.6	17.8	60.9	121.5

Despite there being no change in electricity generation from small and mini hydropower plants in 2016, Lunzua and Shiwang'andu recorded significant increases of 134.5 percent and 51.4 percent, respectively; this was mainly attributed to ramping up generation as in prior years these plants operated well below capacity. However, Lusiwasi and Chishimba recorded a reduction in generation of 35.4 percent and 26.5 percent, respectively, on account of the continued poor rainfall experienced during the 2014/2015 and 2015/2016 rainy seasons.

2.5 Electricity generation from diesel power plants owned by ZESCO

During the year 2016, total electricity generation from ZESCO's diesel power plants decreased by 14 percent, to 20.2 GWh in 2016 from 23.5 GWh recorded a year earlier. The decrease in generation was mainly attributed to the decommissioning of Mwinilunga diesel power plant in September 2016 following the connection of Mwinilunga District to the national electricity grid. Figure 2-5 shows the trend in electricity generation from the diesel power plants owned by ZESCO.

Figure 2-5: Trend in electricity generation from diesel power plants owned by ZESCO, 2010 - 2016



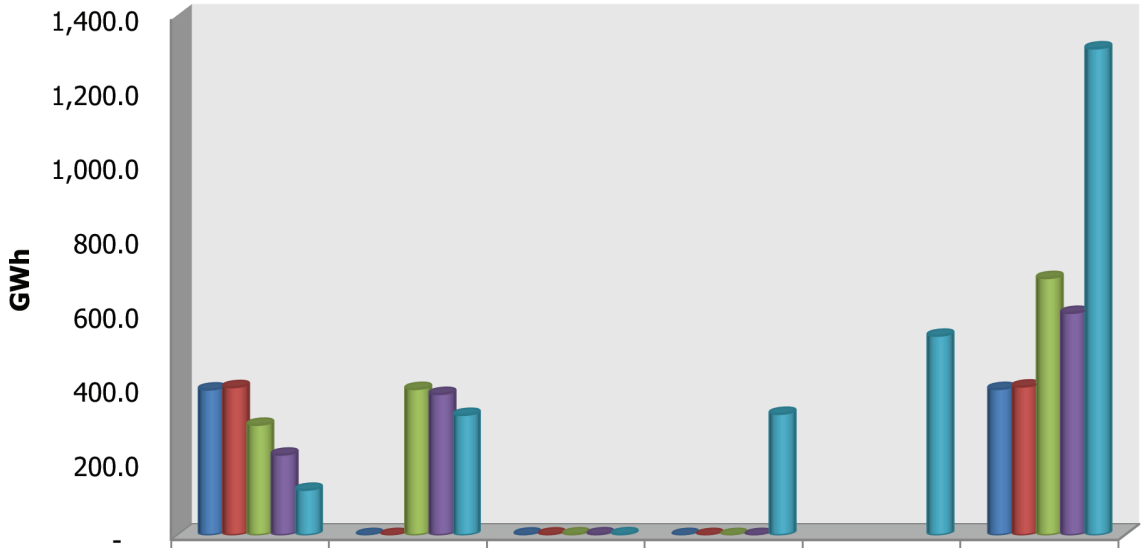
	Kabompo	Zambezi	Shang'ombo	Mwinilunga	Chavuma	Lukulu	Luangwa	Kaputa	Mufumbwe	Itezhi-tezhi	Total Generation
2010	2.1	2.0	-	2.5	0.6	1.7	1.9	1.2	1.0	-	13.0
2011	2.7	1.6	-	2.8	0.9	2.0	1.9	1.5	1.4	-	14.7
2012	3.1	2.5	-	3.8	0.4	1.9	2.4	1.7	1.7	-	17.6
2013	3.1	3.1	-	3.5	1.0	2.3	2.4	1.2	1.8	-	18.6
2014	3.0	2.5	0.7	3.0	1.1	2.3	2.6	-	2.1	-	17.3
2015	3.5	3.0	0.8	4.3	3.6	2.5	2.9	-	2.4	0.5	23.5
2016	3.8	2.9	0.9	2.2	2.1	2.5	3.3	-	2.2	0.2	20.2

As reflected in Figure 2-5, Itezhi-Tezhi, Mwinilunga, Chavuma, Mufumbwe and Zambezi recorded a reduction in electricity generation of 60 percent, 48.8 percent, 41.7 percent, 8.3 percent and 3.3 percent, respectively. However, Luangwa, Shang'ombo and Kabompo recorded increases in electricity generation of 13.8 percent, 12.5 percent and 8.6 percent, respectively.

2.6 Electricity generation from Independent Power Producers

In 2016, the ESI had five (5) IPPs namely: Lunsemfwa Hydropower Company (LHPC), Ndola Energy Company Limited (NECL), Zengamina Power Limited (ZPL), Maamba Collieries Limited (MCL) and Itezhi-Tezhi Power Corporation (ITPC). Appendix 2 shows the Zambian electrical power system including the role IPPs play in the system. Figure 2-6 shows the trend in electricity generation sent out by the IPPs for the period 2012 to 2016.

Figure 2-6: Trend in electricity generation sent out by IPPs, 2012 - 2016



	Lusemfwa Hydro Power Company	Ndola Energy Company Limited	Zengamina Power Limited	Maamba Collieries Limited	Itezhi-Tezhi Corporation Limited	Total
2012	392.0	-	1.4	-		393.4
2013	398.4	0.03	1.5	-		400.0
2014	297.0	393.4	1.8	-		692.1
2015	216.5	380.0	1.9	-		598.4
2016	121.9	323.6	2.1	326.4	536.7	1,310.7

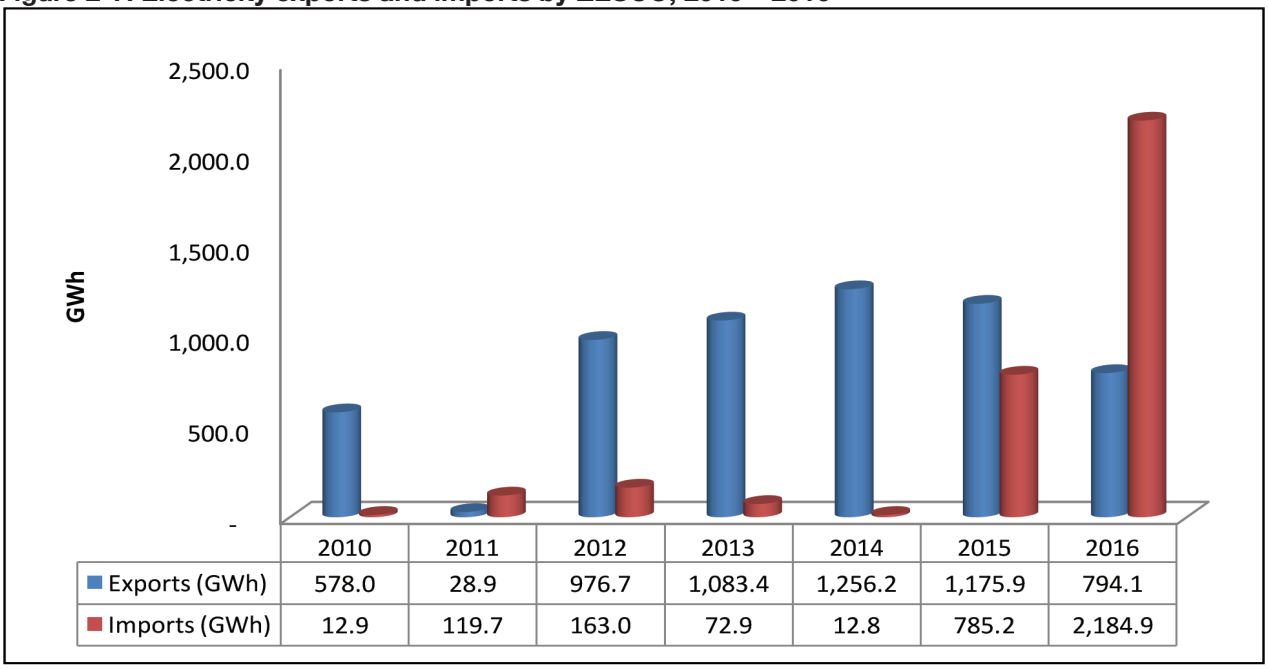
Electricity generation sent out from the power plants by the IPPs increased significantly by 119.0 percent to 1,310.7 GWh in 2016, from 598.4 GWh recorded in 2015. The increase in electricity generation from IPP's was on account of commissioning of two (2) power plants, namely: Maamba coal and Itezhi-Tezhi hydro.

However, LHPC recorded significant reduction in generation of 43.7 percent, to 121.9 GWh in 2016, from 216.5 GWh recorded in 2015 on account of low water levels. NECL also recorded a reduction in generation of 14.8 percent in 2016 on account of the use of fuel that did not meet the required specifications resulting in a shutdown. ZPL recorded an increase of 10.5 percent due to increased demand.

2.7 Electricity exports and imports by ZESCO

In 2016, ZESCO exported and imported electricity through the Southern African Power Pool (SAPP) and bilateral markets. Figure 2-7 shows electricity exports and imports by ZESCO for the period 2010 to 2016.

Figure 2-7: Electricity exports and imports by ZESCO, 2010 – 2016



	2010	2011	2012	2013	2014	2015	2016
Exports (GWh)	578.0	28.9	976.7	1,083.4	1,256.2	1,175.9	794.1
Imports (GWh)	12.9	119.7	163.0	72.9	12.8	785.2	2,184.9

Figure 2-7 shows that ZESCO recorded a significant decrease in electricity exports of 32.5% percent, to 794.1 GWh in 2016 from 1,175.9 GWh in 2015. The decrease in exports was on account of a reduction in the utility's hydro power generation capacity. However, electricity imports increased exponentially by 178.3 percent to 2,184.9 GWh in 2016 from 785.2 GWh recorded in 2015. The reduction in the utility's generation capacity led to the increase in imports in 2016.

2.8 National electricity consumption by economic sector

In 2016, national electricity consumption reduced by 5.2 percent, to 10,857.5 GWh in 2016 from 11,449.9 GWh in 2015. National electricity consumption by economic sector is shown in Table 2-1.

Table 2-1: National electricity consumption by economic sector, 2015 - 2016

Sectors	2015	2016	2015	2016
	GWh		Share (%)	
Mining	6,245.6	5,918.0	54.5	54.5
Domestic	3,482.0	3,382.9	30.4	31.2
Finance & Property	516.9	498.6	4.5	4.6
Manufacturing	530.8	469.8	4.6	4.3
Agriculture	260.4	227.8	2.3	2.1
Others	98.5	80.1	0.9	0.7
Trade	109.8	97.4	1.0	0.9
Energy & Water	89.1	87.7	0.8	0.8
Quarries	68.2	59.58	0.6	0.5
Transport	33.4	28.4	0.3	0.3
Construction	15.2	7.1	0.1	0.1
Total	**11,449.9**	**10,857.5**	**100**	**100**

In 2016, the mining sector accounted for the highest energy consumed at 5,918 GWh, a reduction from 6,245.6 GWh recorded in 2015. This was followed by the domestic sector at 3,382.9 GWh, down from 3,482.0 GWh recorded in 2015. In 2016, the rest of the sectors each recorded energy consumption below 5 percent.

2.9 Operational and technical performance of utilities

In line with its mandate, the ERB carries out operational and technical compliance audits of its licencees in the electricity sub-sector. The operational audits assess the utility's efficiency while technical audits aim to establish the extent to which licensees were complying with their licence conditions, codes, standards and regulations.

2.9.1 ZESCO Limited

Operational Performance

In monitoring the performance of ZESCO, the ERB used the Key Performance Indicators (KPI) Framework. The framework comprised eight (8) thematic areas which include the following:

a. Metering customers;
b. Cash management;
c. Staff productivity;
d. Quality of service supply,
e. System losses;
f. Power generation;
g. Safety; and
h. Customer complaints.

The objective of the framework was to evaluate ZESCO's performance with regard to customer service, financial and technical operations. The framework was based on the use of self-enforcing incentives that were embedded in the tariff determination process. The performance of ZESCO on the KPIs has an impact on tariff awarded. Appendix 3 shows the average tariffs awarded to ZESCO by the ERB while Appendix 4 shows electricity tariffs awarded to ZESCO for each customer category. On the other hand, Appendix 5 shows how ZESCO tariffs compare in the Southern African Development Community (SADC) region.

As a regulatory requirement, on a quarterly basis, ZESCO submitted data and a self-assessed report to the ERB, detailing its performance against set performance targets as per KPI framework. Appendix 6 summarizes ZESCO's performance in 2016.

In 2016, ZESCO attained an annual KPI score of 65.39 percent; an improvement by 19.39 percentage points from 46 percent recorded in 2015. In particular, good performance was recorded on system losses, power generation and customer complaints. Nevertheless, poor performance was recorded on quality of service, cash management and safety.

Technical Performance

In 2016, the ERB undertook a technical audit of ZESCO covering 291 facilities of the utility's infrastructure in all the ten (10) provinces. The scope of the audit included: large hydropower plants, transmission and distribution substations, mini hydropower stations and diesel fueled power stations.

ZESCO's overall compliance rating score was 80.1 percent in 2016 compared to 76 percent in 2015, indicating an increase of 4.1 percentage points. ZESCO achieved the ERB compliance target of 80 percent.

\ The improvement in the compliance levels was attributed in part to the investments by ZESCO in upgrading its distribution infrastructure under the Distribution Expansion and Rehabilitation Project (DERP). However, non-compliances were observed with some of the utility's infrastructure ranging from inadequate maintenance regime and safety concerns.

2.9.2 Copperbelt Energy Corporation Plc

Operational performance

Copperbelt Energy Corporation Plc (CEC) is an independent power company that purchases power from ZESCO under a long term Bulk Supply Agreement (BSA) and supplies to mining customers based on the Copperbelt. Additionally, CEC distributes electricity to residential customers of CEC village housing complex in Kitwe. Table 2-2 highlights the performance of CEC for the period 2013 to 2016.

Table 2-2: CEC's performance

Business element	2013	2014	2015	2016
Electricity sales to the mines	4,281 GWh	4,208 GWh	4,092 GWh	3,521 GWh
Transmission losses	2.8%	2.9%	2.9%	3.6%
Standby generation capacity	60 MW	80 MW	80 MW	80 MW
Electricity Generation	0	0	7.17 GWh	8.16 GWh

Electricity sales to CEC mining customers reduced by 14 percent, that is, from 4,092 GWh recorded in 2015 to 3,521 GWh in 2016. Meanwhile, transmission losses increased to 3.6 percent in 2016, from 2.9 percent recorded in 2015. Further, 8.16 GWh of electricity was generated by CEC from its diesel power stations up from 7.17 GWh in 2015.

Technical performance

During the period under review, a technical audit of CEC infrastructure on the Copperbelt Province covered 24 facilities, comprising transmission substations was undertaken. The average compliance level was 96 percent, an increase from 92.9 percent in 2015. The identified non-compliances related to safety, environment and maintenance of the equipment.

Challenges

In 2016, CEC faced a number of challenges as the utility recorded isolated incidents of vandalism and theft on its electrical infrastructure. Further, CEC's power supply from ZESCO was reduced on account of insufficient rainfall during the 2014/2015 and 2015/2016 rainy seasons.

2.9.3 Ndola Energy Company Limited

Operational performance

Ndola Energy Company Limited (NECL) is an IPP that generates and supplies power to ZESCO under a long term Power Purchase Agreement (PPA). The company operates a HFO power plant with an installed capacity of 50 MW that was commissioned in November 2013. NECL's power plant comprises six (6) generators each rated at 10.30 MVA with a primary voltage of 11 kV. Additionally, in 2016, the company made progress in expanding the current plant with an additional capacity of 55 MW under phase II. NECL spent US$40.92 million towards the construction of the new plant. NECL also intends to also construct two (2) HFO storage tanks each with storage capacity of 6000 m^3 and associated auxiliary equipment will also be installed at the storage facilities. The additional capacity is expected to be commissioned in 2017.

In 2016, electricity sales to ZESCO by NECL reduced significantly by 14.8 percent to 323.58 GWh, from 379.95 GWh recorded in 2015.

Technical performance

During the period under review, a technical audit was conducted at NECL's 50 MW HFO power generation facility in Ndola. The overall compliance level of the inspected facilities was at 100 percent, an improvement by 4.2 percent from 95.80 percent in 2015. In accordance with the technical audit criteria, no non-compliances were observed.

Challenge

The major challenge faced by NECL during the year under review was the use of fuel that did not meet the required specifications resulting in a shutdown.

2.9.4 Kariba North Bank Extension Power Corporation Limited

Kariba North Bank Extension Power Corporation Limited (KNBEPC) is an IPP wholly owned by ZESCO. The KNBEPC owns and operates Kariba North Bank Extension Hydro Power Plant which was commissioned in May 2014 with a rated plant capacity of 360 MW. The plant is operated as a peaking plant with an average operating time of 3.5 hours a day.

ZESCO is the off-taker of power generated from the plant under a long term PPA. In 2016, electricity generation by the plant reduced significantly by 43 percent, to 672.3 GWh from 1,179 GWh recorded in 2015. The significant reduction in electricity generation was on account of the poor rainfall experienced during the last two (2) years.

2.9.5 Lunsemfwa Hydropower Company Limited

Operational performance

LHPC is an IPP that generates and distributes power to ZESCO under a PPA. LHPC owns and operates Mulungushi and Lunsemfwa hydropower plants which have a combined installed capacity of 56 MW. In 2016, LHPC electricity sales to ZESCO reduced significantly by 43.7 percent to 121.95 GWh from 216.5 GWh recorded in 2015. The significant reduction in sales was on account of poor rainfall experienced during the past two (2) years.

Technical performance

In 2016, the ERB undertook a technical audit of the two (2) power stations and two (2) substations situated in Kabwe, Central Province. The average compliance level in 2016 was 93.6 percent compared to 75.6 percent attained in 2015. This represented an increase of 18 percentage points in the compliance level. The non-compliances observed were inadequate maintenance of equipment; and safety concerns.

2.9.6 Zengamina Power Limited

ZPL is an IPP that owns and operates an off-grid mini-hydro plant with an installed generation capacity of 0.75 MW based in Ikelenge District, North-Western Province. ZPL is owned by the North-West Zambia Development Trust.

ZPL generates and supplies power to Kalene Mission Hospital in Ikelenge District and the surrounding areas. In 2016, ZPL generated 2,121.18 MWh, an increase of 10.4 percent from 1,921.62 MWh generated in 2015. In 2016, ZPL's customer base increased by 5.1 percent, to 536, from 510 in 2015. The utility's customer base comprised community service, residential, small businesses and the commercial sector.

Challenges

In 2016, ZPL faced some challenges which included the following: non-cost reflective electricity tariffs, reduced water levels at its dam and increased the cost of business due to its remote location.

2.9.7 North-Western Energy Corporation Limited

Operational performance

North-Western Energy Corporation Limited (NWEC) is a private company that distributes electricity to non-mining customers of Lumwana, Kabitaka and Kulumbila areas in North-Western Province. NWEC purchases power from ZESCO as a Maximum Demand (MD) customer and supplies to its customers.

NWEC has a 15-year distribution and supply licence, issued in 2008 to distribute up to 20 MW in North-Western Province. The utility uses this capacity to meet the demand of its customers. NWEC created Special Purpose Vehicles called Kalumbila Services; and Kabitaka Energy for the purpose of distributing power to its customers. The ZESCO supply arrangements at Lumwana Mine are governed by the PPA between ZESCO and NWEC, backed by a connection agreement between the site managements companies, that is, Kalumbila Property Development Company and Kabitaka Hills Development Company, and NWEC.

NWEC's customer base was 2,378 in 2016, an increase by 51.4 percent, from 1,571 customers in 2015. The significant increase in its customer base was on account of new connections to NWEC's supply network.

Technical performance

In 2016, a technical audit of NWEC's substations in North-Western Province was conducted and covered Lumwana 2 x 10MVA, 33/11 kV; and Kalumbila 1 x 3.5 MVA, 33/11 kV substations. The overall compliance level of the substations in 2016 was 86.50 percent, a decrease by 3.5 percentage points from the score of 90 percent in 2015. The major non-compliances included safety concerns, inadequate maintenance and absence of electrical protection for some equipment.

Challenges

In 2016, the main challenge faced by NWEC was the sub-economic tariff charged by ZESCO which consequently led to NWEC to replicate the same. This was because customers resisted the intention by NWEC to charge economic tariffs which they compared to the ZESCO rate.

2.9.8 Maamba Collieries Limited

MCL is a new IPP that owns and operates a thermal power plant with an installed capacity of 300 MW in Maamba, Sinazongwe District in Southern Province. The utility commissioned its 300 MW coal fired power plant in August 2016. Since commissioning of the plant, MCL has generated and sold electricity to ZESCO under a long term PPA. By the end of 2016, the plant had generated 326.4 GWh of electricity.

Challenges

In 2016, MCL faced a challenge of diminishing water levels in the Kariba dam, especially in the dry season which disrupted operations. The delayed upgrade of the ZESCO transmission infrastructure also limited the capacity of MCL to generate power at full potential.

2.9.9 Itezhi – Tezhi Power Corporation Limited

ITPC is a new IPP that owns and operates the Itezhi-Tezhi hydropower plant with an installed generation capacity of 120 MW. The company is a joint venture between Tata Africa Holdings (SA) Pty Limited and ZESCO that generates and supplies electricity to ZESCO under a long term PPA. ITPC commissioned its power plant in February 2016 and by the end of the year, it had generated 536.7 GWh.

Challenges

ITPC experienced challenges of low water levels and the deplorable state of the road connecting Itezhi-Tezhi district to Mongu road junction, which increased the cost of doing business.

2.10 Operational performance of the electricity network

In 2016, the Zambian power system experienced a total of five (5) power system disturbances which affected most parts of the country. Four (4) power system disturbances were experienced on the ZESCO network while one (1) was experienced on the CEC network. These are depicted in Table 2-3.

Table 2-3: Power system network disturbances, 2016

No.	Date	Description
	ZESCO network	
1.	14th January	Tripping of some generating units at the two (2) major power stations (Kafue Gorge and Kariba North Bank) and loss of power supply to some parts of Lusaka, Copperbelt, North Western, Northern, Eastern, Muchinga, Central and Luapula provinces.
2.	27th September	Loss of power supply to the Copperbelt, Muchinga, Northern, Eastern, North-Western, Western, Luapula, parts of Lusaka, Southern and Central provinces.
3.	19th November	Loss of power to Luapula, Northern, Muchinga and Eastern provinces and parts of Central Province.
4.	12th December	Loss of power to Copperbelt, Luapula, Northern, North-Western, Muchinga and Eastern Provinces and parts of Central Province.
	CEC network	
5.	10th May	Loss of supply to parts of Lusaka, Copperbelt CEC Loads, North-Western (including Kansanshi, Lumwana and Kalumbila), Northern, Eastern, Muchinga and Luapula provinces.

The faults on the two (2) networks were caused among other factors by failure of the main busbar isolator, earthing faults due to rainfall and lightening, poor tower footing resistances, non-availability of line protection function on the bus couplers, mechanical failures of the voltage measurement transformers and circuit breaker trippings.

2.11 Power quality management system

In order to ensure power quality and reliability in the ESI (as defined in the Zambia Standard ZS 387: Electricity Supply – Power Quality and Reliability standard), in July 2014, the ERB developed the Power Quality Management System (PQMS). The ERB subsequently issued Power Quality Directives (PQDs) to the licensees for the implementation of PQMS. To adhere to these directives, licencees were required to install power quality recorders and submit quarterly reports to the ERB. Following the directives, the implementation of the PQMS commenced in 2015.

A total of 340 recorders were to be installed at 340 sites that were identified for the purpose of adequately characterizing power quality performance. Notably, the increase from 337 to 340 sites in 2015 was as a result of three (3) additional recorder requirements by two (2) licensees arising from network expansion. As at end of 2016, only 52 recorders were installed on the required sites. During the period under review, all the 52 sites were monitored and reports submitted to the ERB by the licensees. In terms of performance, the average power quality for the 52 sites was 61 percent, which fell short of the target of 75 percent compliance rate planned for 2016. Going forward, the ERB will engage the various licensees to discuss the challenges being faced and agree on mitigation measures for the improvement of power quality performance.

2.12 Low power factor surcharge

In December 2014, the ERB approved ZESCO's proposal for the introduction of a Low Power Factor surcharge for industrial, mining, commercial, agricultural and all customers on individual PPAs. Low power factor surcharge is a demand side management measure aimed at reducing reactive power and mitigating the power deficit. Under this framework, large power consumers operating an average monthly power factor below 0.92 would be required to pay a surcharge over and above their normal bill. The objective of the framework is to induce a change in consumption patterns of larger consumers so that they become more efficient.

The surcharge was initially supposed to become effective on 1st January 2016. However, following concerns from various stakeholders and the subsequent consultations between the ERB and ZESCO, the effective date was deferred to 1st January 2017. In 2016, the ERB in conjunction with ZESCO and CEC conducted sensitization meetings with large end-use customers on the new framework.

2.13 National power deficit

Following the poor rainfall pattern in the 2014/ 2015 rainy season, ZESCO had projected a reduction in generation output. By the end of 2016, the actual reduction in generation output was 500 MW, while the deficit was 526 MW from a high of 1,000 MW in 2015. During the year, ZESCO could not source sufficient imports to meet the deficit. Consequently, the utility needed to balance supply and demand by implementing power rationing measures through its loadshedding programme.

2.14 Mitigation of the power deficit

In 2016, GRZ, working with ZESCO implemented a number of measures in order to mitigate the inadequate power supply. The short term measures were as follows:

a. Importation of power from the Southern African region;

b. Promoting energy efficiency and awareness programme on the use of alternative forms of energy i.e. solar and Liquefied Petroleum Gas (LPG);

c. Implementation of the low power factor surcharge to encourage customers to use available power more efficiently; and

d. Implementing Demand Side Management initiatives such as the phasing out of incandescent lighting.

The GRZ also initiated the implementation of long term measures as follows:

a. Fast tracking the development/upgrade of small hydro power stations;

b. Fast tracking the development of grid-connected solar PV generation; and

c. Development of the Renewable Energy Feed-in-Tariff (REFiT) framework to attract more investment in the renewable energy sub-sector.

2.15 Statutory Instrument Number 79 – The Electricity (Grid Code) Regulations of 2013

In 2016, the Grid Code Technical Committee (GCTC), established under SI No. 79 of 2013 held four (4) meetings. The meetings considered and approved 29 applications for exemptions from specific provisions of the SI for various time frames.

Further, all the Grid Code participants who had been granted exemptions were requested to commence submission of progress reports indicating the status made in the implementation of the exemptions which were granted. Participants as defined by the Grid Code are those connected to or use the transmission system that include a generator, an end-use customer, a distributor, a supplier, a transmission Network Service Provider, an embedded generator, the System Operator and Regional Operator. In accordance with the provisions of the Grid Code, such participants may apply to be exempted (relieved) from specific provisions of the Grid Code for a stipulated timeframe. This is to allow for interim arrangements before a participant can be compliant with the provisions of the Grid Code.

2.16 Development of technical key performance indicators for non-state owned enterprises

In 2016, ERB developed technical KPI framework for non-state owned enterprises (non-SOE's electricity enterprises. The objective of this framework is to assess the technical operational performance of non-SOE licensees in the ESI. The implementation of the KPI framework is expected to commence in the 1st quarter of 2017. The first set of non-SOE's are: CEC Plc, NECL, MCL and LHPC.

2.17 Development of Standards in the electricity sub-sector

In 2016, significant progress was made in the development of technical standards. The ERB, working in close collaboration with the Zambia Bureau of Standards (ZABS) and in consultation with various industry stakeholders initiated as well as developed a number of technical standards. The two (2) institutions through the Solar Photovoltaic (PV) and the Energy Efficiency Technical Committees conducted extensive reviews of international standards as well as local stakeholder consultations. Through the Technical Committees, the following achievements were scored:

2.17.1 Solar energy products

Through the PV Committee, the following standards were revised and subsequently published as Zambian Standards (ZS):

a. ZS 403: Batteries for Use in Photovoltaic Systems – Specification;

b. ZS 404: Charge Controllers for Photovoltaic Systems Using Lead-Acid Batteries – Specification;

c. ZS 405: Photovoltaic Systems Design and Installation – Code of Practice; and

d. ZS 407: Lighting Devices for Use in Photovoltaic Systems – Specification

Additionally, 68 technical standards published by the International Electrotechnical Commission (IEC) were adopted and approved for use as Zambian Standards through publication in the Government Gazette. These standards cover PV modules and inverters.

2.17.2 Draft standards

The ERB initiated work to develop technical standards on Solar Water Heaters (SWHs). In particular, the development of the following Draft Zambian Standards (DZS) commenced:

a. Domestic Solar Water Heaters, Part 1: Thermal performance using an outdoor test method

b. Domestic Solar Water Heaters, Part 2: Thermal performance using an indoor test method; and

c. The Installation, Maintenance, Repair and Replacement of Domestic Solar Water Heating Systems

Further, the ERB commenced work on drafting Zambian standards on grid connections of energy systems specifications and requirements for grid connected inverters:

a. Grid connections of energy systems via inverters Part 1: Installation requirements; and

b. Grid connections of energy systems via inverters Part 2: Inverter requirements

2.17.3 Energy efficiency

The ERB working with other stakeholders finalised the development of the technical standards targeted at promoting energy efficiency and management. The standards developed covered the following: Electrical Motors, Energy Audits, Energy Management Systems (EMS) and Efficient Lighting Devices.

The finalised standards on Efficient Lighting Devices prescribe the requirements for lighting systems to be manufactured, imported and/or used in Zambia. These technical standards supplement SI No. 74 of 2016, The Control of Goods (Local Manufacturing and Importation of Incandescent and Energy Inefficient Lighting Devices) (Prohibition) Regulations, 2016.

The issuance of SI No. 74 prohibited the manufacturing and importation of incandescent bulbs and other energy inefficient lighting devices effective 1st January 2017. Further, the SI prohibits the sale of such goods in Zambia starting 30th June 2017. With effect from 31st December 2017, it will be illegal to use the products in Zambia for either domestic or industrial applications unless duly exempted.

2.17.4 Electricity distribution infrastructure

In 2016, the ERB in conjunction with ZABS and various stakeholders in the ESI developed the Electricity Distribution Infrastructure Standard DZS 907 which was submitted for approval. The standard is in two (2) parts as follows:

a. DZS 907 Part 1 – covering the planning, design, construction, installation and commissioning of alternating current (a.c.) distribution networks up to and including 33,000 volts a.c.

b. DZS 907 Part 2 - providing recommendations and minimum maintenance and operations requirements for ac distribution networks up to and including 33,000 volts a.c.

2.17.5 Standard on quality of service

In order to enhance consumer protection in the energy sector the ERB reviewed ZS 397: Electricity Supply – Quality of Consumer Service – Specifications. The review sought to harmonise the ERB Complaints Handling Procedure and ensure ease of enforcement of the procedure. Further, the review sought to make it mandatory for licensees to report complaints that they handled . The revised standard was submitted to ZABS for approval. However, by the end of 2016, the standard had not yet been approved.

2.18 Development of a regulatory framework for renewable energy

In 2016, the ERB completed developing a regulatory framework for renewable energy. The Renewable Energy Regulatory Framework (RERF) was developed in line with the National Energy Policy (2008), relevant legislation, the Biofuels Regulatory Framework, the Regulatory Framework for Off-Grid Systems and the REFiT Strategy. These documents individually strive to facilitate the implementation and diversification of the energy sector in order to promote renewable energy technologies and improve access to modern forms of energy. The RERF puts all these requirements in one document. Renewable energy based electricity generation from stand alone and off-grid systems are covered by the RERF with the aim to achieve the following:

a. Facilitate the implementation of Government policy to diversify the energy mix and provide modern forms of energy to rural communities;

b. Consolidate and rationalise existing regulatory frameworks;

c. Promote investment by having a clear regulatory framework that outlines the entry requirements into the sector; and

d. Provide clear internal guidelines to facilitate their deployment.

2.18.1 Revised licensing thresholds for solar energy systems

In 2016, the ERB revised the licensing criteria for a licence to manufacture, wholesale importation and installation of solar energy systems. The objective of the revision was to regulate the quality of solar energy products imported into the country.

Effective 1st January 2017, all importers of solar energy products would be required to have a licence or documentation from the ERB authorising them to import the energy systems. ZRA and/or ZABS would allow the goods entry into the country where the importer has a license or documentation issued by the ERB. Further, all companies and individuals involved in the installation of solar energy systems for third parties would be required to be licensed by the ERB.

2.18.2 Environmental impact assessment

In 2016, the ERB reviewed the Environmental Impact Assessments (EIA) for three (3) renewable energy projects as follows:

a. The proposed 60 kW Solar Micro Grid by Muhanya Solar Limited in Sinda District, Eastern Province;

b. The proposed 10 MW to 150 MW solar power plant by Zuwa Solar Limited in Ndola District, Copperbelt Province; and

c. The proposed production of bioethanol by Thomro Investment Limited in Chibombo District, Central Province

By the end of 2016, the ERB had also commenced a review of the EIA for the proposed 50 MW solar PV power plant by Bangweulu Power Company Limited under the Scaling Solar programme.

2.19 Investments in the electricity sub-sector

This section discusses the various power generation and transmission line projects being implemented in the electricity sub-sector.

2.19.1 Power generation projects

In 2016, various power generation projects were being implemented as shown in the Table 2-4. Both ZESCO and private investors are currently developing various generation projects that will add 4,476 MW of new generation capacity when completed, that is, in the medium to long term. These projects are being undertaken to strengthen security of supply as well as meet the growing demand for electricity.

Table 2-4: Status of power generation project

Generation projects	Capacity (MW)	Planned project duration	Cost (US$' million	Project status	% Of work done
Musonda Falls	10	2 years	42	Implementation phase in progress.	65%
Lusiwasi Upper	15	1.5 years	46	Project about to move to Implementation stage.	0%
Lusiwasi Lower	86	2 years	164	Project about to move to Implementation stage.	0%
Chishimba Falls	15	TBA	42	Procurement of main consultant underway	0%
Kafue Gorge Lower Hydro Scheme	750	4 years	2,000	Implementation phase in progress.	5%
Luapula River Hydro scheme	1,200	TBA	TBA	Project feasibility studies about to commence	0%
Batoka Gorge Hydropower	2,400	TBA	4,000	Project at feasibility study stage	0%
Total	**4,476**		**6,294**		

2.19.2 Transmission line projects

In 2016, ZESCO was undertaking the following transmission projects as depicted in Table 2-5.

Table 2-5: Transmission projects

Transmission Projects	Planned project duration	Estimated Cost (US$' million)	% of work done
ZIZABONA 330 kV interconnector	TBA	59	0%
Connection of Luangwa to the national grid	TBA	63	51%
Kafue town- Muzuma-Livingstone 220 kV transmission line upgrade project	2 Years	100	50%
Chipata-Lundazi-Chama 132kv Transmission Line Project	1 Year	69	0%
Electrification of Vubwi and reinforcement of supply to Eastern Province	TBA	TBA	0%
Lusaka South MFEZ Transmission Project	2 Years	33	60%

Transmission Projects	Planned project duration	Estimated Cost (US$' million)	% of work done
Kasama – Nakonde Transmission Project	2 Years	253	1%
Connection of North-Western Province to the Grid	3 Years	184	75%
Pensulo-Mansa Transmission Project	2 Years	224	0%
Improvement of power supply to Mpika District	3 Years	30	3%
System Wide Reactive Power Compensation	1 Year	6	0%
Mungwi Electrification Project	TBA	70	0%
Kariba Lake Shore/Bottom Road Electrification Project	TBA	65	0%
Evacuation of Power from Ndola Energy Phase II	1 Year	3	0%
Kabwe-Pensulo 330 kV transmission line number 2	3 Years	120	0%
Msoro and Kabwe step down reactors	1 Year	10	0%
Zambia-Tanzania-Kenya (ZTK) Power Project	TBA	1,200	0%
Total		2,489	

2.20 Power purchase agreements

During the year under review, the following PPAs were approved by the ERB:

a. ZESCO Limited and Lunsemfwa Hydropower Company for a period of one (1) year;

b. ZESCO Limited and Kalumbila Minerals Limited for a period of 20 years;

c. ZESCO Limited and Eskom Holdings Limited (South Africa) for a period of one (1) year for purchase of power of between 50 MW to 300 MW;

d. ZESCO Limited and Ndola Energy Company Limited for a period of 15 years for the supply of an additional 55 MW;

e. ZESCO Limited and Bangweulu Power Company Limited for a period of 25 years for the purchase of 47.5 MW (AC); and

f. ZESCO Limited and Ngonye Power Company Limited for a period of 25 years for purchase of 28.2 MW (AC).

2.21 Licensing in the electricity sub-sector

During the year under review, the ERB issued a total of 17 standard licences in the electricity and renewable energy sub-sector compared to 13 in 2015 as shown in Table 2-6.

Table 2-6: Standard licences issued, 2015 and 2016

No.	Type of licence	2015	2016
1.	Generation	2	2
2.	Generation of Electricity for own use	0	1
3.	Transmission	0	1
4.	System Operator Licence – Operation for the Zambia Interconnected Power System	0	1
5.	Supply	1	1
6.	Manufacture, Wholesale Importation and Installation of Solar Energy Systems [3]	10	11
Total		**13**	**17**

[3]Initially this Licence was referred to as the Manufacture, Supply, Installation and Maintenance of Solar Energy Systems Licence but the name was changed during the period under review, due to the fact that there was now a threshold set for solar systems.

Further, 14 provisional licences were issued to applicants who had met all the licensing requirements (see Appendix 7) and their applications were ready for gazetting. The validity of a Provisional Licence is six (6) months from the date of issuance. Of the 14 provisional licences issued, the following were the categories; three (3) electricity generation licences, one (1) Licence for Electricity Generation for own use (embedded), eight (8) Manufacture, Wholesale Importation and Installation of Solar Energy Systems, one (1) licence for Operation of the Zambia Interconnected Power System and one (1) Transmission of Electricity licence.

2.22 Electricity tariff reviews

In 2016, the ERB received and considered a tariff application from CEC for its CEC Village residential customers in Kitwe. The ERB approved the tariff application based on the existing ZESCO tariffs for residential customers effective 30th September, 2016. The approved tariffs are shown in Table 2-7.

Table 2-7: Approved CEC village residential tariffs, 2016

Metered Residential Tariff	Capacity	Current Tariffs (K)	Approved tariffs (K)	Percentage increase (%)
R1 up to 100 kWh	Energy Charge / kWh	0.08	0.15	88
R2 above 101 to 300 kWh	Energy Charge / kWh	0.13	0.31	138
R3 above 301 kWh	Energy Charge / kWh	0.21	0.51	143
	Fixed Monthly Charge	7.41	18.23	146

2.23 Multi-Year Tariff Framework and electricity legislative reviews

In 2016, the ERB developed the draft Multi-Year Tariff Framework (MYTF) comprising the Multi-Year Tariff Determination Methodology and the associated draft Rules and Regulations. MYTF would be implemented after the proposed legislative changes to the Energy Regulation Act and Electricity Act. The proposed changes would facilitate for multi-year tariffs and automatic cost-pass-through.

2.24 Other developments in electricity sub-sector

This section discusses other developments that took place in the electricity sub-sector in 2016.

2.24.1 Rural electrification

1n 2016, the Rural Electrification Authority (REA) continued to implement rural electrification projects nationwide. REA successfully completed ten (10) rural electrification projects. Out of the ten (10), seven (7) were grid extension while three (3) were solar projects. Table 2-8 shows the projects completed by REA in 2016.

Table 2-8: Rural electrification projects completed, 2016

Grid extension projects			
No.	**Name of Project**	**District**	**Province**
1.	Mushindamo II	Solwezi	North-Western
2.	Mwinuna I	Mpongwe	Copperbelt
3.	Mulungushi Agro I	Kabwe	Central
4.	Mwinuna II	Mpongwe	Copperbelt
5.	Mushindamo III Special	Solwezi	North-Western
6.	Kankolonkolo	Kasempa	North-Western
7.	Kakwiya	Petauke	Eastern
Solar home systems installations			
8.	Lundazi	Lundazi	Eastern
9.	Chama	Chama	Muchinga
10.	Mwinilunga	Mwinilunga	North-Western

Further by the end of 2016, 13 grid extensions, two (2) solar mini-grid and one (1) mini-hydropower project were still in progress.

2.24.2 Industrial Development Corporation Scaling Solar Programme

Scaling Solar initiative is a World Bank Group programme designed to make it easier for GRZ to procure solar power through a streamlined procurement process and at low cost through competitive tendering and pre-set financing, insurance products, and risk mitigation measures.

In 2016, the Industrial Development Corporation (IDC) submitted two (2) PPAs to the ERB for regulatory approval for the generation and sale of solar power for: 47.5 MW (AC) by Bangweulu Power Company Limited (BPCL) and 28.2 MW (AC) by Ngonye Power Company Limited (NPCL) to ZESCO. The projects are being implemented through the two (2) Special Purpose Vehicles: BPCL and NPCL. This was in the wake of the earlier enlisting of the Government by the World Bank to the Scaling Solar programme.

BPCL and NPCL are expected to develop two (2) solar photovoltaic power plants at the Lusaka South Multi-Facility Economic Zone (LSMFEZ). The solar power plants are expected to cost US$ 57.329 million and US$ 43.194 million for BPCL and NPCL, respectively.

During the year, the IDC conducted a competitive tender for the two (2) special purpose vehicles. Neoen S.A.S of France was awarded the right to enter into a Shareholders Agreement as the investor shareholder in BPCL. Additionally, Enel Green Power S.p.A of Italy was also awarded the right to enter into a Shareholders Agreement as the investor shareholder in NPCL.

In accordance with the tender requirements, both BPCL and NPCL entered into a 25 year PPA with ZESCO. Meanwhile, the tariffs applicable for the PPAs were determined through the tendering process. The winning tariffs were US cents 6.015 per kWh for BPCL and US cents 7.8389 per kWh for NPCL.

2.24.3 GETFiT

The Global Energy Transfer Feed-In Tariff (GETFiT) programme is designed to leverage private sector investment into renewable energy generation projects. In 2016, the ERB worked closely with GRZ and Kreditanstalt für Wiederaufbau (KfW) to jointly develop the GETFiT Zambia programme. GETFiT programme in Zambia intends to fast-track a portfolio of up to a maximum of 20 MW each, small-scale renewable energy (RE) generation projects, promoted by private developers.

The implementation of the GETFiT programme is on the basis of the support mechanisms and regulatory framework developed by the ERB comprising the following standard documents and other support elements:

a. GETFiT premium (Grant Top-Up);
b. Standardized Legal Documentation;
c. Support for permitting and Licensing;
d. Risk mitigation; and
e. Support for Grid Integration.

Preparations for the GETFiT Zambia Programme advanced well in 2016 and the German Government committed full funding for Phase I of the Programme in December 2016. It is envisaged that the programme will be launched in early 2017 with a Solar PV Auction for a total capacity of 50 MW. The full implementation of the GETFiT programme will done as soon as the renewable energy strategy is launched and is also contingent on the finalization of the following support mechanisms:

a. Development of the Procurement guidelines;
b. Development of the Standard Implementation Agreement; and
c. Agreeing the quantum of GETFiT Top- up (subsidy) on the REFiTs.

2.24.4 Distribution grid code

In 2016, the ERB approved the Zambia Distribution Code. The code is intended to complement the electricity (Grid Code) Regulations, Statutory Instrument Number 79 of 2013, in facilitating non-discriminatory access to the electricity distribution network in Zambia. The objective of the distribution code is to improve the efficiency in the operation of the electricity network and to encourage more investment in the electricity sub-sector.

The Distribution Code is aimed at addressing the eminent challenges envisaged to arise from future developments in the ESI, which has rapidly expanded following integration of the private sector investment in embedded generation and distribution facilities.

The envisaged future developments in the ESI include among other things:

a. The development of embedded generators connecting directly into the distribution network;
b. Integration of renewable energy based generation into the distribution network; and
c. Net metering to allow domestic customers with renewable energy based generation to supply part of their generation into the distribution network.

2.25 Regional developments

This section discusses the regional developments that took place in the electricity sub-sector in 2016. Specifically, the section discusses developments in SAPP.

2.25.1 SAPP installed capacity

During the year under review, the SAPP had an installed capacity of 61,894 MW, out of which 46,959 MW was available. This was partially as a result of poor rainfall experienced in the region. Meanwhile, the peak demand including reserves in 2016 was recorded at 52,542 MW. This resulted in a deficit of 5,582 MW. Table 2-9 shows the details in terms of the installed capacity, operating capacity, peak demand for various utilities among other things.

Table 2-9: SAPP demand and supply balance with current peak demand, 2016

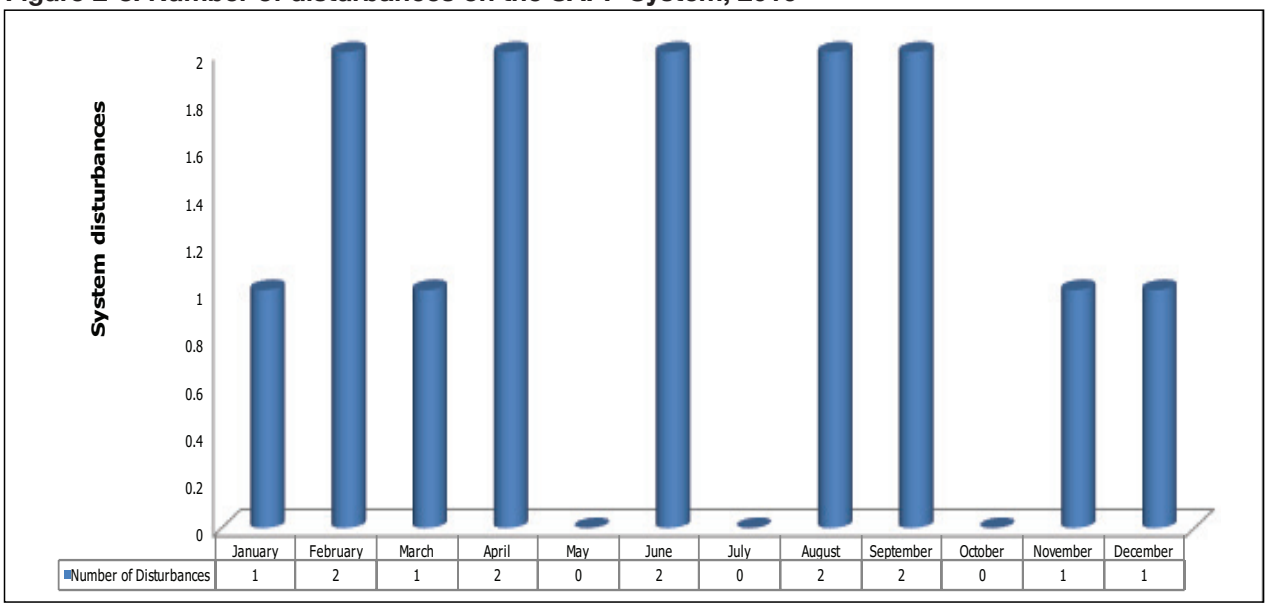
No. Country	Utility	Installed capacity (MW)	Operating Capacity (MW)	Current Peak Demand (MW)	Peak Demand Plus Reserves	Capacity excess/ shortfall including Reserves
Angola	ENE	2,210	1,772	1,599	1,829	**(57)**
Botswana	BPC	927	459	610	698	**(239)**
DRC	SNEL	2,442	1,066	1,317	1,507	**(441)**
Lesotho	LEC	74	70	150	172	**(102)**
Malawi	ESCOM	352	351	326	373	**(22)**
Mozambique	EDM/HCB/ MOTRACO	2,724	2,279	1,780	2,036	**243**
Namibia	Nampower	501	354	629	720	**(366)**
South Africa	Eskom	46,963	36,000	34,481	36,481	**(481)**
Swaziland	SEC	70	55	227	260	**(205)**
Tanzania	TANESCO	1,380	823	935	1,070	**(247)**
Zambia	ZESCO/CEC/ LHPC	2,206	2,175	2,287	2,616	**(441)**
Zimbabwe	ZESA	2,045	1,555	1,589	1,818	**(263)**
TOTAL ALL		**61,894**	**46,959**	**45,930**	**52,542**	**(5,583)**
TOTAL Operating Members Only		**57,952**	**44,013**	**43,070**	**49,270**	**(5,257)**

Source: SAPP 2016

2.25.2 SAPP system disturbances

Unlike the previous year, the SAPP interconnected power system experienced system disturbances during 2016 and performed much better. While the highest number of disturbances in 2015 was seven (7), the year 2016 recorded two (2) system disturbances in each month: February, April, June, August and September. Meanwhile, the months of January, March, May and December recorded one (1) incident. The months of October, July and May recorded no disturbances. Figure 2-8 shows the disturbances that occurred in 2016.

Figure 2-8: Number of disturbances on the SAPP System, 2016



Source: SAPP Monthly Report, 2016

The major system disturbances were characterised by power system frequency excursions resulting in frequency drops, customer load tripping and transmission lines trippings.

2.25.3 SAPP power trading

Among other things, power trading in the SADC region under the SAPP is guided by the SAPP's medium to long term vision of facilitating the development of a competitive electricity market in Southern Africa. Further, the vision is intended to ensure sustainable energy developments through sound economic, environmental and social practices.

In terms of Day Ahead Market (DAM) power trading, the pattern was mixed. In the first half of the year trading was mainly subdued and averaged 43,996 MWh. However, in the second half, trading activities improved and averaged 109,852 MWh.

The average Market Clearing Prices (MCP) averaged US cent 8.26 per kWh between January and December 2016 (See Figure 2-9). The prices generally picked between June and September, averaging US Cents 9.54 per kWh. The last quarter of the year experienced the lowest MCPs averaging US cents 6.12 per kWh.

Figure 2-9: SAPP market clearing prices, 2016

Source: SAPP Monthly Report 2016 (clearing prices are rouned off to 2 decimal places)

2.26 Outlook for the sub-sector

The outlook for the electricity sub-sector is positive for the year 2017 on a number of fronts including the development of additional generation capacity, review of legislation, CoSS, performance review of the electricity industry in Zambia, and REFiT strategy.

2.26.1 Increase in electricity generation capacity

ZESCO and the private investors are currently developing various generation projects that will create additional capacity to existing generation. In the short term, about 131 MW is expected to be commissioned in 2017. The 131 MW expected to be added in the short term will come from NECL (HFO), BPCL (solar) and NPCL (solar).

2.26.2 Review of legislation

The ERB has proposed changes to its governing pieces of legislation that are aimed at enhancing its legislative mandate as well as improve industry efficiency. The reviews include the Energy Regulation Act and the Electricity Act which are envisaged to be enacted in 2017.

2.26.3 Cost of Service Study and tariff migration path

The CoSS that will determine the long-term least cost generation, transmission, distribution and supply programmes to meet the forecasted electricity demand in Zambia over the medium to long-term as well as economic cost-based tariffs will be undertaken by the ERB in 2017. This study will set the stage for the phased migration of tariffs to cost reflective levels.

2.26.4 Multi-year Tariff Framework

Following the development of the MYTF methodology by the ERB in 2016, its implementation is expected in 2017. The MYTF will provide stability and predictability of the tariff determination framework by way of presetting tariffs for a longer period and allowing for the automatic cost pass through when there is a change in the agreed factors.

2.26.5 Performance review of the electricity industry in Zambia

In 2017, GRZ is expected to commission a study to review the performance of the electricity industry. The study is expected to make recommendations on reforms that should be undertaken to enhance competition and improve efficiency of the ESI.

2.26.6 REFIT Strategy

It is expected that the draft REFIT Strategy developed by the Ministry of Energy will be launched by GRZ in 2017. The strategy aims at facilitating and promoting private sector investments in renewable energy power generation.

Furthermore, GET-FiT is expected to be launched in 2017 and will be the operational vehicle for the implementation of the REFiT Programme in Zambia.

3.0 PETROLEUM SUB-SECTOR

This section discusses the supply of national fuel requirements, operations of state owned fuel enterprises, national consumption of fuel, including the market share of OMCs, pricing of petroleum products, challenges and outlook for the petroleum sub-sector.

Petroleum products bulk storage tanks

3.1 Importation of fuel

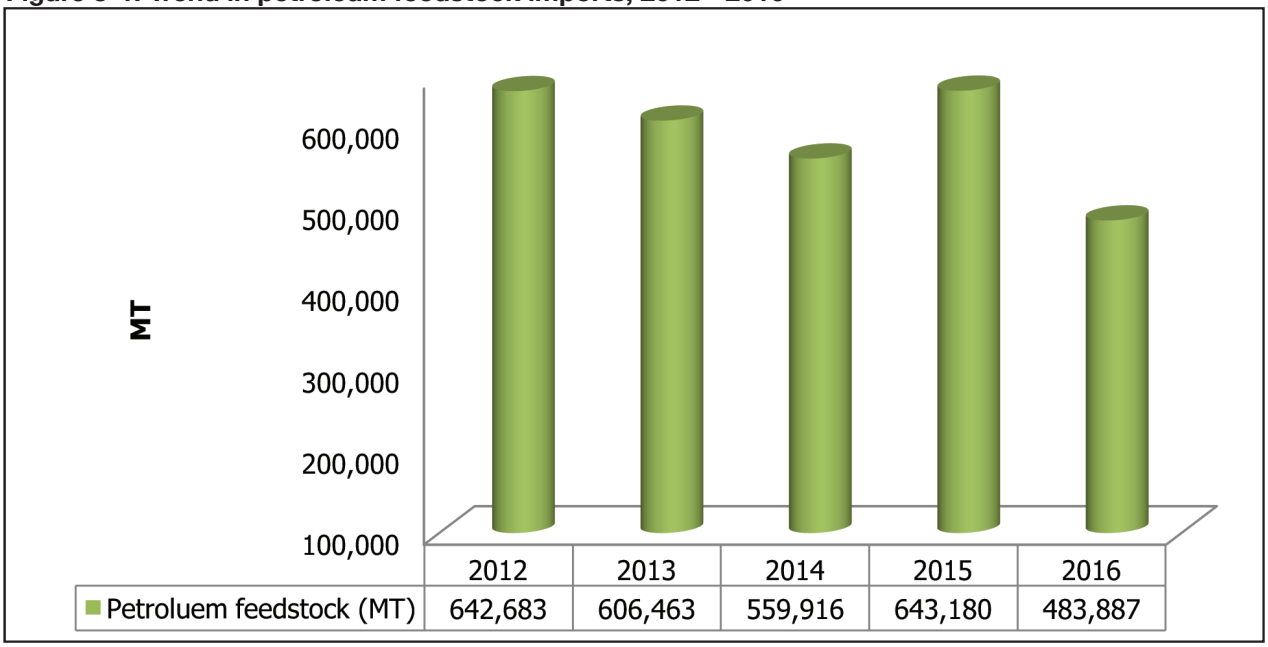
National fuel requirements are met through two (2) sources namely: importation of commingled petroleum feedstock and finished petroleum products which are imported by the Government and OMCs. Commingled feedstock is transported by TAZAMA Pipelines Limited (TAZAMA) via a 1,710 km pipeline from the port of Dar-es-Salaam in Tanzania to Ndola, Zambia where INDENI Petroleum Refinery Limited (INDENI) is located. Finished petroleum products are imported by road from Tanzania, Mozambique or South Africa and distributed to various GRZ owned fuel depots. Typically, commingled feedstock accounts for 50 percent of national consumption while finished petroleum products accounted for the balance. However, in 2016, only 37.7 percent of the national consumption was met by products produced by INDENI.

3.1.1 Importation of petroleum feedstock

Figure 3-1 shows the trend in the importation of petroleum feedstock from 2012 to 2016. The Government imports a commingled petroleum feedstock typically consisting[4] of: crude oil (41%); condensate/naphtha[5] (13%); and gasoil (diesel) (46%). The petroleum feedstock is refined at INDENI. The country imports commingled petroleum feedstock with components in the stated proportions in order for the output of finished products (petrol, diesel, kerosene, LPG, HFO and Jet A-1) to meet specific national requirements. Further, the importation of commingled petroleum feedstock is preferred because INDENI is not designed to process pure crude oil.

[4] On average, composition of a cargo varies from consignment to consignment but the degree of variations is usually between 2 to 3 percentage points for crude oil, gasoil and naphtha and, 0.1 to 1.0 percentage points for condensate.
[5] Naphtha is a general term that is used to refer to a mixture of various volatile flammable liquid hydrocarbons used as a solvent.

Figure 3-1: Trend in petroleum feedstock imports, 2012 - 2016



Source: TAZAMA

As depicted in Figure 3-1 the quantity of petroleum feedstock imports decreased by 24.8 percent to 483,887 MT in 2016 from 643,180 MT in 2015. Notably, the importation levels for 2016 were below the five (5) year average of 608,986 MT. The drop was on account of rejection of one (1) contaminated cargo of petroleum feedstock in March which consequently led to GRZ issuing SI No. 21 of 2016 that allowed OMCs to import finished petroleum products which did not warrant further importation of petroleum feedstock. Details of the imports of the petroleum feedstock by cargo in 2015 and 2016 are provided in Appendix 8.

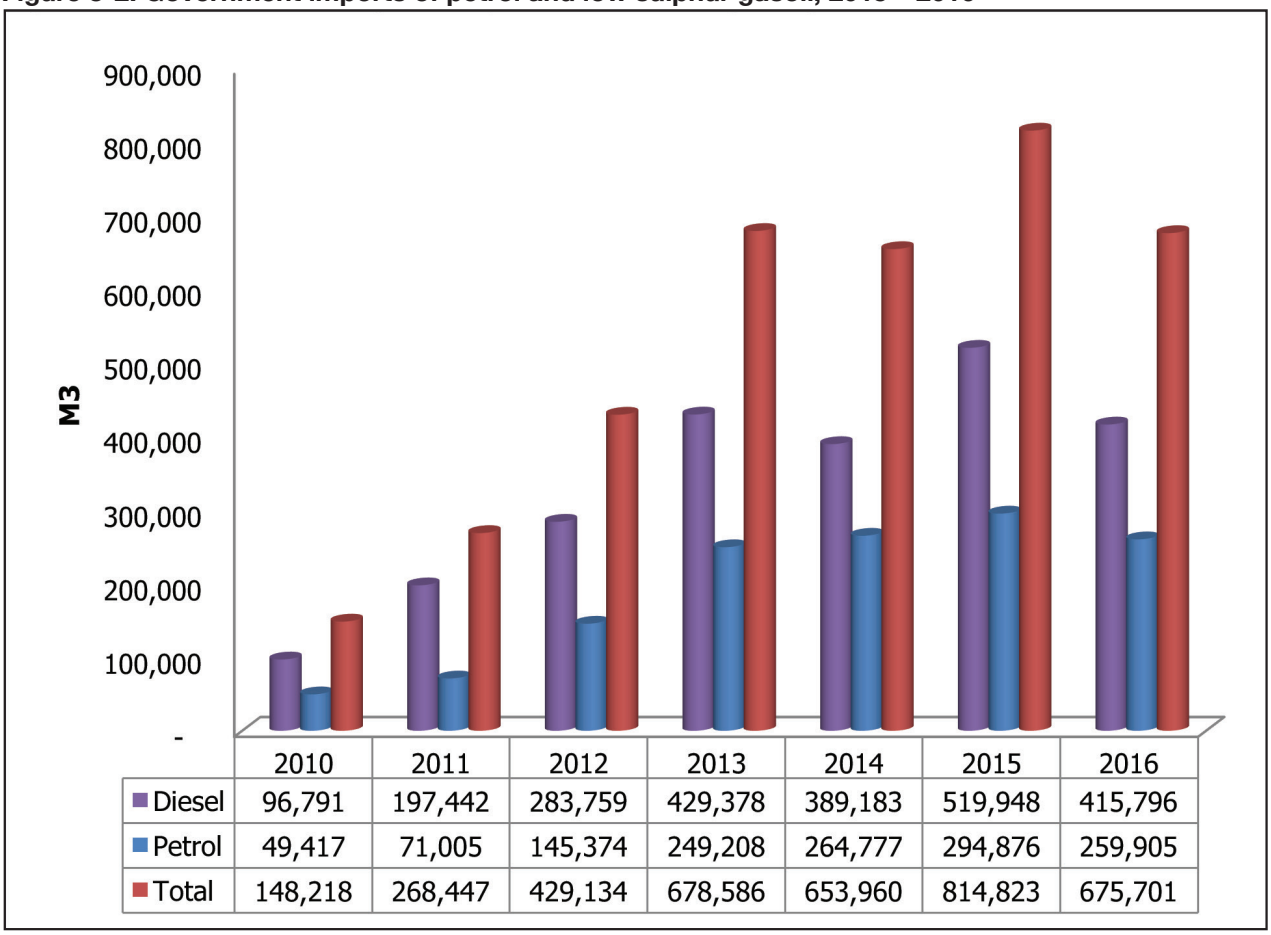
3.1.2 Importation of finished petroleum products

In 2016, a total of 334,716 m^3 of petrol and a total of 702,538 m^3 of low sulphur gasoil (low sulphur diesel) were imported by the Government and OMCs. Of this quantity, 259,905 m^3 of petrol was imported by the Government while 74,810 m^3 of petrol was imported by OMCs. Additionally, of the total quantity of low sulphur gasoil imported, the Government imported 415,796 m^3 while OMCs imported 286,742 m^3.

3.1.2.1 Imports by the Government

In 2016, the Government imported only petrol and low sulphur gasoil. In general, Government imports of the two (2) products reduced by 17.1 percent in 2016 compared to 2015 as depicted in Figure 3-2.

Figure 3-2: Government imports of petrol and low sulphur gasoil, 2015 – 2016



	2010	2011	2012	2013	2014	2015	2016
Diesel	96,791	197,442	283,759	429,378	389,183	519,948	415,796
Petrol	49,417	71,005	145,374	249,208	264,777	294,876	259,905
Total	148,218	268,447	429,134	678,586	653,960	814,823	675,701

3.1.2.2 Imports by Oil Marketing Companies

In 2016, 287 million litres (286,742 m^3) of low sulphur gasoil and 75 million litres (74,811 m^3) of petrol were imported by OMCs. Further, OMCs imported 21 million litres (21,467 m^3) of Jet A-1 and 830 MT of LPG. Table 3-1 shows the monthly imported quantities of petroleum products during the year 2016.

Table 3-1: Monthly imports of petroleum products, 2016

Month	Low sulphur gasoil	Jet A-1	Petrol	LPG
	(M^3)			(MT)
January	9,828	2,014		
February	12,740	1,524	4,641	
March	27,425	1,544	7,065	77
April	24,733	1,155	7,356	179
May	31,833	2,676	11,139	99
June	24,734	1,865	9,000	76
July	29,031	3,117	6,025	77
August	17,955	815	8,966	104
September	20,043	1,197	4,303	147
October	32,449	1,065	964	71

Month	Low sulphur gasoil	Jet A-1	Petrol	LPG
	(M³)			(MT)
November	30,570	1,658	9,383	
December	25,401	2,838	5,969	
Grand Total	**286,742**	**21,468**	**74,811**	**830**

3.1.3 Statutory Instrument Number 21 of 2016

During the period January to March 2016, the country experienced an interruption in fuel supply when GRZ rejected a contaminated cargo of petroleum feedstock. As a result, GRZ issued Statutory Instrument (S.I) No. 21 of 2016, to guarantee security of supply by prescribing import volumes for the OMCs on diesel and petrol. The S.I. was only in effect for the period 2nd March to 31st August 2016, or whenever the import volumes specified in the S.I. were exhausted. The S.I. waived import duty on a total of 200,000 m^3 of diesel and 110,000 m^3 of petrol for the OMCs contained in the schedule to the S.I.

At the expiry of S.I. No. 21, the ERB analysed its performance which revealed that out of 27 OMCs that were allowed to import petrol and diesel, only 12 imported petrol, while 14 imported diesel. Additionally, out of the allocated quantities in the S.I., as at 31st August 2016, a total of 76,464 m^3 of petrol and 132,601 m^3 of diesel were imported by the OMCs. The volumes imported represented 69.5 percent for petrol and 66.3 percent for diesel of the total quantities.

3.2 Operations at TAZAMA Pipelines Limited

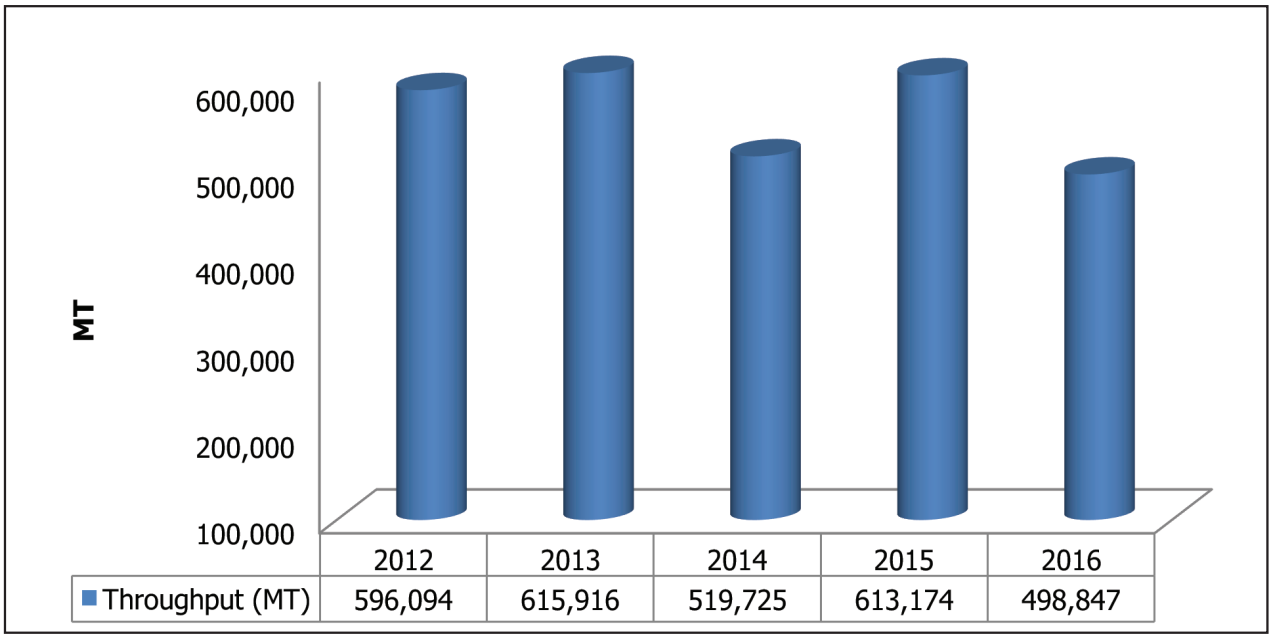
This sub-section discusses operations at TAZAMA in 2016. TAZAMA pipeline has throughput capacity of 1,100,000 MT per annum. Petroleum feedstock is imported mainly from the Middle East.

Source: TAZAMA Pipelines (TAZAMA pipeline endpoint at Ndola)

3.2.1 TAZAMA throughput

In the last five (5) years, the pipeline has operated below its design throughput capacity, averaging 568,751 MT per annum. The reduction in the throughput against the design capacity is as a result of degradation of the pipeline. Specifically, in 2016, the throughput dropped by 18.7 percent to 498,847 MT from 613,174 MT in 2015. As stated earlier, the drop was on account of rejection of a contaminated cargo of petroleum feedstock. Notably, this was the lowest throughput in the last five (5) years. Figure 3-3 shows the throughput processed during the period 2012 and 2016.

Figure 3-3: Throughput for feedstock for TAZAMA Pipeline, 2012 – 2016



Source: TAZAMA Pipelines Limited

3.2.2 Rehabilitation works at TAZAMA

In order to keep the pipeline operational, TAZAMA routinely undertakes rehabilitation works that include pipeline condition monitoring and repair of corroded sections; replacement of pumping units; and rehabilitation of the petroleum feedstock tanks. The major rehabilitation works undertaken during 2016 are shown in Table 3-2.

Table 3-2: TAZAMA pipeline rehabilitation works, 2016

No.	Rehabilitation Works	Status/Comment
1.	Pipeline condition monitoring and repairs	Verifications and repairs of pipeline anomalies identified in the 2013 intelligent pigging[6] and repairs of corroded areas along the pipeline continued in 2016. This involved the replacement of pipeline sections and points with a metal thickness loss of over 50 percent on the Tanzania side of the pipeline. This exercise was completed in 2016 at a cost of ZMW2.3 Million.
2.	Replacement of Pumping Units (Chinsali Pumping Station)	Commenced the supply and delivery of main pumping units for replacement at Chinsali pumping station. By end of 2016, all equipment were purchased and shipped. Installation works were expected to commence in the 1st quarter of 2017. The total cost of the project is US$5.5 Million.
3.	Rehabilitation of Tank No. 4 at the Dar-es-Salaam Tank Farm	Repair works on Tank No. 4 were completed in 2016 at a total cost of US$ 3.5 Million.

[6] Intelligent pigging in the context of pipelines refers to the use of electronic devices known as pigs to collect data on the internal state and thickness of the pipeline.

3.3 Operations at INDENI Petroleum Refinery Limited

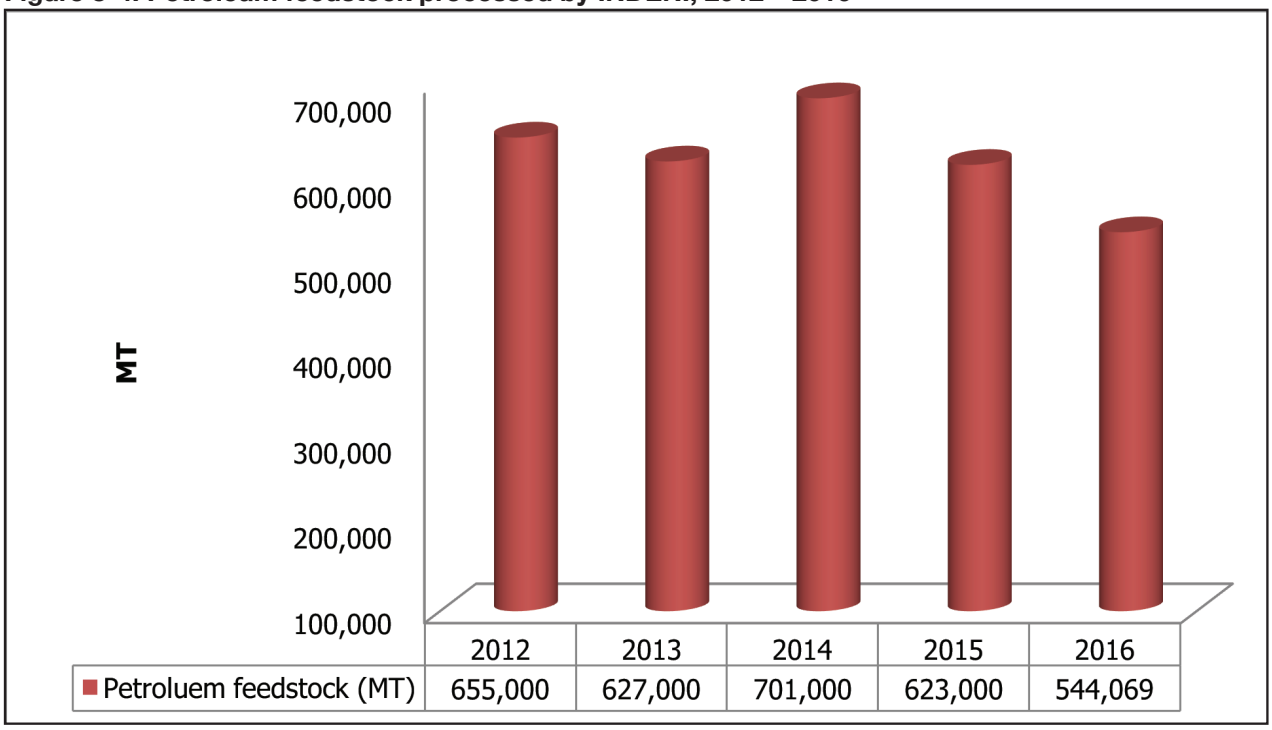
INDENI processes petroleum feedstock into finished petroleum products. The refinery was commissioned in 1973 and had a name plate (design) throughput of 1,100,000 million metric tonnes per annum.

Refinery Chimney

3.3.1 Throughput of INDENI refinery

In the last five (5) years, that is, from 2012 to 2016, the throughput for INDENI has averaged 630,014 MT. During this period, the highest throughput was recorded in 2015 while the lowest was in 2016. Specifically, during 2016, the throughput was 544,069 MT compared to 623,000 MT in 2015. This represented a decrease of 12.7 percent. In 2016, the refinery was operational for 245 days, having shut down for 121 days, against 290 days of operation and 75 days of shutdown in 2015. Figure 3-4 shows petroleum feedstock processed by INDENI, for the period 2012 to 2016.

Figure 3-4: Petroleum feedstock processed by INDENI, 2012 – 2016



Source: INDENI. Note that figures in the graph are rounded off to the nearest hundred

During the shutdown period in 2016, the Government imported finished petroleum products in order to guarantee security of supply. Further, the refinery was shut-down for planned annual general maintenance from 19th October to 5th December, 2016 or 47 days while the period for the unplanned shutdowns totalled 74 days. The main reasons for the unplanned shutdowns include late deliveries of petroleum feedstock, failures by the compressor and other maintenance works at the refinery.

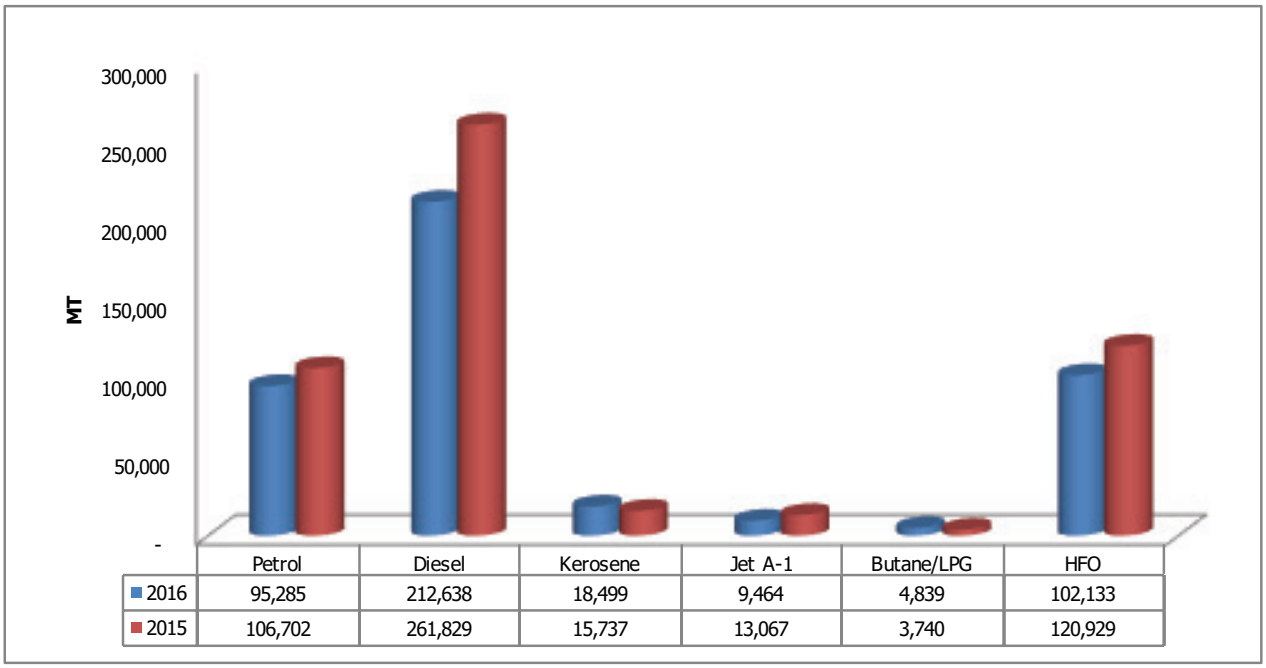
In 2016, the bitumen plant had been on phased commissioning, which was aimed at ensuring that all static and rotating equipment were operating in an optimal state. In 2016, the plant had undergone six (6) test runs and was able to produce a small quantity of 150/200 penetration point bitumen grade. The local market requires a lower penetration point grade of 80/100 and the plant was being re-aligned to produce the 80/100 point grade. Test runs were in campaigns for 2017 with the availability of high Asphaltene content feedstock.

3.3.2 Production of petroleum products by INDENI refinery

Based on the throughput processed by INDENI, of the total national petroleum requirements in 2016, INDENI supplied 27 percent for both petrol and diesel, and 35 percent for Jet A-1. The rest of the demand for petroleum products was met through imports of petroleum products.

In 2016, the petroleum product that INDENI produced the most was diesel at 212,637.94 MT, followed by HFO at 102,132.87 MT. The least produced was Butane/LPG at 4,838.89 MT. Figure 35 shows the INDENI production of petroleum products in 2016 and 2015.

Figure 3-5: Production of petroleum products by INDENI, 2015 – 2016



	Petrol	Diesel	Kerosene	Jet A-1	Butane/LPG	HFO
2016	95,285	212,638	18,499	9,464	4,839	102,133
2015	106,702	261,829	15,737	13,067	3,740	120,929

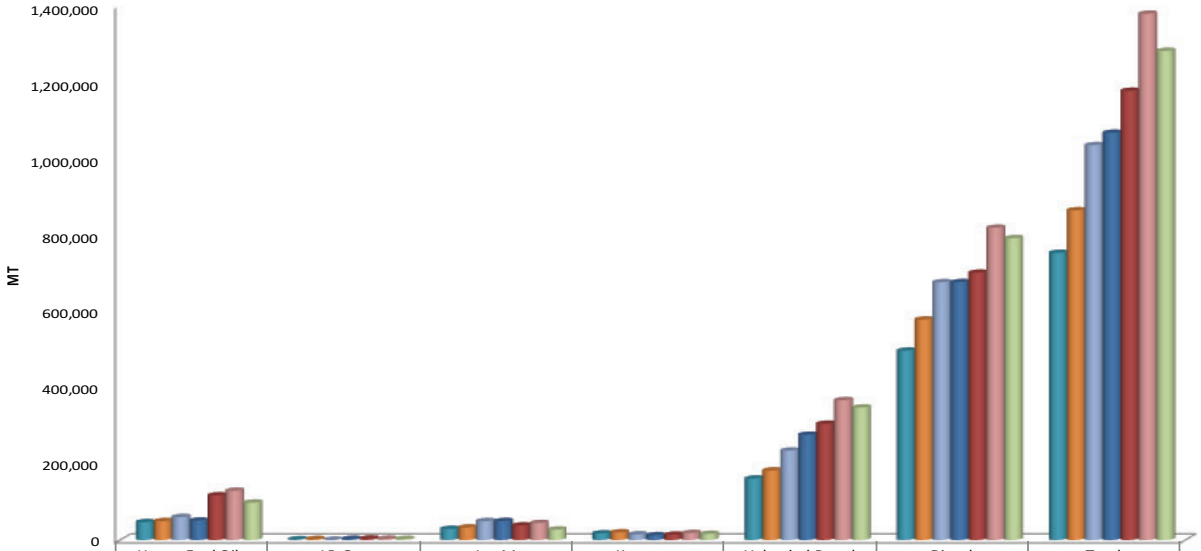
In 2016, production for petrol, diesel, Jet A-1 and HFO generally declined compared to 2015. Specifically, production declined by 10.7 percent, 18.8 percent, 27.6 percent and 15.5 percent for petrol, diesel, Jet-A1 and HFO, respectively. However, there was an increase in production for Butane/LPG and Kerosene by 29.4 percent and 17.6 percent, respectively.

3.4 National consumption of petroleum products

In 2016, there was a decline in the consumption for all petroleum products compared to 2015. In particular, the total national consumption of petroleum products in 2016 declined by 7.1 percent to 1,282,449 MT from 1,379,781 MT.

Figure 3-6 shows the trend in national consumption of petroleum products for the period 2010 to 2016. During the period 2010 to 2015, the consumption of all petroleum products generally increased except for LPG and Kerosene, whose consumption varied during this period.

Figure 3-6: Trend in national fuel consumption by type, 2010 – 2016



	Heavy Fuel Oils	LP Gas	Jet-A1	Kerosene	Unleaded Petrol	Diesel	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

In 2016, diesel was the most consumed product at 791,277 MT (941,997 m^3)[7] followed by petrol at 347,266 MT (463,021 m^3)[8], while the least consumed was LPG at 2,742 MT. However, the consumption of diesel reduced by 3.3 percent, from 818,418 MT (974,307 m^3) in 2015 to 791,277 MT (941,997 m^3) in 2016. Similarly, the consumption for petrol decreased by 5.3 percent, from 366,524 MT (488,699 m^3) in 2015 to 347,266 MT (463,021 m^3) in 2016.

The national consumption for HFO decreased by 24.2 percent, from 129,149 MT in 2015 to 96, 881 MT in 2016. HFO is supplied 100 percent by INDENI. Additionally, in 2016, INDENI experienced intermittent shutdowns due to ullage constraints in petrol and diesel storage. Consequently, this resulted in reduced supply of HFO thereby affecting the consumption of the product. Similarly, the consumption for Jet A-1 decreased by 38.3 percent, from 44,160 MT (55,546.65 m^3) in 2015 to 27,237 MT (34,260 m^3) in 2016. The consumption for Jet A-1 in Zambia is mainly driven by the demand by international airlines, which prefer to refuel in countries or cities where the price for Jet A-1 is cheaper.

In 2016, the national consumption for LPG declined by 15.1 percent, from 3,230 MT in 2015 to 2,742 MT. Similarly, the national consumption for kerosene decreased to 16,045 MT in 2016 from 18,300 MT (23,019 m^3) in the previous year.

3.5 Daily national average consumption of petroleum products

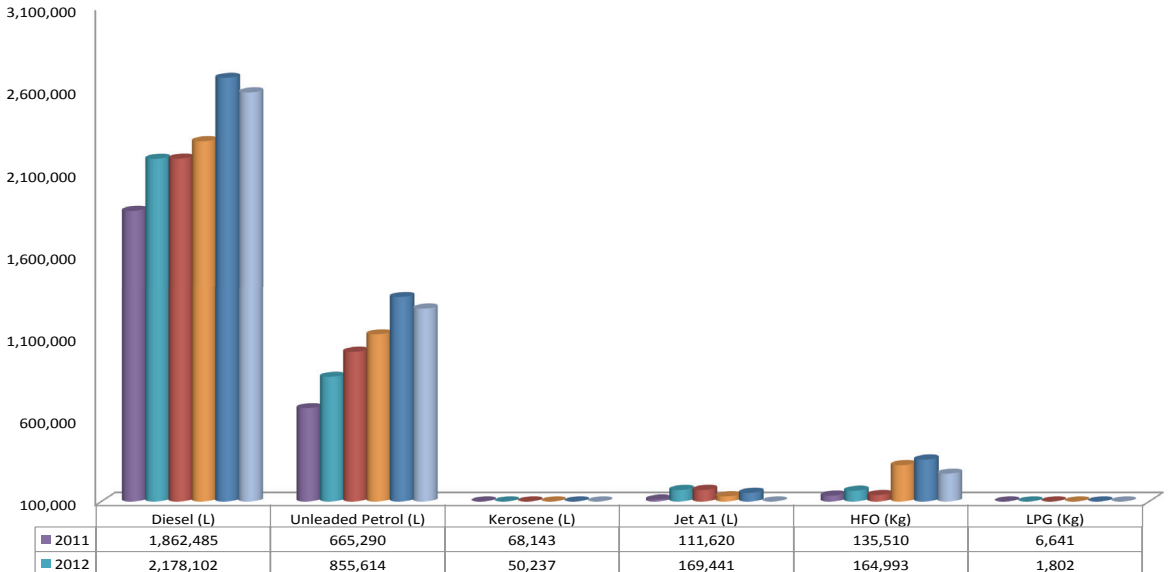
Figure 3-7 shows the trend in national average daily consumption of petroleum products for the period 2011 to 2016. Generally, there was an increase in the average consumption for most petroleum products between 2011 and 2015. However, in 2016, the average daily consumption of all petroleum products decreased compared to 2015. In particular, the average daily national consumption for diesel decreased to 2,580,813 litres from 2,669,334 litres in 2015. Similarly, the daily national average consumption for petrol reduced to 1,268,551 litres in 2016, from 1,338,901 litres in 2015. Meanwhile, the daily national average consumption for kerosene reduced to 54,950 litres in 2016 from 63,065 litres in 2015, whereas the daily national average consumption of

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

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

Jet A-1 reduced to 93,863 litres from 152,183 litres in 2015. Further, the daily national average consumption for HFO and LPG reduced to 268,168 kg and 7,513 kg in 2016, from 353,834 kg and 8,849 kg in 2015, respectively.

Figure 3-7: Daily national average consumption of petroleum products, 2011 – 2016

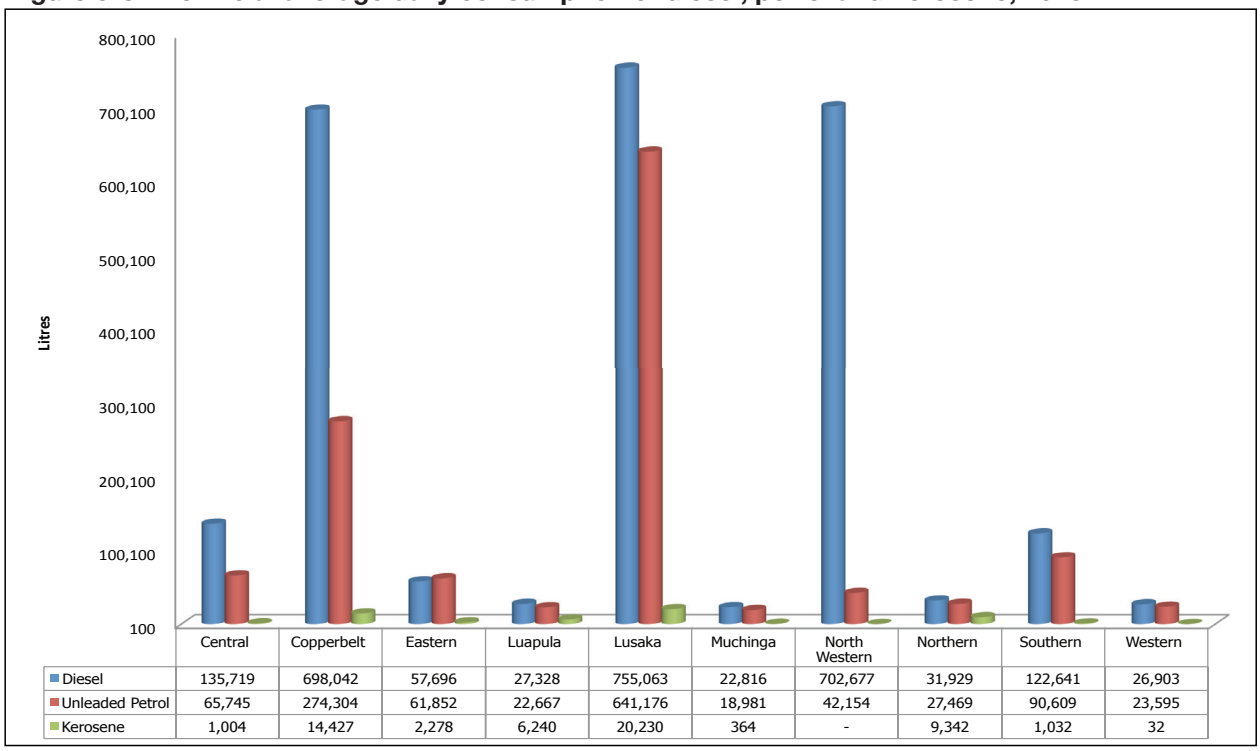


	Diesel (L)	Unleaded Petrol (L)	Kerosene (L)	Jet A1 (L)	HFO (Kg)	LPG (Kg)
2011	1,862,485	665,290	68,143	111,620	135,510	6,641
2012	2,178,102	855,614	50,237	169,441	164,993	1,802
2013	2,179,138	1,006,772	42,297	169,907	139,160	8,278
2014	2,284,986	1,112,555	47,474	131,126	320,058	10,083
2015	2,669,334	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

3.5.1 Average daily national consumption by province

The provincial average daily consumption of white products (diesel, petrol and kerosene) in 2016 is depicted in Figure 3-8. Lusaka, Copperbelt and North-Western Provinces consumed most of the white products, while the least was consumed by Muchinga, Western and Luapula Provinces.

Figure 3-8: Provincial average daily consumption of diesel, petrol and kerosene, 2016



	Central	Copperbelt	Eastern	Luapula	Lusaka	Muchinga	North Western	Northern	Southern	Western
Diesel	135,719	698,042	57,696	27,328	755,063	22,816	702,677	31,929	122,641	26,903
Unleaded Petrol	65,745	274,304	61,852	22,667	641,176	18,981	42,154	27,469	90,609	23,595
Kerosene	1,004	14,427	2,278	6,240	20,230	364	-	9,342	1,032	32

The provincial daily average consumption for diesel (inclusive of Low Sulphur Gasoil), petrol and kerosene, combined was 3,904,314 litres in 2016. In terms of provincial daily average, Lusaka province accounted for the largest proportion of the national average daily consumption of white products at 36.3 percent (1,416,470 litres). This comprised 755,063 litres of diesel, 641,176 litres of petrol and 20,230 litres of kerosene.

Copperbelt Province was the second largest share of the provincial average daily consumption of white products at 986,773 litres representing 25.3 percent of the total national daily average consumption. This comprised 698,042 litres of diesel, 274,852 litres of petrol and 14,427 litres of kerosene.

North-Western Province was the third highest consumer accounting for a provincial daily average consumption of 744,830 litres. This represented 19.1 percent of total national average daily consumption and comprised 702,677 litres of diesel and 42,154 litres of petrol.

In terms of overall average daily consumption, the three (3) provinces (Lusaka, Copperbelt and North-Western provinces) consumed 80.6 percent of the total national daily average consumption. This was consistent with the level of economic activities that take place in these provinces; including the number of retail outlets. Specifically, the mines on the Copperbelt and North-Western provinces consume most of the white products.

Meanwhile, the three (3) provinces (Muchinga, Western and Luapula) accounted for 3.8 percent of the combined national daily average consumption of the three (3) white products. Amongst these, Muchinga Province recorded the lowest (1.1 percent) followed by Western (1.3 percent) and Luapula (1.4 percent). The rest of the four (4) provinces, that is, Central, Eastern, Southern and Northern provinces collectively consumed 15.6 percent of the combined national daily average consumption of the three (3) petroleum products.

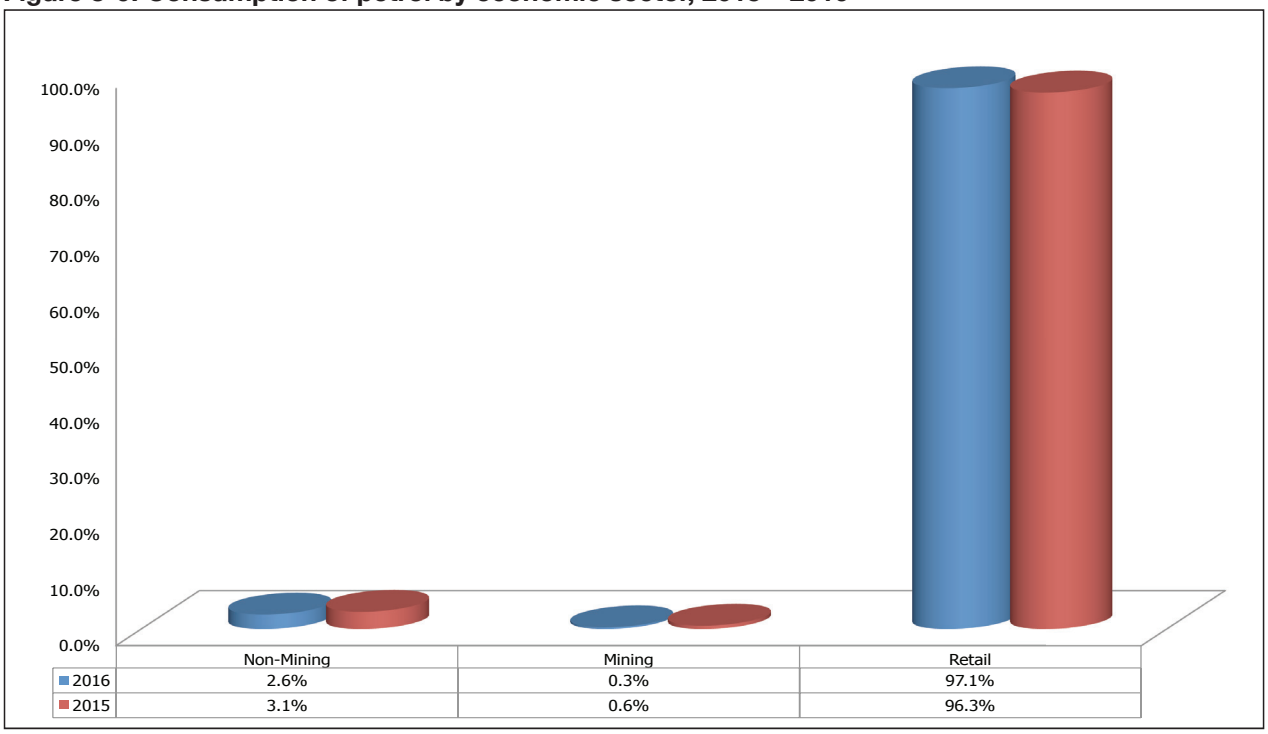
3.5.2 Consumption of petroleum products by economic sector

This section discusses the consumption of petrol and diesel by economic sector in 2016 compared to 2015. The economic sectors are classified as retail, mining and non-mining. Retail refers to petroleum products that are sold at the forecourt 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.

3.5.2.1 Consumption of petrol by economic sector

Figure 3-9 shows consumption of petrol by the mining, retail and non-mining sectors. In 2016, the consumption of petrol was predominantly by the retail sector, in the previous year, the sector equally had the largest share. Specifically, the consumption of petrol was 97.1 percent and 96.3 percent in 2016 and 2015, respectively. Meanwhile, the Mining sector only consumed 0.3 percent of the total market demand for petrol in 2016, from 0.6 percent in 2015. In 2016, the non-mining sector consumed 2.6 percent while in 2015; its consumption was 3.1 percent.

Figure 3-9: Consumption of petrol by economic sector, 2015 – 2016

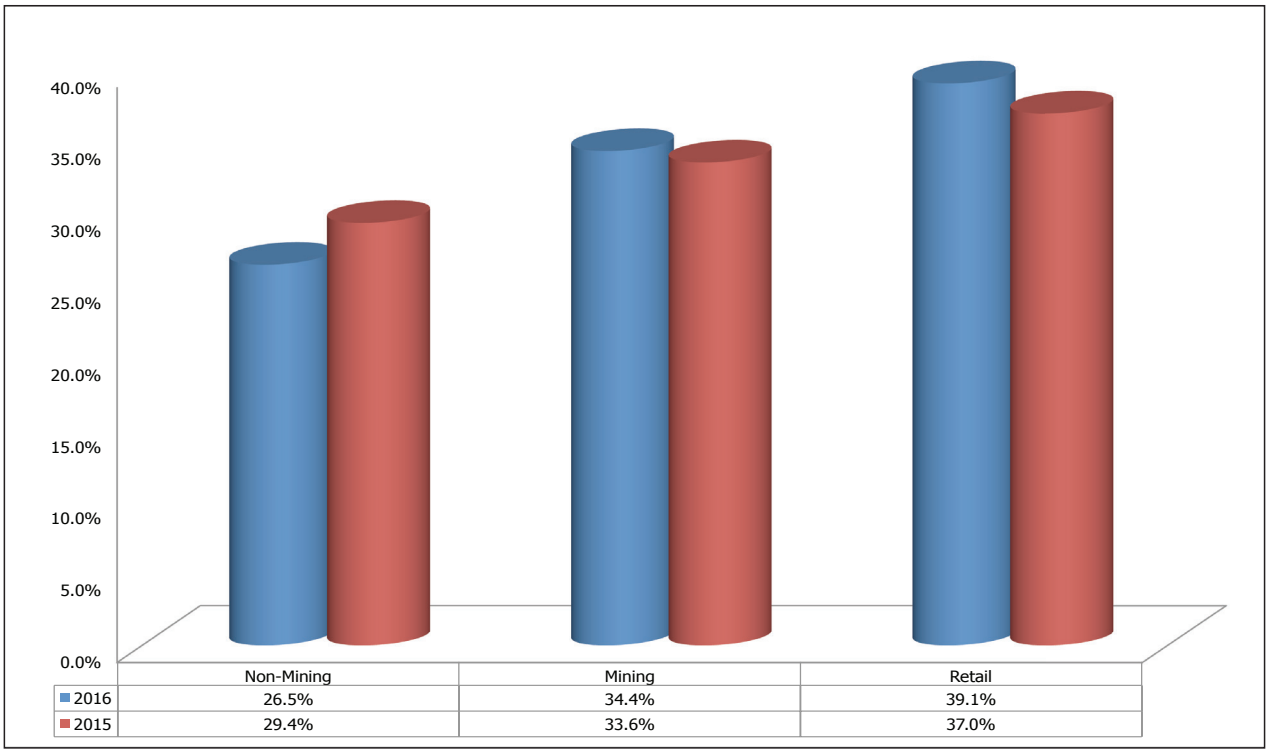


	Non-Mining	Mining	Retail
2016	2.6%	0.3%	97.1%
2015	3.1%	0.6%	96.3%

3.5.2.2 Consumption of diesel by economic sector

Figure 3-10 shows the consumption of diesel by economic sector in 2015 and 2016. In 2016, the consumption of diesel continued to be led by the retail sector followed by the mining sector. Meanwhile, non-mining sectors continued to be in third place. In 2016, the retail sector predominantly led the consumption of diesel at 39.1 percent of the market demand, while 34.4 percent was consumed by the mining sector and 26.5 percent by the non-mining sector.

Figure 3-10: Consumption of diesel by economic sector, 2015 – 2016



	Non-Mining	Mining	Retail
2016	26.5%	34.4%	39.1%
2015	29.4%	33.6%	37.0%

3.6 Market share of Oil Marketing Companies

In 2016, there were a total of 49 OMCs licensed by the ERB to distribute petroleum products in Zambia. The market share of an OMC is defined as a percentage of its total sales volume to the total industry market sales volume in a specified period of time.

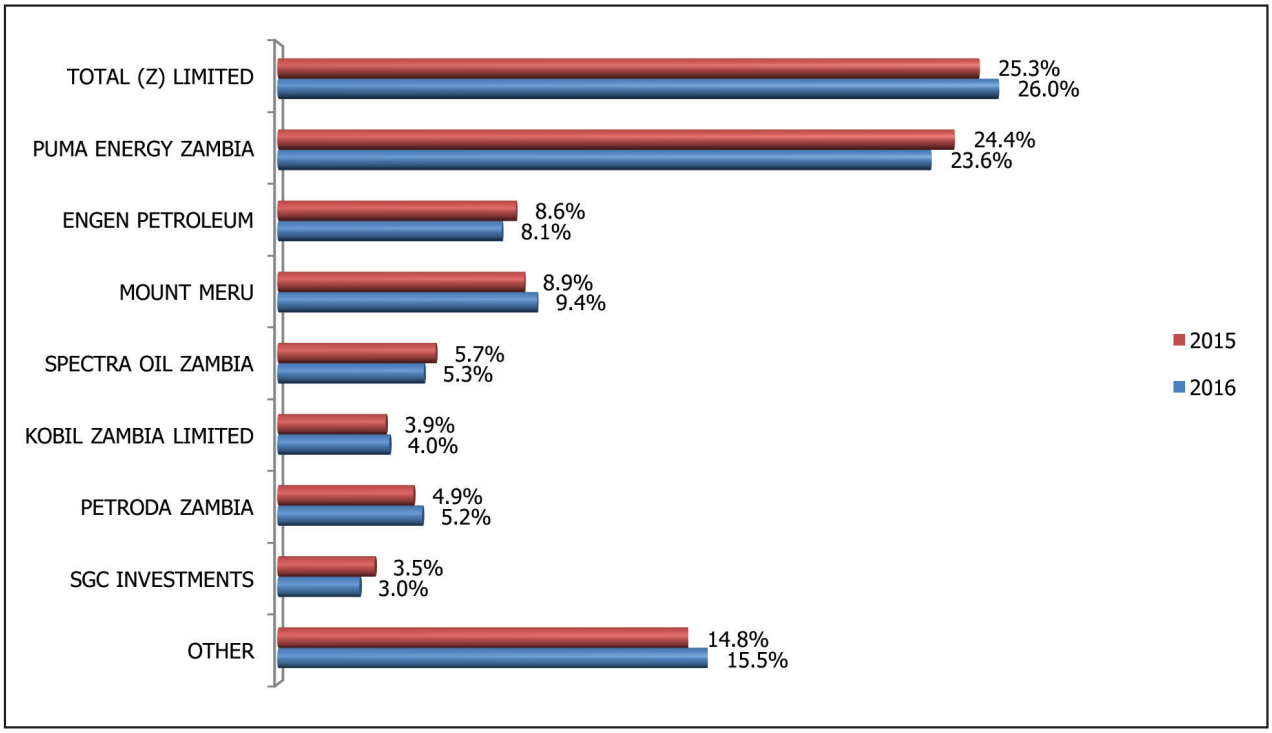
This section discusses the combined market share for OMCs in 2016 for white products, lubricants and Jet A-1.

3.6.1 Market share of white products

The market share of OMCs for white products in 2016 compared to 2015 is depicted in Figure 3-11.

Figure 3-11 shows that in 2016, Puma Energy (Z) Plc (Puma Energy) and Total (Z) Limited (Total Limited) continued to dominate the market for white products. However, despite their dominance, the combined market share decreased by 0.1 percentage point from 49.7 percent in 2015 to 49.6 percent. Total Limited maintained its lead in the market with a market share of 26.0 percent, increasing from 25.3 percent in 2015. This was followed by Puma Energy which recorded a decrease of 0.8 percentage points at 23.6 percent, from 24.4 percent in 2015.

Figure 3-11: Market share for white products, 2015 – 2016



Other than the top two (2) OMCs, the rest had the following market shares; 9.4 percent, 8.1 percent, 5.3 percent, 5.2 percent, 4.0 percent and 3.0 percent for Mount Meru, Engen, Spectra, Petroda, Kobil and SGC, respectively.

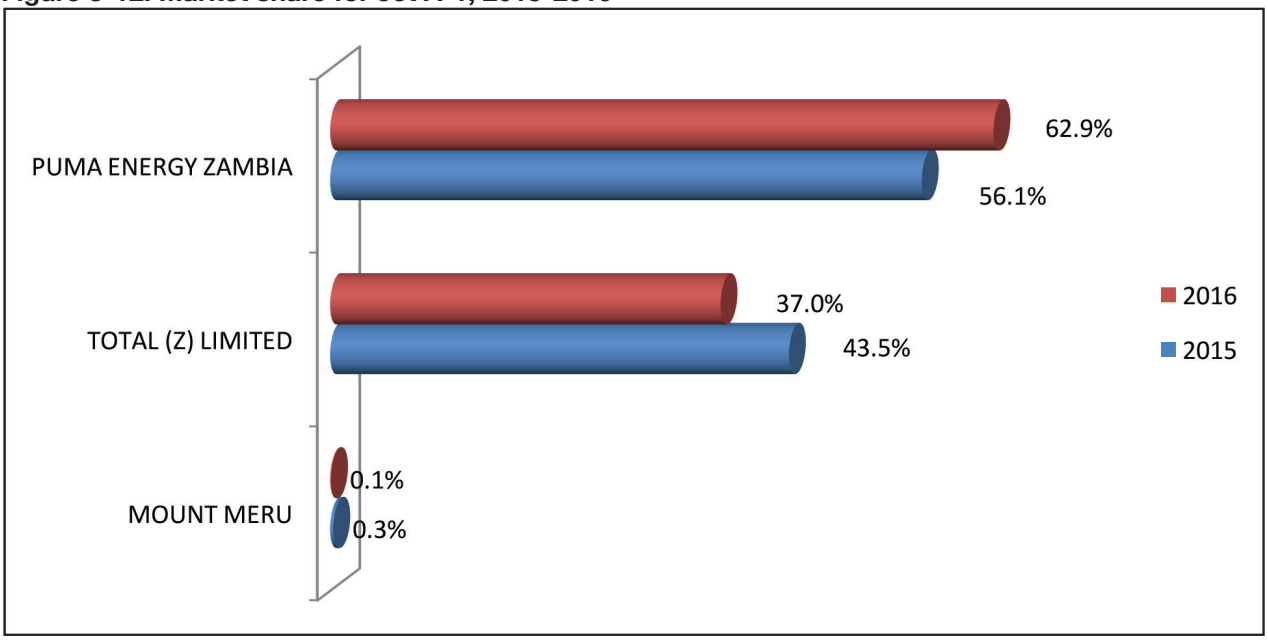
Meanwhile, the other OMCs collectively accounted for 15.5 percent of the market share, increasing from 14.8 percent in 2015.

3.6.2 Market share for Jet A-1

In 2016, there were three (3) OMCs dealing in Jet A-1 namely: Puma Energy; Total Limited and Mount Meru. Figure 3-12 shows the market share for the OMCs. Of the three (3), Puma Energy and Total Limited continued to dominate the market for Jet A-1 as in 2015. The two (2) OMCs collectively accounted for 99.9 percent of the total market supply in 2016, reflecting a marginal

increase of 0.3 percentage points from 99.6 percent recorded in 2015. Puma Energy had the highest market share at 62.9 percent followed by Total Limited at 37.0 percent. In 2016, Puma Energy increased its market share by 6.8 percentage points compared to 2015. Meanwhile, the market share for Total Limited declined by 6.5 percentage points during the same period.

Figure 3-12: Market share for Jet A-1, 2015-2016

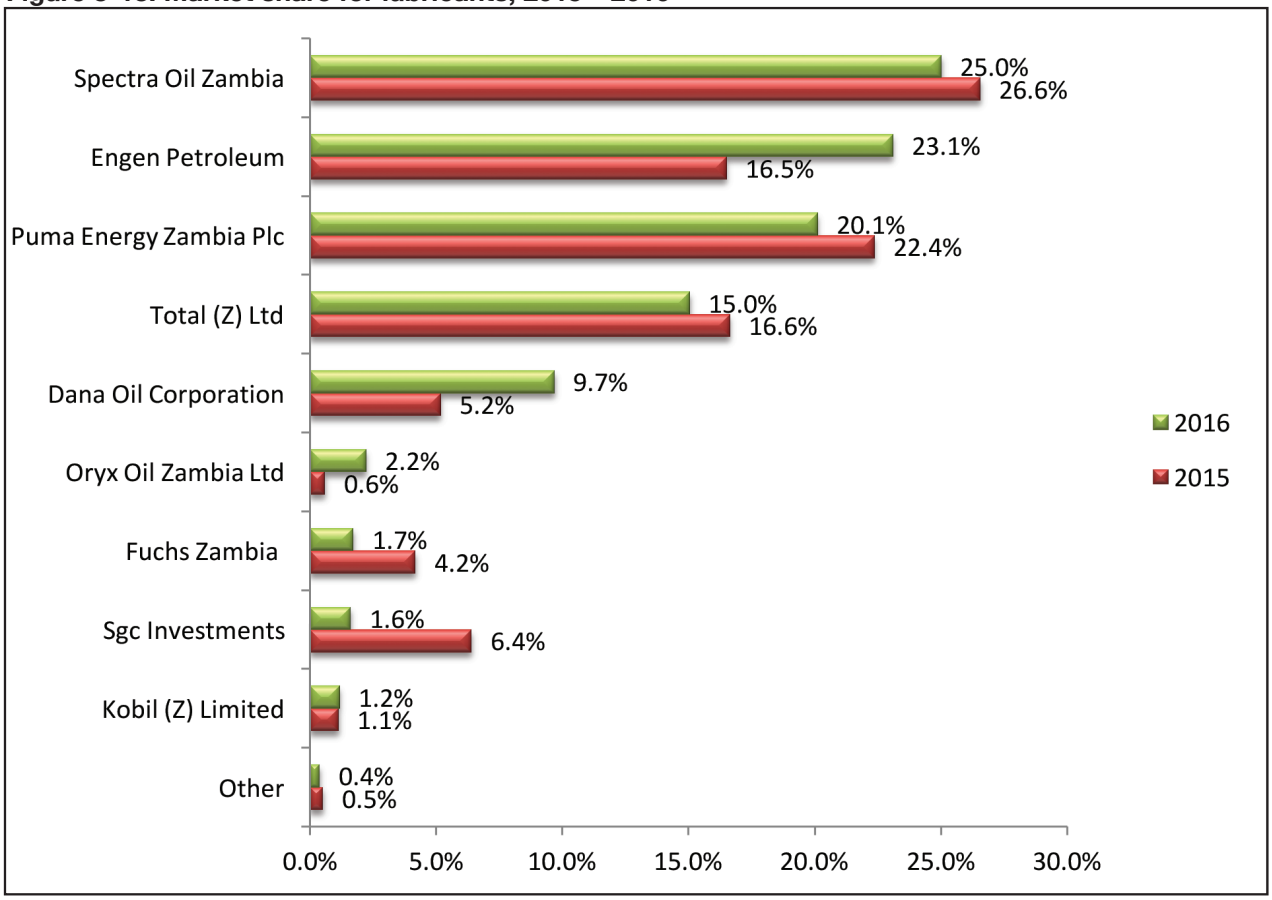


Meanwhile, the market share for Jet A-1 for Mount Meru decreased by 0.2 percentage points, from 0.3 percent recorded in 2015 to 0.1 percent in 2016.

3.6.3 Market share for lubricants

In 2016, the total number of companies licensed by the ERB to deal in lubricants was 13. Figure 3-13 shows that in 2016, Spectra Oil Zambia maintained its lead in the market for lubricants at 25.0 percent. Despite Spectra Oil's lead in the market, its share declined by 1.6 percentage points from 26.6 percent in 2015. On the other hand, Engen Petroleum increased its market share by 6.6 percentage points to 23.1 percent from 16.5 percent, while Puma Energy and Total Limited had market shares of 20.1 percent and 15.0 percent, respectively.

Figure 3-13: Market share for lubricants, 2015 – 2016



Further, Figure 3-13 shows that in 2016, Dana Oil Corporation, Oryx Oil Zambia Limited, Fuchs Zambia, SGC Investments and Kobil (Z) Limited had market shares of 9.7 percent, 2.2 percent, 1.7 percent, 1.6 percent and 1.2 percent respectively. The other licensees had a combined market share of 0.4 percent.

3.7 Pricing of petroleum products

Nozzle for dispensing petroleum products

3.7.1 Determinants of petroleum prices

In 2016, the price of fuel in Zambia continued to be determined mainly by international oil prices and the exchange rate of the Kwacha to the United States Dollar. Any major movements in the two (2) factors could trigger a price adjustment. Other factors that can initiate a price adjustment are changes in levies and duties, charges such as Strategic Reserve Fund (SRF) fees, margins for transporters, OMCs or Dealers, changes in pumping or processing fees.

3.7.2 Trends in International Oil Prices

In 2016, international oil prices generally increased mainly due to various efforts by the Organisation for Petroleum Exporting Countries (OPEC) and non-OPEC members to try and influence the level of output, in order to promote higher prices. One (1) of these interventions resulted in an agreement on allocating output quotas. Figure 3-14 shows the trend in international oil prices in 2016 and indicates that oil prices increased. Initially, very steeply in the first half of the year and moderately in second half of the year.

Figure 3-14: International oil prices, 2016

	January	February	March	April	May	June	July	August	September	October	November	December
WTI Midland	31.68	30.32	37.55	40.75	46.71	48.76	44.65	44.72	45.18	49.78	45.66	51.97
Murban	29.95	33.00	38.20	42.00	47.35	49.05	44.60	45.75	45.50	51.35	49.28	54.15
Brent	30.70	32.18	38.21	41.58	46.85	48.25	44.95	45.84	46.57	49.52	44.77	53.32

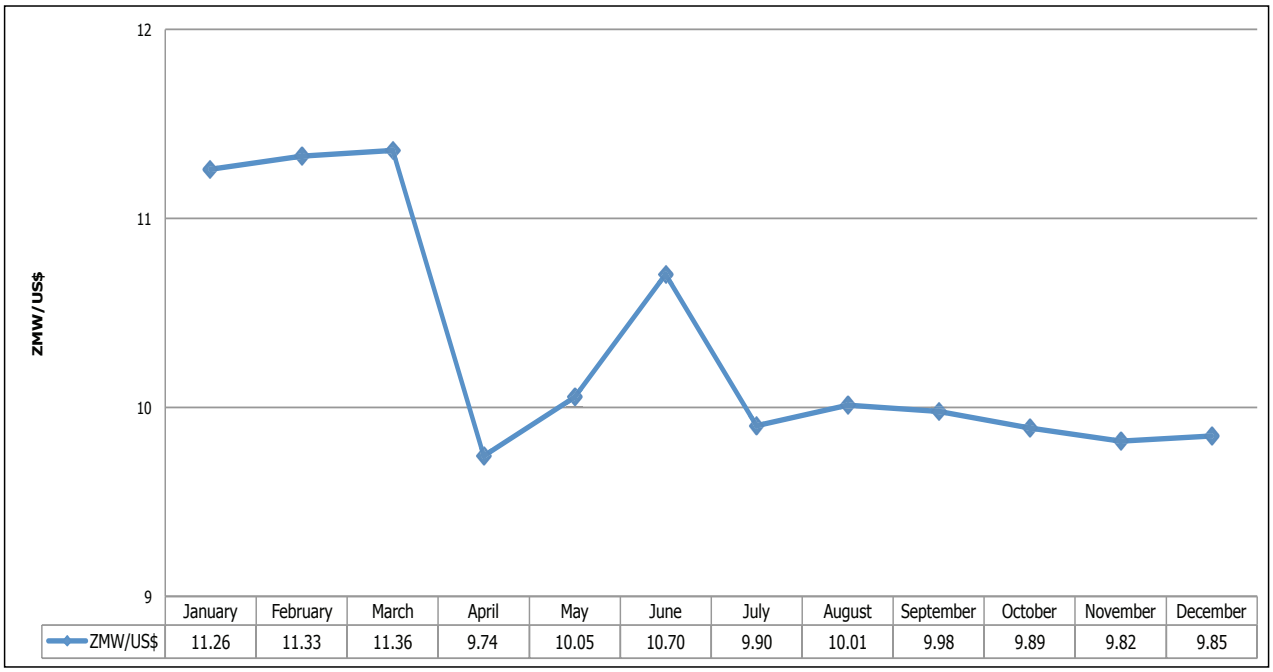
As depicted in Figure 3-14, international oil prices averaged about US$30/bbl in January and closed the year at an average of US$53.14/bbl, indicating a general increase of 77.2 percent. According to OPEC[9], the rise in prices was on account of supply factors which included a decline of investments in crude oil production and a decline of oil inventories. Demand factors equally had their share as a global rise in employment and an increase of car sales on the American continent. The rise in oil prices was sustained following proposals by OPEC to allocate production quotas to its members and eventually produce less oil in order to boost oil prices to higher levels. Through the 'Algiers Accord' of November 2016, OPEC committed itself to reducing output for the first time since 2008.

[9] OPEC Monthly Report for October 2016

3.7.3 Trend in the exchange rate

During the year, the Kwacha was characterised by significant volatility during the first half of the year recording a high of ZMW11.36/US$ and a low of ZMW9.74/US$, which a movement of 14.26 percent. In the second half of the year, the Kwacha exhibited relative stability and averaged ZMW9.91/US$. This is depicted in Figure 3-15. The volatility in the first half of the year was on account of several factors including the continued unfavourable terms of trade into January 2016. The relative stability and appreciation in the second half of the year was on account of a combination of factors, which included higher copper prices, strong non-resident investor's appetite for GRZ securities and export-led foreign currency conversions to meet domestic obligations.

Figure 3-15: Exchange rate, 2016

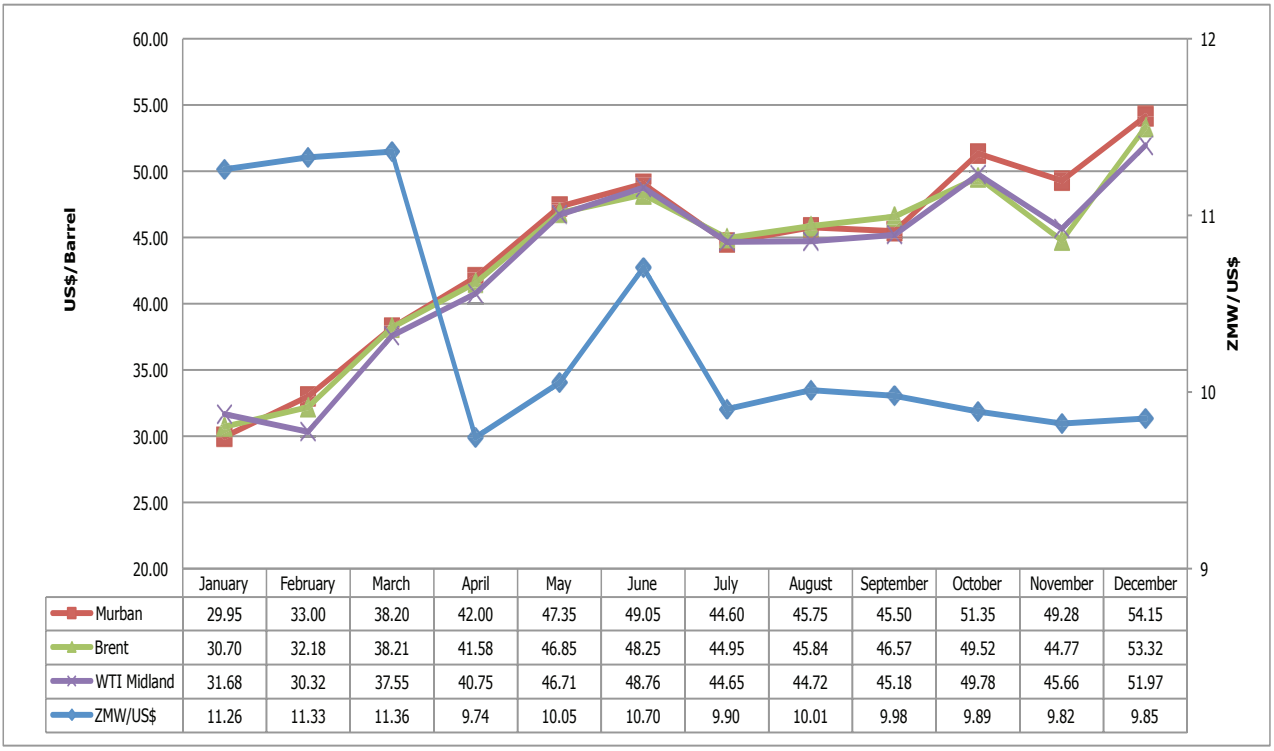


	January	February	March	April	May	June	July	August	September	October	November	December
ZMW/US$	11.26	11.33	11.36	9.74	10.05	10.70	9.90	10.01	9.98	9.89	9.82	9.85

3.7.4 Trend in international oil prices & exchange rate

Figure 3-16 shows that in general, international oil were on the rise in 2016 while the Kwacha generally appreciated against the United States Dollar. In general, any benefits from a price reduction on account of the strengthening of the Kwacha were outweighed by increases in oil prices.

Figure 3-16: International oil prices & exchange rate, 2016



	January	February	March	April	May	June	July	August	September	October	November	December
Murban	29.95	33.00	38.20	42.00	47.35	49.05	44.60	45.75	45.50	51.35	49.28	54.15
Brent	30.70	32.18	38.21	41.58	46.85	48.25	44.95	45.84	46.57	49.52	44.77	53.32
WTI Midland	31.68	30.32	37.55	40.75	46.71	48.76	44.65	44.72	45.18	49.78	45.66	51.97
ZMW/US$	11.26	11.33	11.36	9.74	10.05	10.70	9.90	10.01	9.98	9.89	9.82	9.85

3.7.5 Pricing of petroleum products

In 2016, the ERB continued to determine wholesale and pump prices of petroleum products using the Cost-Plus Pricing Model (CPM). The CPM operates on the principle that the final price should cover all the costs incurred in the petroleum supply chain. Appendix 9 shows the petroleum value chain in Zambia while the components of the CPM are discussed in Appendix 11. 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 indicated as follows:

i. Expected Revenue from imported LSG (A) = Total quantity of Imported LSG multiplied by The landed unit cost CIF Ndola
ii. Revenue expected from INDENI Diesel (B) = Expected Diesel yields from processed Cargo multiplied by Computed Diesel Wholesale price as per CPM
iii. Weighted Average Wholesale Price (C) = (A+B)/(INDENI yields of diesel plus LSG Import Quantity)

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

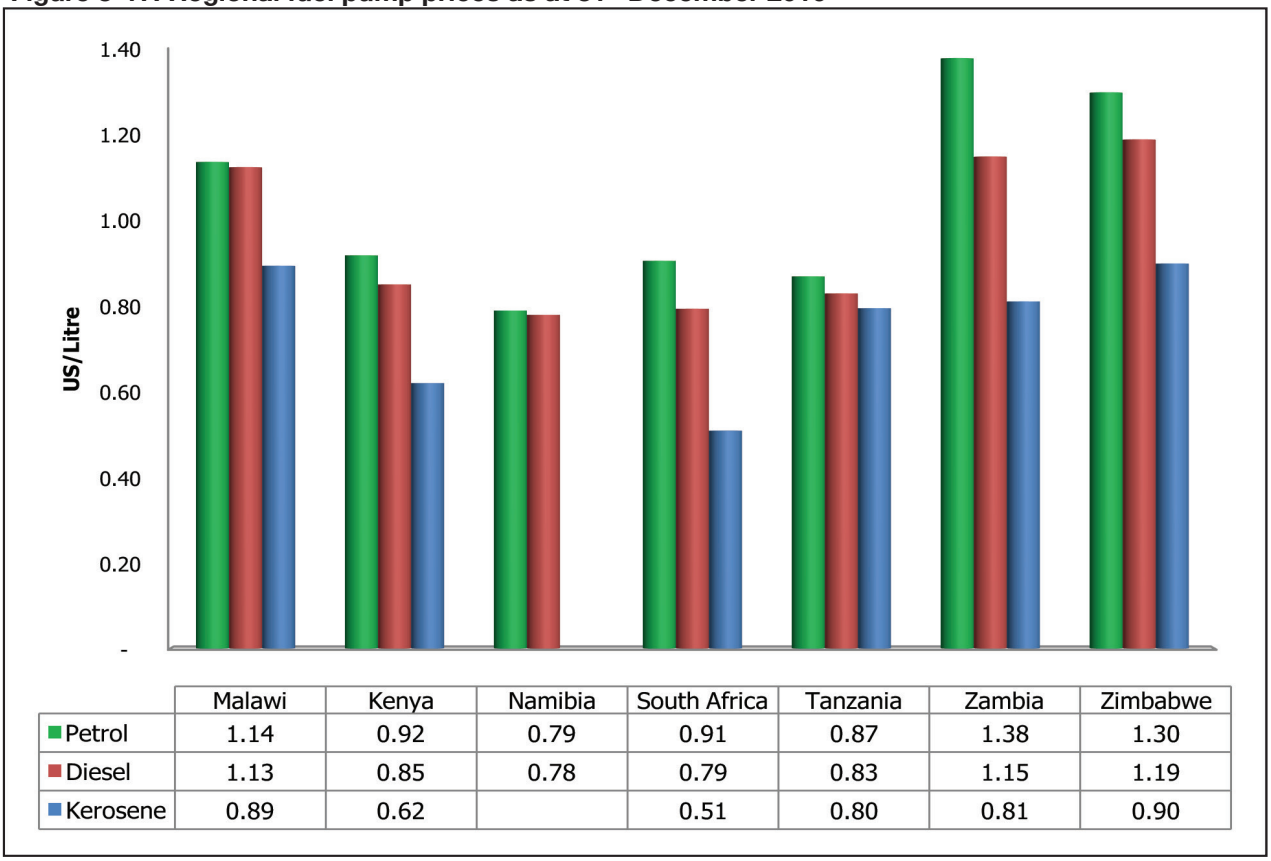
i. Expected Revenue from imported Petrol (D) = Total quantity of Imported Petrol multiplied by The landed unit cost CIF Ndola
ii. Revenue expected from INDENI Petrol (E) = Expected Petrol yields from processed Cargo multiplied by Computed Petrol Wholesale price as per CPM
iii. Weighted Average Wholesale Price (F) = (D+E)/(INDENI yields of petrol plus Quantity of Petrol Imported)

During the period under review, the Government imported a total of five (5) petroleum feedstock cargoes. Meanwhile, out of the five (5) cargoes received, two (2) resulted in fuel price adjustments. One (1) was an upward adjustment while the other was a reduction. The upward adjustment was triggered by the removal of the fuel subsidy, changes in the exchange rate and international oil prices. The removal of the fuel subsidy triggered the migration to cost reflective pricing.

3.7.6 Fuel pump prices in selected African countries

Figure 3-17 shows the regional pump price comparison of petrol, diesel and kerosene as at 31st December 2016 in selected African countries. Pump prices vary mainly on account of different factors including fiscal policy and different supply options among other factors.

Figure 3-17: Regional fuel pump prices as at 31st December 2016



	Malawi	Kenya	Namibia	South Africa	Tanzania	Zambia	Zimbabwe
Petrol	1.14	0.92	0.79	0.91	0.87	1.38	1.30
Diesel	1.13	0.85	0.78	0.79	0.83	1.15	1.19
Kerosene	0.89	0.62		0.51	0.80	0.81	0.90

Source: National Energy Regulator/Department of Energy websites

Pump prices for petrol were highest in Zambia followed by Zimbabwe and Malawi. The rest of the countries had petrol prices which were below US$1 per litre with lowest being Namibia. Diesel prices were highest in Zimbabwe followed by Zambia and Malawi. The lowest diesel price was recorded in Namibia. For kerosene, the pump prices were less than US$1 per litre for all the countries. Zimbabwe had the highest price at US$0.90 per litre, while the lowest was South Africa at US$0.51 per litre.

3.7.7 Pricing of Jet A-1

In 2016, the ERB approved the monthly automatic review of the price of Jet A-1 based on the Import Parity Pricing Model. The new framework is expected to be implemented in future once modalities have been finalised. Consequently, by the end of 2016, Jet A-1 was still priced using the Cost-Plus Model.

3.7.8 Pricing Framework for Liquefied Petroleum Gas

In 2016, the ERB approved the regulatory framework on pricing LPG. The framework recommended a light handed regulation by monitoring wholesale and retail prices for both imported and locally sourced LPG. The objective of the framework was to ensure consumer protection against exploitation through excessive pricing. In October 2016, the licencees were notified on the immediate implementation of the new pricing framework.

3.7.9 Development of transport differentials

In 2016, the sector continued to implement the Uniform Pump Pricing (UPP) Programme. The programme entails that the national pump price for petrol, diesel, kerosene and low Sulphur gasoil sold at retail level was the same throughout the country.

The UPP was administered through a transport cross subsidy mechanism. OMCs or independent dealers delivering fuel to retail sites near a national fuel wholesaling facility (i.e. GRZ fuel storage depots) were required to remit the transport differential for each litre of fuel into the UPP fund. OMCs delivering fuel to sites far from a national fuel wholesaling depot were reimbursed the transport differential for each litre of fuel delivered.

The transportation cost in the price build-up of petrol, diesel and kerosene was held constant for all the districts. This was achieved by calculating 'adjustors' or 'differentials' for each district in the country. These differentials were added to the actual transport cost for each litre of fuel to have a uniform cost in the price build up for each district. The formula used to compute the adjustor is shown below:

Transport Differential = Actual Transport Cost - Transportation Cost in Price Build Up

In May 2016, the ERB developed transport differentials from all fuel depots to all districts in Zambia. The development of the differentials was a proactive measure in readiness to service any retail service station that could be established in any district of Zambia in future. Further, the development of the adjustors was done to ensure that in a case were a crisis befell the nation where fuel to be uplifted was only available from a single fuel depot or terminal, transport differentials would be applied.

In summary, the transport differentials were remodeled to support operations where fuel can be uplifted from any of the existing fuel hubs and destined to any new retail service station constructed in any district of the country.

3.7.10 Annual review of petroleum downstream margins

In October 2016, the ERB implemented new wholesale and pump prices which also included the new margins for OMCs and Dealers. In particular, OMC margins were increased by 33.3 percent to ZMW0.56/litre from ZMW0.42/litre. Similarly dealer margins were increased by 35.7 percent from ZMW0.28/litre to ZMW0.38/litre. Transporter margins were earlier increased by 37 percent in September 2015.

Further in October 2016, the ERB commenced the process of reviewing margins for OMCs, dealers and transporters. The purpose of this review was to ensure that the margins were reflective of the cost dynamics consistent with the changing economic variables such as inflation, exchange rate amongst others. It is expected that the review would be concluded in 2017.

3.7.11 Strategic Reserve Fund

The SRF is a GRZ Programme introduced in 2005, specifically to finance the procurement of National Strategic Petroleum Reserves. The programme is managed by the ERB on behalf of GRZ. In 2016, the sector continued to implement the SRF Programme.

The SRF is financed by SRF fees, collected by the ERB through a cost-line in the price build-up for petroleum products. In 2016, the SRF fee was ZMW0.15/litre for petrol, diesel, kerosene and jet A-1, and ZMW0.15/kg for HFO and LPG. The ERB collects the SRF fee through OMCs and has in place a monitoring mechanism to ensure that an appropriate amount is paid into the Fund by OMCs.

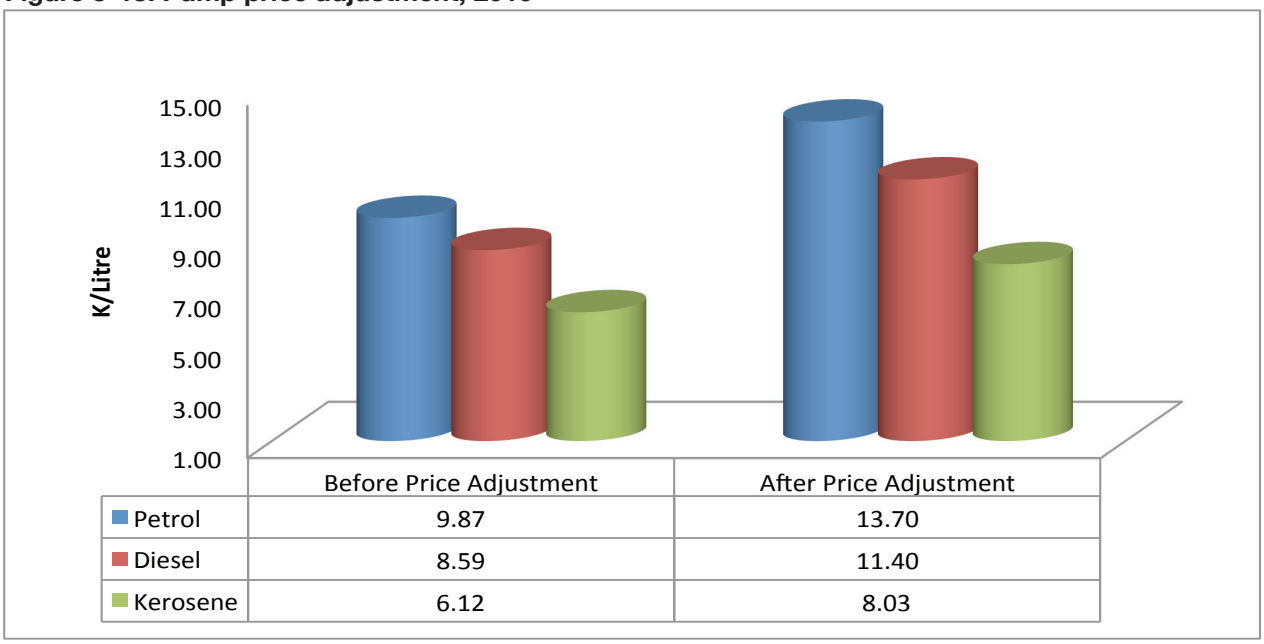
The SRF is used to finance the development of petroleum infrastructure such as fuel depots, road works around fuel storage depots; rehabilitation of fuel tanks at storage depots; and rehabilitation of infrastructure such as the bitumen plant at INDENI.

3.8 Local and regional fuel prices

3.8.1 National fuel pump prices

In 2016, the ERB made one upward price adjustment in October 2016. This is depicted in Figure 3-18. Specifically, petrol, diesel and kerosene increased by 38.8 percent, 32.7 percent and 31.2 percent, respectively.

Figure 3-18: Pump price adjustment, 2016

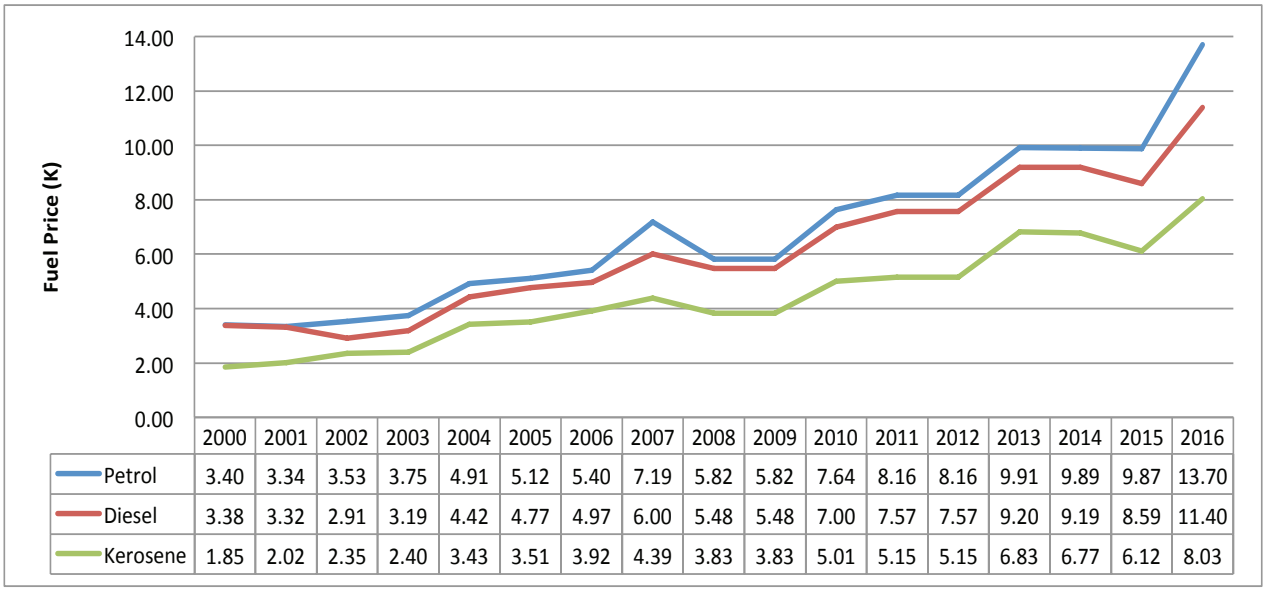


	Before Price Adjustment	After Price Adjustment
Petrol	9.87	13.70
Diesel	8.59	11.40
Kerosene	6.12	8.03

3.8.2 Trend in domestic fuel prices

Figure 3-19 shows the trend in the domestic pump prices of petrol, diesel and kerosene. The pump prices for the three (3) products have generally been on the rise during the period 2000 to 2016. The price of petrol had consistently been higher than the price of diesel followed by kerosene. During the stated period, the price of petrol had risen from ZMW3.40 per litre in 2000 to ZMW13.70 in 2016. Similarly, the price of diesel had risen from ZMW3.38 to ZMW11.40 per litre, while that of kerosene had risen from ZMW1.85 to ZMW8.03 per litre. The observed steep rise in 2016 was mainly on account of the removal of subsides.

Figure 3-19: Trend in domestic fuel prices, 2000 - 2016



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Petrol	3.40	3.34	3.53	3.75	4.91	5.12	5.40	7.19	5.82	5.82	7.64	8.16	8.16	9.91	9.89	9.87	13.70
Diesel	3.38	3.32	2.91	3.19	4.42	4.77	4.97	6.00	5.48	5.48	7.00	7.57	7.57	9.20	9.19	8.59	11.40
Kerosene	1.85	2.02	2.35	2.40	3.43	3.51	3.92	4.39	3.83	3.83	5.01	5.15	5.15	6.83	6.77	6.12	8.03

3.9 Technical audits of licencees

In 2016, the ERB carried out compliance audits of petroleum infrastructure of licencees. The scope of the audits included compliance audits of service stations, grading of retail service stations and product quality assessments.

3.9.1 Compliance audits of service stations

In 2016, the ERB carried out country–wide technical compliance inspections of 268 retail sites out of a total of the 305 active retail sites. Out of those inspected, 254 were in urban areas while 14 were in rural areas. Within 2016, two (2) technical audits were undertaken one (1) being an initial audit and the other being a verification audit.

The average technical compliance rate was 87.7 percent; an improvement of 1.3 percentage points over the initial compliance rate of 86.4 percent. The increase in the compliance rate was attributed to the technical hearings conducted after the initial inspections. During the verification audit, it was discovered that a total of 14 sites were closed and were non-operational.

3.9.2 Grading of retail service stations

During the period under review, the ERB revised the grading criteria for service stations. The new criterion has included a consumer compliance rate by including service factors such as the availability of compressed air pressure; general aesthetics of service stations; courtesy by attendants; and provision of services such as cleaning of windscreen and engine oil checks for customers. Previously, the grading of infrastructure was entirely based on the technical compliance rate. Based on the revised criteria, the overall grading for retail sites is calculated as follows:

Overall Compliance Rate (OCR) = 0.7T + 0.3C

Where T = Technical Compliance Rate; and

C = Consumer Compliance Rate

The criterion was used to grade 159 service stations in provincial centres only (see Appendix 10 for the total number of service stations in 2016). The results of these inspections are detailed in Table 3-3.

Table 3-3: Grading of retail service stations, 2016

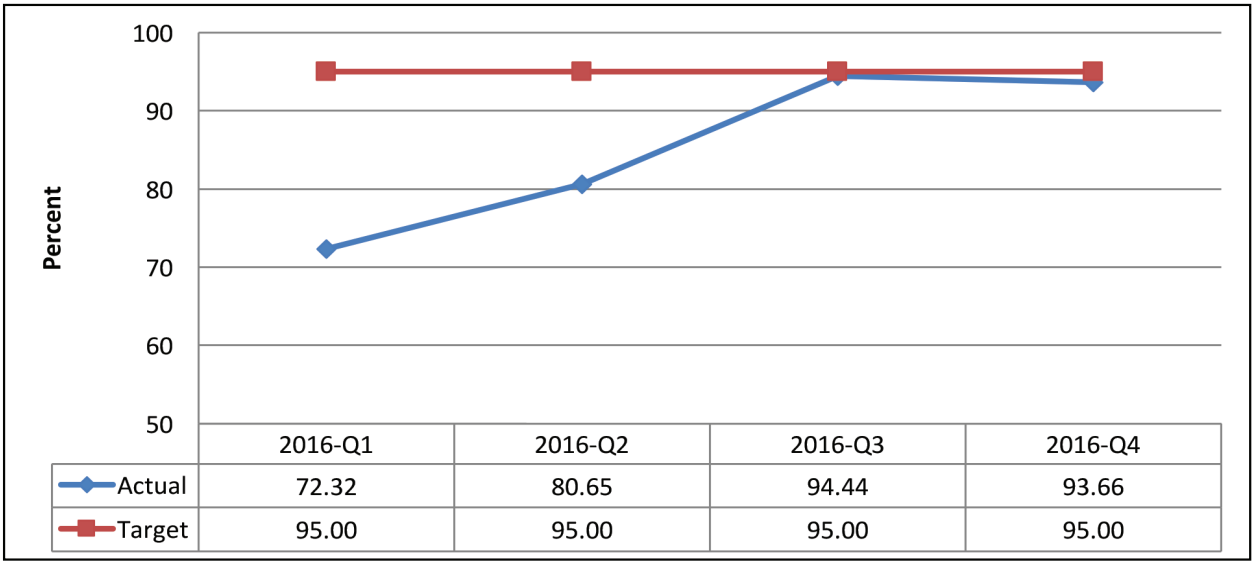
No.	Grade	Number	Percentage	Comment
1.	A - very good	18	11	Scored above 95%
2.	B – good	114	71	Scored between 80% and 94%
3.	C - fair	25	16	Scored between 60% and 79%
4.	F – poor	2	2	Scored below 60%
Total		**159**	**100**	

3.9.3 Petroleum product quality assessment

In 2016, a total of 285 samples were collected from various retail sites and bulk fuel storage depots throughout the country. The samples were submitted for analysis to an independent laboratory. The laboratory results revealed an average overall product quality compliance score of 93.7 percent, representing an increase of 18.3 percentage points when compared to the overall product quality compliance score of 75.4 percent recorded in 2015.

Meanwhile, the trend in the overall product quality compliance increased from 72.3 percent in the first quarter to 93.7 percent in the fourth quarter, which was still short by 1.34 percentage points in terms of meeting the Strategic Business Plan (SBP) target of 95 percent product quality compliance by December 2016. Figure 3-20 presents the overall product quality trend recorded in the year 2016.

Figure 3-20: Overall product quality compliance, 2016



The observed upward trend in overall product quality presented in Figure 3-20 is attributed to adherence to the Sampling Protocol and established product quality standards for fuel distributed to consumers.

3.10 Regulation of state owned enterprises

3.10.1 Financial reviews of INDENI and TAZAMA

In October 2016, consistent with the ERB mandate, financial reviews for TAZAMA and INDENI were conducted spanning a period of five (5) years, ending in December 2015. The purpose of the review was to evaluate the efficiency and effectiveness of state owned enterprises in achieving their set objectives; which was mainly profitability and efficiency in the delivery of their services to the public. The review utilised audited financial statements and allied non-financial information. The financial review revealed that the two (2) state owned enterprises were a going concern.

3.10.2 Incentive based regulation for state owned enterprises

In 2016, the ERB developed and implemented an incentive based regulatory framework that uses KPIs. The framework monitors the operational, financial and technical performance of TAZAMA and INDENI.

The purpose of the incentive based regulatory framework is to provide motivation to the state owned enterprises to achieve the set KPIs. The previous framework on KPIs of the two state owned enterprises did not provide motivation to attain the KPI targets. The average KPI score for the year preceding the tariff application will be used to determine the tariff to be awarded to the enterprises. The tariff award formula and criteria is as shown below:

ERB Tariff Awarded = ERB determined tariff multiplied by overall KPI Score

No.	Actual Score achieved	Tariff Awarded by ERB
1.	75% and above on the KPIs;	One hundred percent (100%)
2.	Score between 50% and 75%;	Seventy five percent (75%) of the ERB determined
3.	Score between 25% and 50%	Fifty percent (50%) of the ERB determined fee
4.	Score less than 25% on the KPIs.	Twenty five percent (25%) of the ERB determined fee

3.11 Licensing in the petroleum sub-sector

In 2016, a total of 79 standard licences were issued in the petroleum subsector compared to the 103 issued in 2015 as shown in Table 3-4. The licences issued were either renewals or for new applicants.

Table 3-4: Standard licences issued/renewed, 2015 and 2016

No.	Type of licence	2015	2016
1.	Distribution, Import and Export of Liquefied Petroleum Gas	23	7
2.	Distribution, Import and Export of Petroleum Products	13	16
3.	Importation of Lubricants	11	6
4.	Retail of Liquefied Petroleum Gas	1	9
5.	Retail of Petroleum Products	11	11
6.	Road Transportation of Petroleum Products	43	30
7.	Refining of Petroleum Feedstock	1	0
Total		**103**	**79**

Further, 35 applications for inclusion of retail sites that were either rehabilitated or newly constructed were granted for inclusion to the schedule of the already existing licences. On the other hand, 79 tankers were included and/or had tanker combination changes to the existing tankers licensed under the various licence holders for road transportation of petroleum products. In addition, there were 39 construction licences (permits) issued for retail sites and storage depots.

In 2016, a total of 71 provisional licences (permits) were issued to applicants meeting all licensing requirements (see Appendix 7) and whose applications were ready for gazetting (see Table 3-5).

Table 3-5: Provisional licences issued, 2016

No.	Type of provisional licence	Number issued
1.	Authority to Operate Retail Site	14
2.	Bioethanol Production	1
3.	Distribute, Import and Export Liquefied Petroleum Gas	2
4.	Distribute, Import and Export Petroleum Products	11
5.	Importation of Lubricants	4
6.	Retail of Liquefied Petroleum Gas	3
7.	Retail of Petroleum Products	11
8.	Road Transportation of Petroleum Products	25
Total		**71**

3.12 Petroleum storage infrastructure

Apart from private owned fuel storage infrastructure, GRZ owns storage facilities which are operated and managed by TAZAMA. These are: Ndola Fuel Terminal (NFT), Lusaka, Mongu, Mpika and Solwezi Fuel Depots. The total combined storage capacities at these facilities in 2016 were: 54,600 m^3 for petrol, 99,948 m^3 for diesel, 4,400 m^3 for kerosene and 8,400 m^3 for Jet A-1. With regard to the storage capacity, diesel/low sulphur gasoil accounts for 59.7 percent followed by petrol which accounts for 32.6 percent. Jet A-1 and Kerosene account for 5 and 2.7 percent, respectively. Apart from NFT, all the fuel depots were commissioned starting in 2013. The latest depot to be commissioned was Mongu. Table 36 shows the installation cost, date of commissioning and the storage capacities of the fuel depots.

Petroleum products bulk storage tanks

Table 3-6: GRZ owned storage depots for white products as at 31st December, 2016

No.	Fuel Storage Depot	Date Commissioned	Cost US$' million	Total Storage Capacity
1.	Lusaka	2nd August 2013	24	25,500 m^3 ✓ two diesel tanks at 7,000 m^3 each ✓ two petrol tanks at 5,000 m^3 and ✓ two kerosene tanks at 500 m^3 each
2.	Mongu	8th August 2016	27	6,500 m^3 ✓ two diesel tanks at 2,000 m^3 each ✓ two petrol tanks at 1,000 m^3 and ✓ kerosene one tank – 500 m^3
3.	Mpika	5th September 2014	23	6,500 m^3 ✓ two diesel tanks at 2,000 m^3 each ✓ two petrol tanks at 1,000 m^3 and ✓ kerosene – one tank - 500 m^3
4.	Solwezi	7th December, 2015	30	15,500 m^3 ✓ two diesel tanks at 5,000 m^3 each ✓ two petrol tanks at 2,500 m^3 and ✓ kerosene – one tank - 500 m^3
5.	Ndola Fuel Terminal			110,348 m^3 ✓ Three (3) tanks of petrol totalling 35,600 m^3. ✓ Three (3) tanks of diesel totalling 57,324 m^3. ✓ Two (2) tanks of low sulphur gasoil totalling 6,624 m^3. ✓ Two (2) tanks of Jet A-1 totalling 8,400 m^3. ✓ One (1) tank of kerosene totalling 2,400 m^3.
6.	**Total Combined** (NFT + fuel depots)			**167,348 m^3**

3.13 Development of technical standards in the petroleum sub-sector

The ERB designs standards with regard to the quality, safety and reliability of supply of energy and fuels in conjunction with the ZABS. In 2016, the ERB commenced the revision of the following standards:

a. ZS 371: ROAD TANK VEHICLES FOR PETROLEUM - BASED FLAMMABLE LIQUIDS - Specification

b. ZS 371: TRANSPORTATION OF PETROLEUM PRODUCTS: Operational Requirements for Road Tank Vehicles - Code of Practice

3.14 Challenges in the petroleum sub-sector

3.14.1 Interruption in fuel supply

During the first quarter of 2016 the country experienced an interruption of fuel supply when GRZ rejected the contaminated feedstock on 10th January 2016.

During the fuel shortages, the ERB monitored the supply of the commodity and engaged OMCs to improve access to fuel through measures which included the following:

a. Waiving of tanker driving time restrictions to extend beyond 06:00 hours to 18:00 hours threshold;

b. The Directive for fuel to be sold to motorists on demand rather than hoarding for account holders only; and

c. The Directive to licencees to guard against fuel attendants preferring to sell fuel in containers to suspected vendors at the expense of motorists.

3.14.2 Illegal fuel vending

Illegal fuel vending, which includes selling fuel without a licence and/or authorisation from the ERB, continued to be a challenge in 2016. In collaboration with other stakeholders, the ERB conducted raids on premises used for illegal fuel vending which resulted in the confiscation of the illegal fuel and prosecution of the alleged illegal fuel vendors. To further help in the curbing of illegal fuel vending, ERB continued to pursue possibilities of using fuel marking as a solution to fuel dumping, and adulteration.

3.14.3 Poor service delivery at retail service stations

In 2016, the ERB revised the grading system for service stations to include a component to adequately address additional customer expectations at service stations. This was after a review of various complaints received; and feedback from consumers indicating that the service delivery at several service stations was poor. Further, it was observed that the grading system then was purely based on technical compliance and set technical standards which however did not adequately address the deficiencies in service delivery at service stations. To address the deficiencies, the ERB among other things incorporated: the availability of compressed air pressure; general aesthetics of service stations; courtesy by attendants; and provision of services such as cleaning of windscreen and engine oil checks for customers. Consequently, the grading system now has two (2) components, that is, technical and consumer compliance.

3.15 Outlook for the sub-sector

In 2017, the petroleum sub-sector is expected to experience significant developments such as the following:

a. Situational analysis of state owned enterprises

In order to improve service delivery, efficiency and to determine the viability of state owned enterprises such as: ZESCO, INDENI and TAZAMA, GRZ through the IDC will conduct a situational analysis with a view to recapitalize enterprises that would be found to be viable and hive off non-performing ones.

b. Participation of the private sector in the procurement of fuel

In November 2016, the Minister of Finance announced through the 2017 National Budget Speech that effective 1st March 2017 that the private sector would be responsible for the procurement and financing of national fuel requirements. The new policy on private sector participation in procurement of finished products was intended to improve efficiency.

c. Review of Petroleum Act

The Petroleum Act, Chapter 435 of the Laws of Zambia will be reviewed in line with the changes in the petroleum subsector in order to align it with the key developments in the energy sector.

4.0 CONSUMER AND PUBLIC AFFAIRS

One of the functions of the ERB is to receive and investigate complaints from consumers on price adjustments, services provided by licencees and the location or construction of any energy facility. This section discusses complaints handling, consumer watch groups, toll free line and service charter.

4.1 Complaints handled

The ERB receives consumer complaints through its offices located in Chinsali, Kitwe, Livingstone and Lusaka; Toll Free Line, through the Consumer Watch Groups (CWG) and referrals from the Consumer Protection and Competition Commission (CPCC). In 2016, a total of 573 complaints were received and investigated. A total of 408 were resolved in accordance with the complaints handling procedure (see Appendix 12). The complaints resolved represented a resolution rate of 71.2 percent, against a set target of 70 percent. Table 4-1 shows the complaints handled by source.

Table 4-1: Complaints received and resolved, 2016

No.	Complaint by source	Number of complaints received	Number resolved	Resolution rate (%)
1.	ERB offices	284	176	62.0
2.	Toll Free Line	77	69	89.6
3.	Consumer Watch Group	206	159	77.2
4.	CPCC	6	6	100
Total		**573**	**408**	**71.2**

The complaints mainly related to delayed service connections, pricing of energy products and services, product quality and power outages. Of the complaints resolved, four (4) required site visits for conclusive resolution of the complaints. The site visits were on the following issues:

a. Damaged household goods due to a power surge;

b. Non-functional air pressure facility;

c. Voltage fluctuations eventually leading to damage in household appliances; and

d. Alleged damage to motor vehicles after purchasing fuel (petrol) from a retail service station.

Similarly, five (5) hearings on consumer complaints were held on the following issues:

a. Compensation claim by tenants against a power utility for the fire that gutted four (4) flats which was allegedly caused by power current fluctuations;

b. Delayed electricity service connection;

c. Wrong refuelling of a motor vehicle by a fuel attendant; and

d. Alleged refuelling of a motor vehicle with contaminated fuel.

The outcome of these hearings included the dismissal of some on account of lack of evidence, inconclusive evidence and finally, reaching an amicable solution between the parties without the involvement of the ERB.

4.2 Consumer Watch Groups

CWGs were set up primarily as an extension of the regulatory arm of the ERB in areas where it had no presence. In 2016, the operations of the CWGs were reviewed and a decision was made that effective 1st January 2017, due to expected limited resources, the number of CWGs would be scaled down, that is, from 15 to six (6).

4.3 Operation of the Toll Free line

In May 2016, the ERB changed the Toll Free Line short code from 8080 to 8484 to resolve a communication conflict on the previous short code.

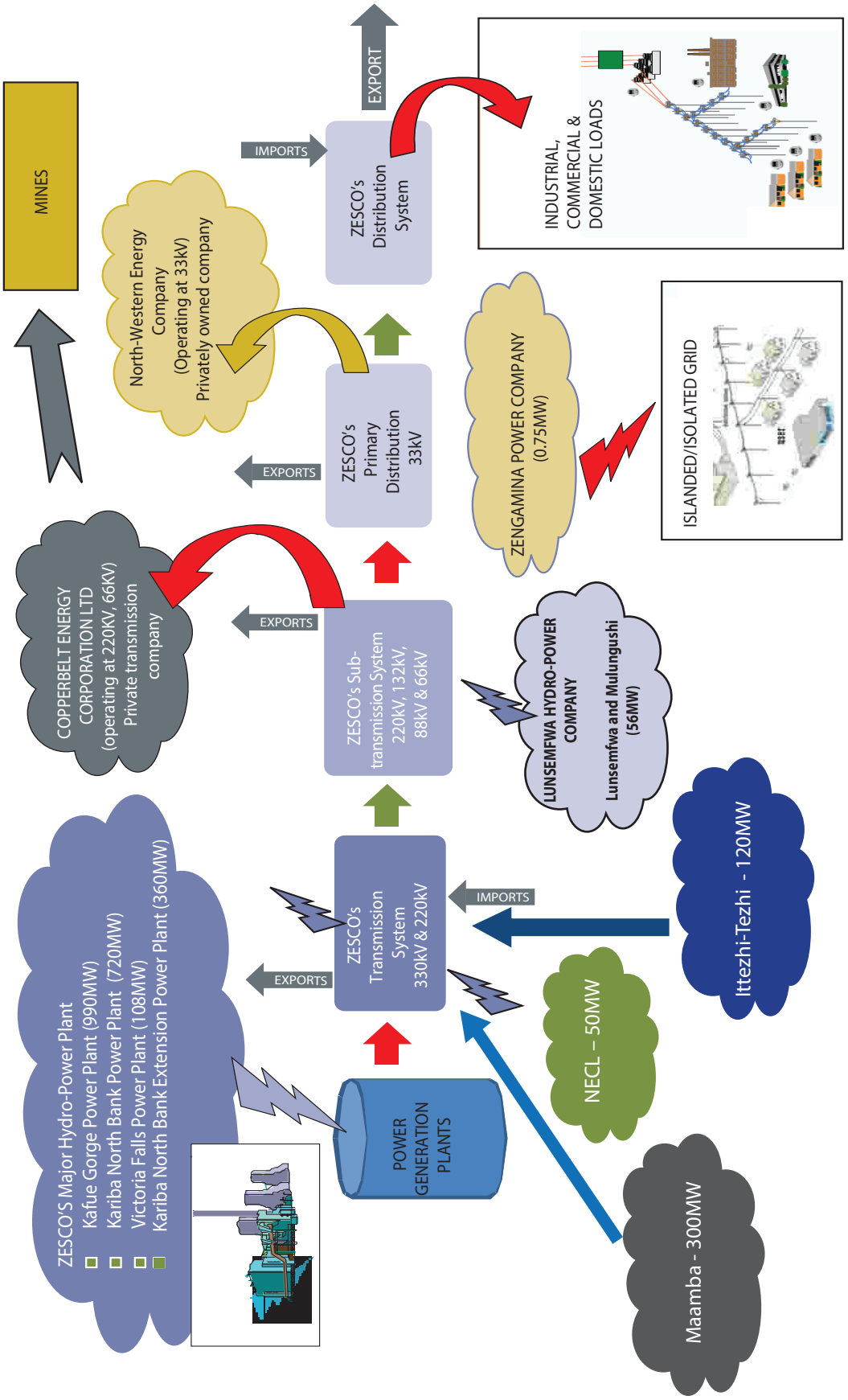
4.4 Service Charter

In 2016, in order to serve its clients better, the ERB developed a Service Charter; outlining Service Level Agreements. The objective of the Charter is to enhance operational efficiency and service delivery to the public. Under the Charter, all licensing processes, including other services offered by the ERB were assigned timelines within which the service offered must be concluded. The implementation of the Service Charter is expected in 2017.

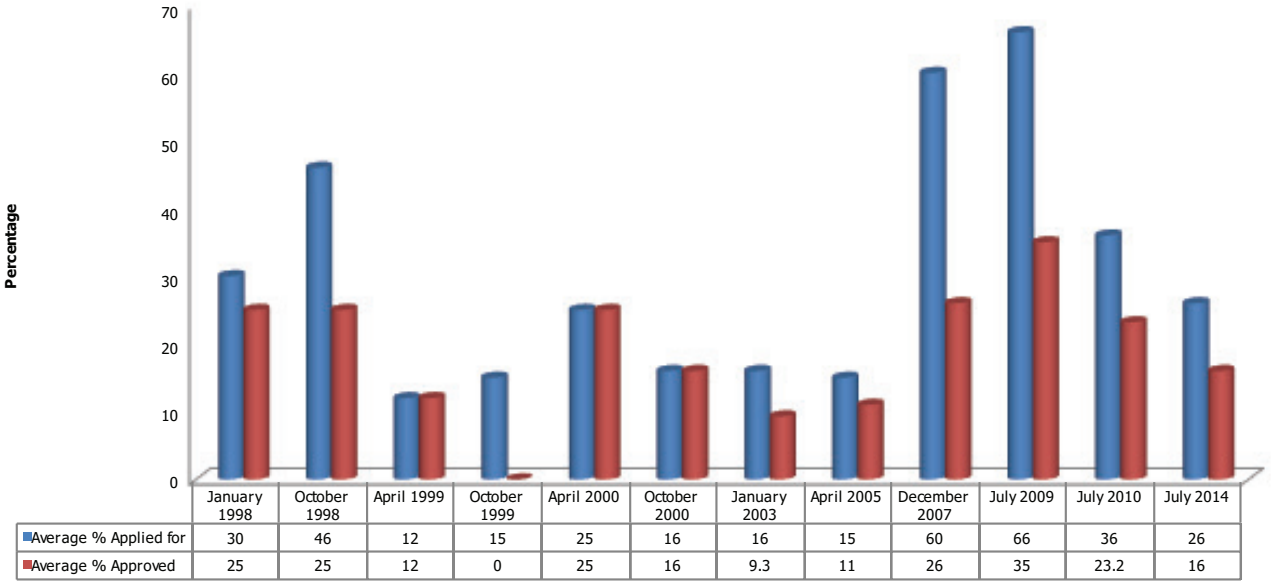
Appendix 1: National electricity generation installed capacity, 2016

Power station	Type of plant	Installed capacity
Kafue Gorge	Hydro	990.00
Kariba North	Hydro	720.00
Kariba North extension	Hydro	360.00
Victoria Falls	Hydro	108.00
Lunzua River	Hydro	14.50
Lusiwasi	Hydro	12.00
Chishimba Falls	Hydro	6.00
Shiwang'andu	Hydro	1.00
Itezhi-Tezhi	Hydro	120.00
Mulungushi	Hydro	32.00
Lunsemfwa	Hydro	24.00
Zengamina	Hydro	0.75
Total (Hydro)		**2,388.25**
Maamba Power Plant	Coal	300.00
Total (Coal)		**300.00**
Bancroft-CEC	Diesel	20.00
Luano-CEC	Diesel	40.00
Luanshya-CEC	Diesel	10.00
Mufulira-CEC	Diesel	10.00
Kabompo	Diesel	2.00
Zambezi	Diesel	1.90
Mufumbwe	Diesel	0.80
Luangwa	Diesel	2.60
Lukulu	Diesel	0.50
Chavuma	Diesel	0.80
Total (Diesel)		**88.60**
Ndola	Heavy Fuel Oil	50.00
Total (HFO)		**50.00**
Samfya	Solar	0.06
Total (Solar)		**0.06**
GRAND TOTAL		**2,826.91**

Appendix 2: Overview of the Zambian electrical power system



Appendix 3: Zambia's average electricity tariffs adjustments, 1998 – 2016

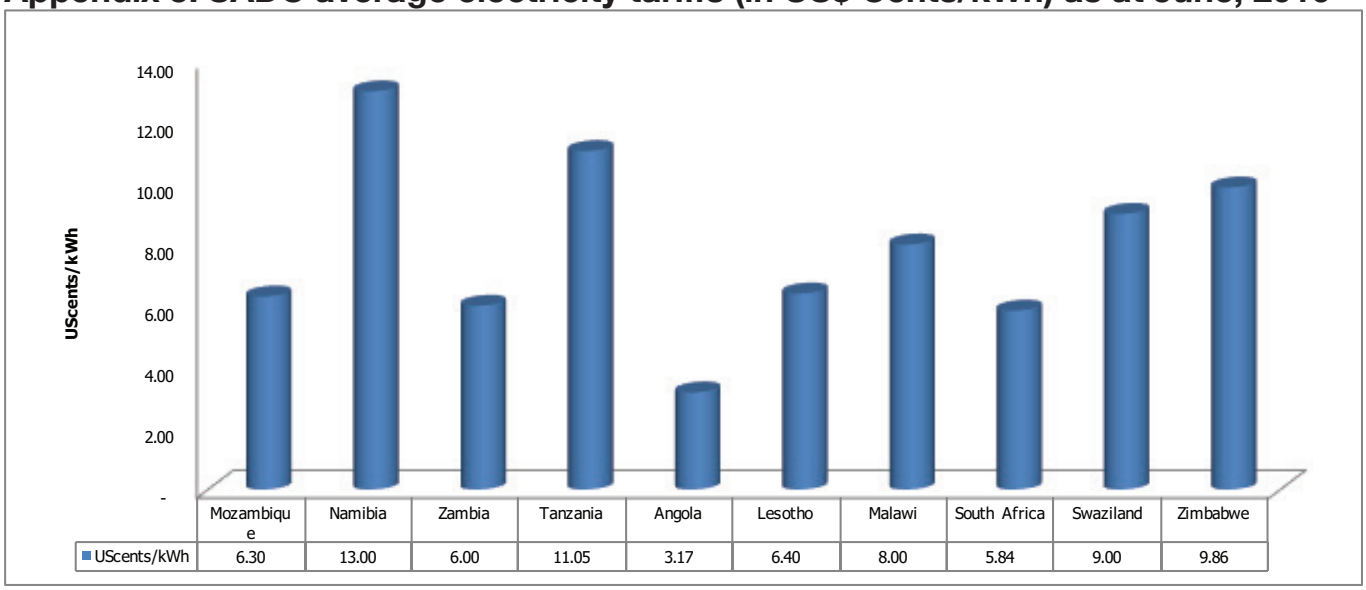


	January 1998	October 1998	April 1999	October 1999	April 2000	October 2000	January 2003	April 2005	December 2007	July 2009	July 2010	July 2014
Average % Applied for	30	46	12	15	25	16	16	15	60	66	36	26
Average % Approved	25	25	12	0	25	16	9.3	11	26	35	23.2	16

Appendix 4: Applicable electricity tariffs, 2016

CUSTOMER CATEGORY	Unit Charge	2016 Electricity Tariffs
1.METERED RESIDENTIAL(Prepaid) (capacity 15 kVA)		(K)
R1 -Consumption up-to 100kWh in a month now revised up to 300kWh	Energy charge/kWh)	0.15
R2- Consumption between 101 & 300 kWh abolished	Energy charge/kWh)	0.31
R3- Consumption to above 300kWh (R3 becomes new R2)	Energy charge/kWh)	0.51
	Fixed Monthly Charge	18.23
2.COMMERCIAL TARIFFS (capacity 15kVA)		
Commercial	Energy charge/kWh)	0.31
	Fixed Monthly Charge	55.09
3.SOCIAL SERVICES		
Schools, Hospital, Orphanages, churches, water pumping & street lighting	Energy charge K/kWh	0.28
	Fixed Monthly Charge	47.91
4.MAXIMUM DEMAND TARIFFS		
MD1- Capacity between 16 - 300 kVA	MD charge/kVA/Month	13.97
	Energy charge /kWh	0.20
	Fixed Monthly Charge	136.82
	Off-peak MD charge/kVA/Month	6.98
	Off-peak energy charge/kWh	0.15
	Peak MD charge/kVA/Month	17.46
	Peak Energy Charge/kWh	0.25
MD2- Capacity 301 to 2,000 kVA	MD charge/kVA/Month	26.13
	Energy charge /kWh	0.17
	Fixed Monthly Charge	273.62
	Off-peak MD charge//kVA/Month	13.07
	Off-peak energy charge/kWh	0.13
	Peak MD charge//kVA/Month	32.67
	Peak Energy Charge/kWh	0.21
MD3- Capacity 2,001 to 7,500kVA	MD charge/kVA/Month	41.75
	Energy charge /kWh	0.14
	Fixed Monthly Charge	579.74
	Off-peak MD charge/kVA/Month	20.87
	Off-peak energy charge/kWh	0.10
	Peak MD charge/kVA/Month	52.19
	Peak Energy Charge/kWh	0.17
MD4-Capacity above 7500kVA	MD charge/kVA/Month	41.98
	Energy charge /kWh	0.12
	Fixed Monthly Charge	1,159.50
	Off-peak MD charge/kVA/Month	20.99
	Off-peak energy charge/kWh	0.09
	Peak MD charge/kVA/Month	52.48
	Peak Energy Charge/kWh	0.14

Appendix 5: SADC average electricity tariffs (in US$ Cents/kWh) as at June, 2016



Source: Regional Electricity Regulatory Association [10]

[10] So urce for the electricity tariffs is the Regional Electricity Regulators Association (RERA) June 2016. Note: the tariffs are for comparative purposes only as the actual end user tariffs depend on the market structure in each country. Namibia and South Africa relate to wholesale tariffs.

Appendix 6: ZESCO Key Performance Indicators, 2016

No.	KPI and Weight (%)	Sub KPI	Target	Actual Performance	Comment
1.	**Metering Customer (10%)**	Metering new connections	ZESCO is required to meter all new connections upon connection.	All new connections during the period under review were metered upon connection.	Target achieved
		Un-metered customers	ZESCO is required to clear the backlog of all un-metered customers.	There was no backlog of unmetered customers in 2016.	Target achieved
		Average quotation time	ZESCO is required to issue a quotation within 30 days for all types of connections after an application is lodged.	ZESCO recorded 11 days annual average duration for quotation time.	Target achieved
		Connection time	ZESCO is required to connect a customer within 30 days of payment.	ZESCO recorded 45 days annual average connection time.	Target not achieved
		Customer Metering Percentage Score		**8.13%**	
		Indicator was not fully achieved			
2.	**Cash Management (20%)**	Non-GRZ debtor days	ZESCO is required to reduce non-GRZ debtor days to not more than 60 days.	ZESCO's Non-GRZ debtor days stood at 1,056 days as at 31st December 2016.	Target not achieved
		GRZ debtor days	ZESCO is required to reduce GRZ debtor days to not more than 90 days.	ZESCO's GRZ debtor days stood at 386 days as at 31st December 2016.	Target not achieved
		Cash Management Percentage Score		**15.38%**	
		Indicator was not achieved. However, credit was given for the reduction of debtors from the prior periods hence the score given.			
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 annual average ratio of 65:1.	Target not 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 annual average ratio of 124:1.	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 annual average ratio of 108:1.	Target achieved
		Northern Division Customer-Employ ratio	ZESCO is required to maintain a Northern Division customer-employee ratio of 100:1 or better.	ZESCO achieved a Northern Division customer-employee annual average ratio of ratio of 72:1.	Target not achieved

Appendix 6: ZESCO Key Performance Indicators, 2016 *Continued*

No.	KPI and Weight (%)	Sub KPI	Target	Actual Performance	Comment
		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 annual average ratio of 89:1.	Target not achieved
		Staff Costs	ZESCO is required to Reduce staff costs to 45% or less as a share of total operations and maintenance costs (O&M).	ZESCO's annual staff costs stood at 21% of total annual O&M costs.	Target achieved
		Staff productivity Percentage Score		**11.13%**	
		Indicator was not fully achieved.			
4.	**Quality of Service Supply (20%)**	**SAIDI**[11]	ZESCO is required to maintain the Dry Season (DS) System Average Interruption Duration Index (SAIDI) at 27 hours or less.	ZESCO recorded annual average SAIDI of 167 hours per customer	Target not achieved
		SAIFI[12]	ZESCO is required to maintain the System Average Interruption Frequency Index (SAIFI) of 5 times or less.	ZESCO recorded annual average SAIFI of 13 times.	Target not achieved
		CAIDI[13]	ZESCO is required to maintain the Customer Average Interruption Duration Index (CAIDI) at 5 hours or less	ZESCO recorded annual average CAIDI of 13 hours.	Target not achieved
		ASAI[14]	ZESCO is required to maintain the Average System Availability Index (ASAI) at 90% or better.	ZESCO recorded annual average ASAI of 77%.	Target not achieved
		Quality of Service Percentage Score		**0%**	
		Indicator was not achieved.			
5.	**System Losses (10%)**	Distribution Losses	ZESCO is required to maintain distribution losses at 12% or better per quarter.	ZESCO recorded annual average distribution losses of 10%.	Target achieved
		System Losses Percentage Score		**10%**	
		Indicator fully achieved			

[11] SAIDI refers to the average outage duration for each customer served.
[12] SAIFI refers to the frequencies of interruptions per customer.
[13] CAIDI refers to the average duration of a power supply outage.
[14] ASAI refers to availability of a given power system.

Appendix 6: ZESCO Key Performance Indicators, 2016 *Continued*

No.	KPI and Weight (%)	Sub KPI	Target	Actual Performance	Comment
6.	**Power Generation (10%)**	Unit capability factor (UCF)[7]15 for large hydro plants	ZESCO is required to maintain a generation UCF for large hydro power plants at 80% or better per quarter.	ZESCO recorded annual average UCF of 88.89 % 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 per quarter.	ZESCO recorded annual average UCF of 87.87% for small hydro power plants.	Target achieved
		Power generation Score percentage Score		**10%**	
		Indicator fully achieved			
7.	**Safety (5%)**	Fatality	ZESCO is required to ensure that no fatalities are experienced on account of its negligence.	ZESCO recorded a total of five (5) fatalities in 2016.	Target not achieved
		Lost time injury	ZESCO is required to ensure that no Life Threatening Injuries (LTIs) occur on account of its negligence.	ZESCO recorded a total of 54 LTIs in 2016.	Target not achieved
		Safety Percentage Score		**0.75%**	
		Indicator was not achieved. However some marks were awarded for recording zero fatality in the third quarter of 2016			
8.	Customer Complaint **(10%)**	Complaint resolution rate	ZESCO is required to maintain a total customer complaint resolution rate of 90% or better for all reported complaints per quarter.	ZESCO's recorded annual average customer complaint resolution rate of 94%.	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 2.1 days for replacement of faulty meters.	Target achieved
		Customer complaints Percentage Score		**10%**	
		Indicator fully achieved.			
Total Score				**65.39%**	

[15] UCF refers to the ratio of actual to potential output of a given power plant.

Appendix 7: Licensing procedure

The following were the steps under the licensing procedure in place in 2016:

1. Once an Applicant submits a Licence application, the Legal Department assesses the application to determine whether the activity applied for is one that requires licensing under the Energy Regulation Act, Chapter 436 and the Electricity Act, Chapter 433 of the laws of Zambia;

2. Upon being satisfied that an application has been duly lodged and that the activity applied for is one authorized by the relevant legislation, the application is forwarded to the Directorate of Technical Regulation for a technical assessment and the Directorate of Economic Regulation for a financial assessment;

3. Where an application is not duly lodged or the activity applied for is not regulated by the ERB, the Applicant is informed in writing of any additional information required or that the activity applied for is not subject to regulation;

4. Where an application has been forwarded to the Directorate of Technical Regulation, a technical assessment of the application is carried out by way of inspection of the Applicant's energy facility in order to determine whether or not the Applicant is technically capable of carrying out the activity applied for;

5. In an event that the technical assessment of an application is not successful, the Applicant is notified of the technical anomalies of the energy facility inspected which need to be addressed;

6. It is worth noting that the purpose of a financial assessment of a licence application is to determine the financial capability of the Applicant to carry out the licensed activity and to determine the licence application fee for the activity applied for;

7. The application is, where a financial assessment is successful, subsequently referred to the Executive Director for approval of the assessment/ application fee;

8. After the Executive Director approves the assessment/application fee, the application is submitted to the Director of Finance who causes an invoice to be issued to the Applicant;

9. Once an invoice is issued, the Applicant is notified in writing of the licence application fee to be paid to the Ministry of Finance – Energy Regulation Board Revenue Account within 14 days of the date of receipt of the invoice;

10. Upon payment of the application fee, a search to verify the shareholding structure and status of registration is conducted at the Patents and Companies Registration Agency.

11. Administratively, the Applicant may be issued with a Provisional Licence upon request from the Applicant.

12. Thereafter a Notice of Intention to Issue a Licence for Executive Director's approval is prepared and once approved, the Notice is published in the GRZ Gazette for thirty (30) days inviting members of the public to present objections (if any) to the issuance of a licence to the listed Applicants; and

13. In the event that there are no objections to the licence application gazetted, the Board approves the issuance of a standard licence to the Applicant and the Board decision to issue or not to issue a licence is communicated to the Applicant within 14 days of the date of the Board decision.

Appendix 8: Imports of petroleum feedstock imports, 2015 - 2016

Cargo name	Month	Tonnage (metric tonnes)
MT. Euro Strength II	January 2015	92,900.00
MT. Euro Strength III	March 2015	92,600.00
MT. Phoenix Concord	April 2015	90,000.00
MT. Ambrosia	June 2015	91,903.00
MT. Spike	July 2015	89,100.00
MT. Nectar	September 2015	95,187.00
MT. Alberta	December 2015	91,490.00
Total		**643,180.00**
MT. Argos	March 2016	90,000.00
MT. Signal Puma	May 2016	92,569.00
MT. Afra Oak	June 2016	93,970.00
MT. Leyla K.	September 2016	102,330.06
MT. Desh Mahima	December 2016	105,018.00
Total		**483,887.06**

Appendix 9: Petroleum value chain

Oil Rig

Tazama tank farm at Dar-es-salaam

Feedstock cargo ship at Dar-es-salaam

Tazama pipeline 1710km

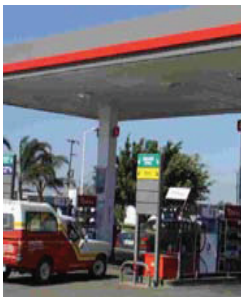
Finished products from region

Indeni Refinery

Ndola Fuel Terminal

Rail

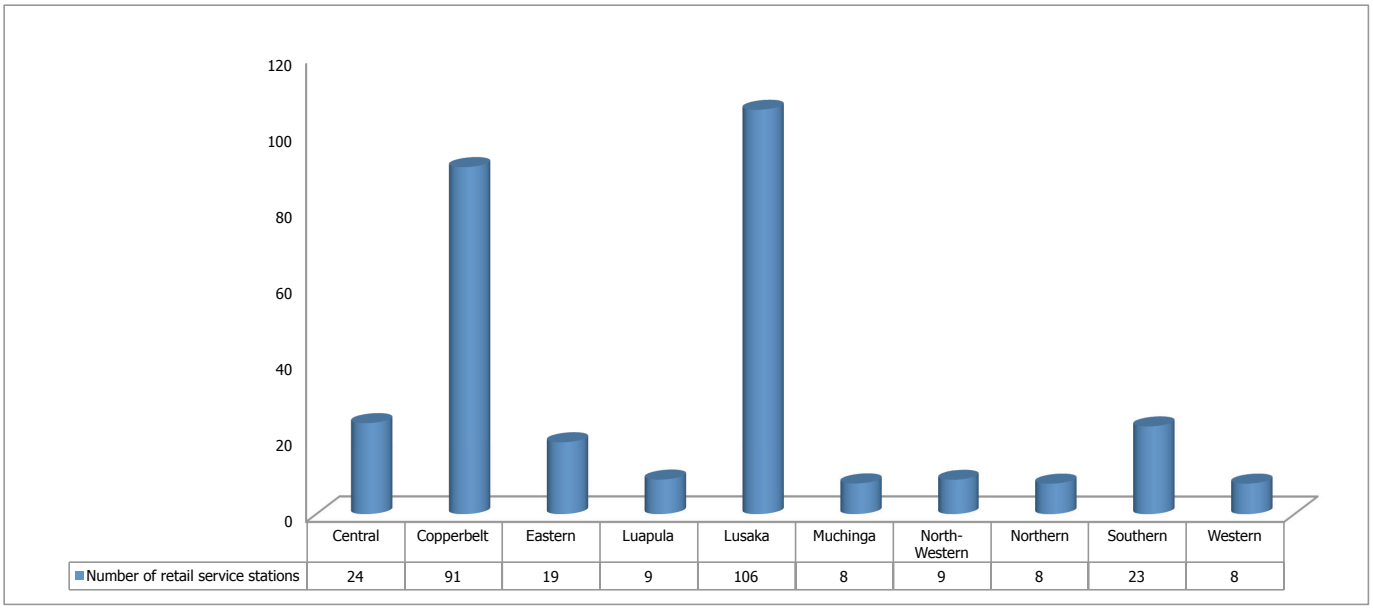
Filling station



Road

Industry

Appendix 10: Provincial retail service station network, 2016



	Central	Copperbelt	Eastern	Luapula	Lusaka	Muchinga	North-Western	Northern	Southern	Western
Number of retail service stations	24	91	19	9	106	8	9	8	23	8

Appendix 11: Cost – Plus Pricing Model

The Wholesale Price Build up

The ERB uses the CPM to determine the wholesale price of all the refined products at INDENI and the pump prices for petrol, diesel, low sulphur gasoil and kerosene. In arriving at these prices, the model takes into account the attendant costs incurred along the petroleum supply chain from the port of discharge in Dar-es-salaam to the INDENI where the feedstock is processed up to NFT where the product is stored and sold. The Table below shows the different cost elements up to the wholesale price.

Cost elements upto the wholesale price

No.	COST ELEMENT	UNIT COST	BASIS
1.	Cost-Insurance-Freight (US$/MT)		Contract/Supplier Invoice
2.	Ocean Losses	0.30%	Best Practice
3.	Wharfage	1.25%	Tanzanian Harbour Authority
4.	Finance Charges	4.00%	Financier
5.	Collateral Manager (US$/MT)	0.39	Stock Monitoring Agreement
6.	Insurance	0.15%	Insurer
7.	TAZAMA Storage Fee (US$/MT)	2.00	TAZAMA
8.	TAZAMA Pumping Fee (US$/MT)	54.00	Approved ERB Pumping Tariff
9.	TAZAMA consumption & pipeline losses	1.48%	Determined by ERB
10.	Agency Fee (US$/MT)	5.00	Agency Agreement
11.	Refinery Fee (US$/MT)	60.38	Approved ERB Processing Fee
12.	Refinery Consumption and Processing Losses	9%	Determined by ERB
13.	Terminal Losses (LPG, Petrol, Diesel/ Kerosene/Jet A-1/HFO, respectively)	1%, 0.5%, 0.3%	Best Practice

The cost elements of the wholesale price build-up are discussed below.

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, Tanzania. The quantities of the constituent components of the petroleum feedstock, which include Crude Oil, Condensate, Naphtha and Gas oil, are multiplied by the unit costs to derive the total monetary cost of the feedstock.

The information is obtained from the supplier's invoice which is based on the contract between GRZ and the oil supplier and ultimately used to compute a profitability statement.

ii. Ocean losses

The 0.3 percent ocean loss is based on international best practice. This is the acceptable loss incurred during loading and offloading of petroleum feedstock and petroleum products from a vessel.

iii. Wharfage

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

Appendix 11: Cost – Plus Pricing Model *Continued*

iv. Finance charges

A financing charge of 4 percent to cover the cost of financing the cargo, particularly the letter of credit (LC) costs, and the cost of refinancing for liabilities that remain un-discharged after payment has been effected through the LC.

v. Collateral management fees

Collateral management fees are set at US$0.39/MT. The financier employs the services of a collateral manager in order to secure their interests. The financier usually holds the petroleum feedstock and petroleum products as collateral, so the collateral manager has to manage the stocks. The basis for providing the fees is stipulated in the "Stock Monitoring Agreement" signed between the collateral manager, the financier and the GRZ agent.

vi. Insurance

The insurance costs set at 0.15 percent of CIF. The insurance covers the cost of insuring the feedstock from the Dar-es-Salaam to Ndola.

vii. TAZAMA storage fee

TAZAMA charges US$2/MT/month 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 charge was agreed upon between TAZAMA and the GRZ.

viii. TAZAMA pumping fee

TAZAMA charges US$54.00/MT to the importer for transporting petroleum feedstock through the pipeline from the Dar-es-Salaam tank farm to the refinery in Ndola.

ix. TAZAMA consumption and pipeline losses

Consumption and losses for TAZAMA are currently set at 1.48 percent. The losses comprises consumption at 0.83 percent based on the consumption level of 10 litres/MT of petroleum feedstock for the pumping engines at the pumping stations and allowable losses at 0.65 percent.

x. Agency fee

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

xi. Processing fee

INDENI charges a processing fee of US$60.38/MT for refining (processing) petroleum feedstock. This fee is approved by the ERB on the basis of licencees' revenue requirement.

xii. Refinery consumption and processing losses

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

a. Normal processing losses; and
b. Consumption, as some quantities are consumed as fuel in the process.

Appendix 11: Cost – Plus Pricing Model *Continued*

The consumption and losses are set at 9 percent; that is, 8.4 percent relates to consumption with the balance of 0.6 percent relating to losses.

xiii.Terminal losses

These are terminal losses as prescribed by international norms and best practice. A loss level of 0.5 percent is allowed for petrol whilst a loss of 0.3 percent has been allowed for diesel, kerosene, jet A-1 and HFO covering handling and storage losses. A loss of 1 percent is provided for LPG.

The Retail Pump Price Build-up

The build-up to the retail pump price constitutes the terminal fee; respective statutory excise duty on the different products; the OMC, Dealer and transporters margins (as determined by the ERB); the ERB fees of 0.7 percent of turnover; the Strategic Reserves Fund (SRF) fees (for infrastructure development in the sector and procurement of strategic reserves); and Value Added Tax (VAT) on products. The Table below gives an outline of these costs up to the retail pump price, based on prices as at 31st December, 2016.

Cost elements in the retail pump price build-up, 31st December 2016

No.	DETAILS	UNIT COSTS	WORKINGS
1.	Wholesale price to OMC	K8.28, K7.67, K6.67 & K9.63 per litre each for petrol, diesel, kerosene and LSG, respectively.	**a**
2.	Terminal fee	K0.025/litre	**b**
3.	Marking fee	K0.10/litre	**c**
4.	Excise duty (incl.) road levy	K1.97 for Petrol/litre, K0.62/litre for Diesel and LSG, K0/litre for Kerosene	**d**
5.	Ex-NFT/fuel depot		**E=(a+b+c+d)**
6.	Transport cost	K0.26 for Petrol, K0.26 for Diesel, K0.09 for Kerosene and K0.26 for LSG	**f**
7.	OMC margin	K0.56/litre	**g**
8.	Total (Excluding VAT)		**h=(e+f+g)**
9.	Dealer margin	K0.38/litre	**i**
10.	Price to dealer		**j= (h+i)**
11.	ERB fees	0.7%	**k**
12.	SRF fees	K0.15/litre for Petrol, Diesel and Kerosene	**l**
13.	Price before VAT		**m=(j+k+l)**
14.	VAT	16%	**n**
15.	Uniform Pump Price	K13.70, K11.40, K8.03 & K13.69 per litre each for petrol, diesel, kerosene and LSG, respectively.	**o=(m+n)**

Appendix 12: Complaints handling procedure

Type of complaint	Time-frames for resolving the complaint
Complaints in the electricity sub-sector	
Connection to Supply	5 – 30 working days, depending on nature of works prescribed under ZS 397
Unplanned Interruptions	Up to 48 hours
Billing	10 working days
Faulty Meters	15 working days
Poor Voltage	30 working days
Disconnection	Within 24 hours after payment of outstanding bill
Wrong Tariffs	30 working days
Compensation Claims	60 working days
Other Complaints	Up to 30 working days
Complaints in the petroleum sub-sector	
Pump prices (Fuel price per litre)	Up to 48 hours
Poor Quality of Fuel	30 working days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