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MISSION STATEMENT
To regulate the energy sector in a fair, transparent and predictable manner that safeguards the interests of all stakeholders

THEME
Promoting and Sustaining Investment in the Energy Sector
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Namakando Mukelabai — Statistician
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bbl</td>
<td>Barrels</td>
</tr>
<tr>
<td>CEC</td>
<td>Copperbelt Energy Corporation Plc</td>
</tr>
<tr>
<td>CoS</td>
<td>Cost of Service</td>
</tr>
<tr>
<td>CSO</td>
<td>Central Statistical Office</td>
</tr>
<tr>
<td>ERB</td>
<td>Energy Regulation Board</td>
</tr>
<tr>
<td>ESI</td>
<td>Electricity Supply Industry</td>
</tr>
<tr>
<td>GCTC</td>
<td>Grid Code Technical Committee</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GWh</td>
<td>Giga-Watt hour (1,000 MWh)</td>
</tr>
<tr>
<td>GRZ</td>
<td>Government of the Republic of Zambia</td>
</tr>
<tr>
<td>HFO</td>
<td>Heavy Fuel Oil</td>
</tr>
<tr>
<td>KNB</td>
<td>Kariba North Bank</td>
</tr>
<tr>
<td>IPP</td>
<td>Independent Power Producer</td>
</tr>
<tr>
<td>KM</td>
<td>Kilo metre</td>
</tr>
<tr>
<td>kV</td>
<td>Kilo Volt (1,000 volts)</td>
</tr>
<tr>
<td>kVA</td>
<td>Kilo Volt amperes (1,000 amps)</td>
</tr>
<tr>
<td>kW</td>
<td>Kilo watt</td>
</tr>
<tr>
<td>kWh</td>
<td>Kilo Watt Hour (1,000 kWh)</td>
</tr>
<tr>
<td>LFO</td>
<td>Light Fuel Oil</td>
</tr>
<tr>
<td>LHPC</td>
<td>Lunsemfwa Hydro Power Company Limited</td>
</tr>
<tr>
<td>LPG</td>
<td>Liquefied Petroleum Gas</td>
</tr>
<tr>
<td>MD</td>
<td>Maximum Demand</td>
</tr>
<tr>
<td>MMEWD</td>
<td>Ministry of Mines, Energy and Water Development</td>
</tr>
<tr>
<td>MW</td>
<td>Mega Watt</td>
</tr>
<tr>
<td>MWh</td>
<td>Megawatt hour (1,000 kWh)</td>
</tr>
<tr>
<td>MT</td>
<td>Metric Tonne</td>
</tr>
<tr>
<td>M³</td>
<td>Cubic Meter</td>
</tr>
<tr>
<td>MVA</td>
<td>Mega Volt Amperes</td>
</tr>
<tr>
<td>NWEC</td>
<td>North Western Energy Corporation Limited</td>
</tr>
<tr>
<td>NECL</td>
<td>Ndola Energy Company Limited</td>
</tr>
<tr>
<td>NFT</td>
<td>Ndola Fuel Terminal</td>
</tr>
<tr>
<td>OMC</td>
<td>Oil Marketing Company</td>
</tr>
<tr>
<td>REA</td>
<td>Rural Electrification Authority</td>
</tr>
<tr>
<td>RERA</td>
<td>Regional Electricity Regulators Association of Southern Africa</td>
</tr>
<tr>
<td>SADC</td>
<td>Southern African Development Community</td>
</tr>
<tr>
<td>SAPP</td>
<td>Southern African Power Pool</td>
</tr>
<tr>
<td>ZESCO</td>
<td>ZESCO Limited</td>
</tr>
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</table>
ACKNOWLEDGEMENTS

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- Bank of Zambia
- Copperbelt Energy Corporation Plc
- INDENI Petroleum Refinery
- Lunsemfwia Hydro Power Company
- Ministry of Finance
- Ndola Energy Company Limited
- Ndola Fuel Terminal
- North Western Energy Corporation Limited
- Office for Promotion of Private Power Investment
- Oil Marketing Companies too many to mention individually
- Regional Electricity Regulators Association of Southern Africa
- Rural Electrification Authority
- Southern African Power Pool
- TAZAMA Pipelines Limited
- TAZAMA Petroleum Products Limited
- Zengamina Power Limited
- ZESCO Limited
The provision of sufficient quality energy services and products remains a key driver of economic development. However, the existing capacity constraints in the energy infrastructure in Zambia still pose a challenge to expanding energy access. In view of these challenges, the Energy Regulation Board (ERB) continues to facilitate the development of energy infrastructure in generation; transmission; distribution and supply in the Electricity Sub-sector. Meanwhile, the guarantee for security of supply of petroleum products and services is being attained through the rehabilitation and building of new infrastructure in refining; storage and distribution.

With these developments, the energy generation mix in the Electricity Sub-sector is poised to shift from predominantly hydro to other sources such as renewable energy and coal. In the Petroleum Sub-sector, the building of storage facilities in provincial centres will, in general, significantly contribute to the reduction in the cost of transportation of petroleum products.

Despite on-going developments, Zambia continues to experience electricity and petroleum capacity constraints that may adversely affect long-term development prospects. On the electricity front, it has been recognized that low tariffs have adversely impacted on the inadequate past investments in electricity infrastructure especially in the generation and transmission sectors. Meanwhile, on the petroleum front, there is still continued debate on why the prices of petroleum products are comparatively high in the region and how best Zambia can streamline the petroleum supply value chain.

Furthermore, the ERB is undertaking comprehensive reviews of the pricing of energy services and products in order to make them more responsive to market needs. The other critical aspect in the industry that the ERB is focusing on is the quality of products and services. In this respect the ERB has embarked on physical infrastructure inspections, on-the-spot sample testing of petroleum products and performance audits of utilities in addition to enforcement actions targeting non-compliant licensees. All these actions are aimed at improving the provision of energy services and products.

This edition of the Energy Sector Report covers developments that have taken place over the past two years, that is, 2012 and 2013. The publication builds on the previous annual publications. The publication provides an opportunity for Government; electricity and petroleum utilities; and all stakeholders to get a quick insight on the state of the energy sector in Zambia especially with regard to statistical information and data; opportunities; challenges and future prospects. This publication is, therefore, very essential and ERB has committed that it will make it comprehensive and available timely.

With the continued support from Government and Cooperating Partners, the ERB will commit to enhance the scope, depth of analysis and timeliness of future publications.

I would like to thank all the stakeholders who were consulted for their good cooperation in providing the data and information used in this publication. It is the ERB’s trust that stakeholders and the general public as a whole will find this publication valuable.

Langiwe H. Lungu (Ms)
Executive Director
September 2014
PREAMBLE

The Energy Sector Report (ESR) is an annual publication of the Energy Regulation Board (ERB) that provides an in-depth analysis of the electricity and petroleum sub-sectors in Zambia. The report provides statistical information and discusses the performance, developments, challenges and prospects in the energy industry.

This report, which is limited to 2012 and 2013, is arranged as follows: the first section introduces the report by providing an overview of the mandate of the ERB, performance of the Zambian economy and overview of the energy sector. The second section discusses, in detail, the electricity sub-sector while the third and last section discusses the petroleum sub-sector.
1 SITUATIONAL OVERVIEW

1.1 THE MANDATE OF THE ENERGY REGULATION BOARD

The Energy Regulation Board (ERB) is an autonomous statutory body established under the Energy Regulation Act of 1995, Chapter 436 of the Laws of Zambia, to regulate the energy sector in Zambia. The ERB commenced operations in February 1997. The mandate of the Energy Regulation Board is to regulate the energy sector in line with the provisions of the Energy Regulation Act Cap 436 of the Laws of Zambia. Specifically, the ERB’s statutory functions are as follows:

i. Issue licenses;
ii. Monitor the efficiency and performance of the licensed undertakings;
iii. Receive and investigate complaints from consumers;
iv. Approve the location and construction of, and receive and investigate complaints concerning the location or construction of any common carrier or any energy or fuel facility or installation or the carrying out of any works by any undertaking and regulate such location and construction by the attachment of appropriate conditions to licences held by undertakings;
v. In conjunction with the Competition and Consumer Protection Commission established under the Competition and Fair Trading Act Cap 417:
   - Investigate and monitor the levels and structures of competition within the energy sector with a view to promoting competition and accessibility to any company or individual who meets the basic requirement for operating as a business in Zambia, and
   - Develop and implement appropriate rules to promote competition in the energy sector;
vi. In conjunction with the Zambia Bureau of Standards established under the Standards Act Cap 416, design standards with regard to the quality, safety and reliability of supply of energy and fuels;
vii. In conjunction with the Zambia Environmental Management Agency establishment under the Environmental Protection and Pollution Control Act Cap 204, formulate measures to minimise the environmental impact of the production and supply of energy and the production, transportation, conversion, storage and use of fuels and enforce such measures by the attachment of appropriate conditions to licences held by the undertaking; and
viii. Make recommendations to the Minister as to the measures to be undertaken through regulations to be made under the Act.

The ERB has offices in Lusaka, and Northern and Southern Regions in Kitwe and Livingstone respectively. The headquarters covers Lusaka, Central, and Eastern Provinces while the Northern Region Office covers Copperbelt, North Western Luapula, Northern, and Muchinga Provinces. The Southern Region Office covers Southern and Western Provinces.

1.2 DEVELOPMENTS IN THE DOMESTIC ECONOMY

Zambia’s economy has been growing in the last decade especially in the tourism, mining, construction, and agriculture sectors and prospects for further development are enormous. The outlook for the Zambia economy remains favourable in the medium term, underpinned by robust growth and single-digit inflation.

The economy was projected to grow at 6.9% in 2012, picking up to 7.3% in 2013, while inflation has remained within single digits, at around 8% in both years. However, in 2012 and 2013 the economy grew by 7% and 6.5% respectively. The decrease in 2013 was largely driven by a poor agricultural harvest, slowdown in mining investment which affected allied industries such as transportation; construction and energy. In the medium term, growth is projected at 7.1% in 2014 and 7.4% in 2015 while inflation is expected to fall below the 2013 level (Zambia Outlook Report, AfDB, 2013).
Overall, Zambia’s economy has experienced strong growth in recent years, with real Gross Domestic Product (GDP) growth in 2005-13 of more than 6% per year. In 2012-2013, Zambia made monetary regulatory changes that included Statutory Instrument (SI) Number 33 (mandatory use of the Kwacha for domestic transactions) and SI Number 55 (monitoring foreign exchange transactions). Along with problems of fiscal management of these measures and weakening global copper prices, these SI’s were perceived as undermining confidence in the economy and currency, leading to sharp depreciation of the kwacha immediately after implementation.

The country, however, still remains vulnerable to external shocks. The sluggish global economy recovery poses a concern for its key mining exports. Zambia’s dependency on copper makes it vulnerable to depressed commodity prices.

1.3 OVERVIEW OF THE ENERGY SECTOR

1.3.1 ELECTRICITY SUB-SECTOR

In 2013, the national power consumption stood at 10,845 GWh compared to 10,317.4 GWh in 2012, depicting an increase of 5%. For the period 2011 to 2012, national consumption increased by 28% from 8,037 GWh in 2011 to 10,317.4GWh in 2012.

Zambia has abundant hydroelectric resources and meets most of its electricity energy needs from its own hydroelectric stations. Installed electricity generation capacity is about 2,000 MW out of which about 1,900MW is hydropower, despite undeveloped generation capacity being in the excess of 6,000 MW. The key players in the sector are ZESCO Limited, responsible for the bulk of generation, transmission, distribution and supply. There is the Copperbelt Energy Corporation (CEC) that distributes powers to the mines based on the Copperbelt Province and Lunsemfwa Hydropower Company (LHPC) that is an electricity generation company.

During the last decade, the energy sector has continued to grow and subsectors like electricity have contributed between 3-5% to GDP per year (CSO, 2012). Growth in demand for electricity has outstripped supply as evidenced by increased loading shedding during 2012 to 2013. Access to electricity has continued to remain low at a national level (approximately 22%) while access in rural areas remained at about 5%. Meanwhile, Government continued to work with the private sector to enhance access, energy infrastructure, development and distribution. The most significant projects being the Itezhi-Tezhi, Kafue Gorge Lower power stations and the Kariba North Bank power station. Figure 1.1 shows the major players in the Zambian electrical power system.
FIGURE 1.1: ZAMBIAN ELECTRICAL POWER SYSTEM OVERVIEW
1.3.2 PETROLEUM SUB-SECTOR

Zambia has an over dependency on crude oil imports which directly affects growing sectors like manufacturing; construction; mining; tourism and agriculture. With ever-rising crude oil prices, for example, from US$76.6/bbl in 2010 to US$105/bbl in 2013, there is now substantial demand for cheaper and environmentally friendly forms of energy that can be produced locally.

Zambia has no known proven reserves of crude oil and therefore imports all its fuel requirements. The importation is in two modes, namely, the petroleum feedstock importation mode through the 1,710 km long TAZAMA pipeline from the port of Dar-es-Salaam in Tanzania to Ndola in Zambia for refining at INDENI refinery. The other mode of importation is through road and rail.

The petroleum feedstock imported is specifically tailored to the configuration of the INDENI Refinery and is best suited to meeting the needs of the Zambian market. The refinery is not configured to process pure crude oil but is configured to process a spiked or commingled feedstock which typically comprises pure crude oil, condensate, naphtha and gasoil (diesel). Figure 1.2 shows the key players in the Zambian fuel supply value chain.

FIGURE 1.2: PLAYERS IN THE FUEL SUPPLY VALUE CHAIN
As depicted in figure 1.2, the major upstream players are TAZAMA, INDENI Refinery Limited and Ndola Fuel Terminal. On the downstream the key players are the Oil Marketing Companies (OMC’s); Transporters; and Dealers. The key petroleum products on the Zambian market are: diesel, petrol, kerosene, jet A-1, heavy fuel oil (HFO), liquefied petroleum gas (LPG), low sulphur gas oil (LSGO), bitumen and lubricants. Of these products, LSGO, bitumen and some lubricants are imported while the rest are produced by INDENI and, if need be, are also imported.

1.4 DEVELOPMENT PROSPECTS

Developments in the energy sub-sectors have increased the demand for supply of energy products and services. This has created pressure on the ERB to achieve cost reflective energy prices to enhance reliability and quality of service.

The growth in demand is estimated to be between 150 MW and 200 MW per year, meaning that the demand for electricity will exceed 2,000 MW per year by 2015 (Electricity Demand Forecast in Zambia 2005 to 2020, MEWD, 2010). The demand for electricity has been growing at 3% per year, however our country is experiencing a deficit of between 150 MW and 200 MW during peak time.

The power deficit in the recent past has provided an opportunity to investors to venture in power generation and transmission projects. Investment opportunities also exist in the exploration and production of petroleum resources; coal exploration and mining and the development of renewable energy sources that are supported by the National Energy Policy.
2 ELECTRICITY SUB-SECTOR

This section discusses the structure of the electricity industry, development, prospects and challenges during the periods under review.

2.1 ELECTRICITY GENERATION IN 2012 AND 2013

Zambia’s electricity generation mix is pre-dominated by hydro generation which accounts for more than 93%. The balance of the generation mix is diesel, gas, solar and Heavy Fuel Oil (HFO). The hydro generation mix comprises major and mini power stations. ZESCO owns the bulk of the generation stations while the rest are owned by Independent Power Producers (IPPs). By end of December 2013, there were three (3) main IPPs, namely Lusemfwa Hydro Power Company (LHPC), Copperbelt Energy Corporation (CEC) Plc and Ndola Energy Company Limited (NECL). The total installed capacity, in 2013, was 2,038MW broken down as follows: hydro 1,898MW; gas turbine 80MW; diesel 11MW; HFO 50MW and solar 0.06MW.

2.1.1 GENERATION FROM MAJOR HYDRO POWER STATIONS

The major hydro power stations are owned by ZESCO and these are: Kafue Gorge; Kariba North Bank; and Victoria Falls. The installed capacity for each of these plants was 990MW, 720MW and 108MW for Kafue Gorge, Kariba North Bank and Victoria Falls respectively. During the years under review, total generation output from these major hydro power stations increased by 8% and 4% in 2013 and 2012 respectively, that is, increasing to 12,780 GWh in 2013 from 11,854 GWh in 2012 and increasing to 11,854GWh in 2012 from 11,381GWh\(^1\) in 2011. Figure 2.1 shows the generation trend from ZESCO’s three major hydro power plants from 2009 to 2013.

\(^1\) Gigawatt hours, abbreviated as GWh, is a unit of energy representing one billion watt hours and is equivalent to one million kilowatt hours.)
As depicted in figure 2.1, for the period 2012 to 2013, Kariba North Bank Power Station recorded the highest increment of 23%, moving from 3,668 GWh in 2012 to 4,507GWh in 2013. The increase at Kariba North bank was on account of uprating works undertaken during the year. During the same period, Kafue Gorge power station recorded a marginal increment of 1% while Victoria Falls power did not record any increment in 2013.

With regard to the period 2011 to 2012, all three major power plants recorded increases as follows; Kariba North Bank at 6%, Kafue Gorge at 3% and Victoria falls at 8%.

### 2.1.2 GENERATION FROM MINI HYDRO POWER STATIONS

The mini hydros\(^1\) comprise Lusiwasi, Musonda Falls, Chishimba Falls and Lunzua. The installed capacities for these plants were: 12MW, 5MW, 6 MW and 0.7MW for Lusiwasi, Musonda Falls, Chishimba Falls and Lunzua respectively. The other mini hydro was Shiwang’anu which had an installed capacity of 1MW.

For the period 2012 to 2013, generation sent out from these power stations reduced by 2%. This was in comparison to an increase of 3% that was recorded between 2011 and 2012. As depicted in figure 2.2, 101.59GWh were generated in 2011. The generation increased to 104.33 GWh in 2012 but later decreased to 102.7GW in 2013.

---

\(^1\) In this report capacity below 20MW
The generation of the mini-hydro’s over the last five (5) years is depicted in Figure 2.2. During the period 2012 to 2013, of the four mini-hydro stations, Musonda Falls recorded the highest increase of 8%, followed by Lunzua at 2%. Meanwhile, Lusiwasi and Chishimba Falls recorded decline of 8% and 6% respectively.

For the period 2011 to 2012, increases of 3%, 5% and 7% were recorded at Lusiwasi, Musonda falls and Lunzua respectively. However, during the same period, Chishimba Falls recorded a minor decline of 1%.

### 2.1.3 GENERATION FROM DIESEL STATIONS

Figure 2.3 shows the electricity generation from diesel power stations for the years 2009 to 2013. The total installed capacity for diesel stations was 10.57MW in 2013.
The diesel stations comprised Kabompo; Zambezi; Mwinilunga; Chavuma; Lukulu; Luangwa; Kaputa and Mufumbwe. The installed capacities were as follows: 2MW; 1.86MW; 1.44MW; 0.8MW; 0.51MW; 2.6MW; 0.55MW and 0.8MW for Kabompo; Zambezi; Mwinilunga; Chavuma; Lukulu; Luangwa; Kaputa and Mufumbwe respectively.

Total generation sent out from these stations increased by 6% in 2013 and 16% in 2012. As depicted in figure 2.3, generation increased to 18.57GWh in 2013 from 17.57GWh in 2012. For the period 2011 to 2012 generation increased from 14.74GWh to 17.57GWh.

Of the eight existing diesel power stations, six plants registered increased generation while the rest recorded declines in 2013. Similarly, in 2012, six plants recorded increases in generation while two recorded declines.

### 2.1.4 GENERATION FROM INDEPENDENT POWER PRODUCERS

Figure 2.4 depicts independent power generation for the years 2012 and 2013. There were three (3) Independent Power Producers (IPPs), namely Lusemfwa Hydro Power Company (LHPC), Ndola Energy Company Limited (NECL) and Zengamina Power Limited (ZPL). LHPC owns Mulungushi and Lusemfwa power stations.

**FIGURE 2.4: INDEPENDENT POWER GENERATION, 2012 AND 2013**

<table>
<thead>
<tr>
<th></th>
<th>Mulungushi</th>
<th>Lusemfwa</th>
<th>Ndola Energy</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2012</strong></td>
<td>230.60</td>
<td>161.40</td>
<td>0</td>
<td>392.00</td>
</tr>
<tr>
<td><strong>2013</strong></td>
<td>212.68</td>
<td>185.76</td>
<td>0.03</td>
<td>398.47</td>
</tr>
</tbody>
</table>

Source: Lunsemfwa Hydro Power Company and Ndola Energy Company Limited reports 2012 and 2013

The total installed capacity from these IPPs was 105MW. This was broken down as follows; LHPC (54MW), NECL (50MW) and ZPL (0.75MW). In 2013, total generation from the IPPs increased marginally by 2% from 392.00 GWh in 2012 to 398.47GWh 2013. A key development in 2013 was the commissioning of the 50MW NECL HFO power plant in November.
In 2013, the national electric energy consumption stood at 10,845 GWh compared to 10,317.4 GWh in 2012, depicting an increase of 5%. For the period 2011 to 2012, national consumption increased by 28% from 8,037 GWh in 2011 to 10,317.4GWh in 2012. The increases in both years positively correlate with the growth in real GDP, which was 6.8 % in 2011, 7.3% in 2012 and 6.5% in 2013.

In terms of the share of total electric energy consumption by economic sector, mining still remained the largest power consumer at 54.7% in 2013 and 53.8% in 2012. This was followed by the domestic sector, which includes residential consumers, at 31.0% and 30.9% for the years 2013 and 2012 respectively. The balance of 14.3% and 15.3% was accounted for by the rest of the economic sectors, in 2013 and 2012 respectively. Table 2.1 shows consumption by economic sector.

<table>
<thead>
<tr>
<th>Sectors</th>
<th>2013 (GWh)</th>
<th>2012 (GWh)</th>
<th>Proportion of total consumption in 2013</th>
<th>Proportion of total consumption in 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining</td>
<td>5,929.1</td>
<td>5,554.4</td>
<td>54.7%</td>
<td>53.8%</td>
</tr>
<tr>
<td>Domestic</td>
<td>3,360.8</td>
<td>3,187.2</td>
<td>31.0%</td>
<td>30.9%</td>
</tr>
<tr>
<td>Finance and Property</td>
<td>499.7</td>
<td>434.0</td>
<td>4.6%</td>
<td>4.2%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>397.1</td>
<td>506.0</td>
<td>3.7%</td>
<td>4.9%</td>
</tr>
<tr>
<td>Agriculture</td>
<td>270.3</td>
<td>244.5</td>
<td>2.5%</td>
<td>2.4%</td>
</tr>
<tr>
<td>Others</td>
<td>120.9</td>
<td>117.5</td>
<td>1.1%</td>
<td>1.1%</td>
</tr>
<tr>
<td>Trade</td>
<td>115.8</td>
<td>136.7</td>
<td>1.1%</td>
<td>1.3%</td>
</tr>
<tr>
<td>Energy &amp; Water</td>
<td>71.0</td>
<td>81.8</td>
<td>0.7%</td>
<td>0.8%</td>
</tr>
<tr>
<td>Quarrying</td>
<td>35.0</td>
<td>19.1</td>
<td>0.3%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Transport</td>
<td>28.3</td>
<td>23.7</td>
<td>0.3%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Construction</td>
<td>17.5</td>
<td>12.7</td>
<td>0.2%</td>
<td>0.1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>10,845.7</strong></td>
<td><strong>10,317.4</strong></td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Source: ZESCO annual statistics, 2012 and 2013
2.3 ELECTRICITY EXPORTS AND IMPORTS IN 2012 AND 2013

Zambia, through ZESCO, engages in cross border trading of electricity through the Southern African Power Pool (SAPP) and bilateral markets. During the period 2012 to 2013, ZESCO recorded an increase in electricity exports of 11%, from 979.7GWh in 2012 to 1,083.4 GWh in 2013. However, electricity imports dropped by 55% in 2013, from 163GWh in 2012 to 72.9GWh in 2013. The drop in imports was attributed to the coming on board of the new HFO powered plant in Ndola which has a generation capacity of 50 MW and Kariba North Bank extension project which has a generation capacity of 360MW.

2.4 ZESCO QUALITY OF SERVICE PERFORMANCE MONITORING 2012 AND 2013

Since April 2008, the ERB and ZESCO have in place a performance monitoring mechanism using agreed Key Performance Indicators (KPIs). The KPI framework was meant to ensure that the Utility operates efficiently and provides high quality service to its customers. The framework is incentive based and is embedded in the tariff determination process. The agreed indicators were as follows (see details in appendix 1):

i. Metering customers;
ii. Cash management;
iii. Staff productivity;
iv. Quality of service supply; and
v. System losses.

METERING CUSTOMERS

Metering customers KPIs consisted of clearing the backlog of unmetered customers; metering new customer connections; and a connection time indicator, which determines the average number of days it takes for ZESCO to connect new standard 2 residential customers once a customer has made payments for connection.

During 2013 and 2012, ZESCO attained KPI scores of 25% and 22% respectively, against the target score of 25%. This implied that, for the periods under review, ZESCO improved its performance on customer metering.

CASH MANAGEMENT

The cash management KPI comprised trade receivables; debtor days for Government (GRZ) (targeted at 90 days) and non-Government (targeted at 60 days). The trade receivables indicator expresses trade receivables for non-GRZ and GRZ customers respectively, as a percentage of revenue earned. The debt-equity ratio indicator measures the proportion of long term debt capital and equity in the utility’s capital structure. This is expected to be no more than 70:30 by March 2016.

On the cash management KPI, ZESCO attained scores of 0% for both years under review against a target of 10%. This result implied that ZESCO performed below target and was required to improve on this KPI.

---

2 Customers requiring minimal cable connections to be connected to the supply lines
3 Total costs include cost of sales, total operating and maintenance costs, financing charges and exchange losses/gains
STAFF PRODUCTIVITY AND STAFF COSTS

The staff productivity KPI is composed of the customer-employee ratio and staff cost to total costs percentage ratio. The KPI requires ZESCO to reduce and maintain staff costs at 45% or less of total operating and maintenance costs by March 2013. During the periods under review, ZESCO attained a score of 15% and 13% in 2013 and 2012 respectively, against the 15% agreed target.

QUALITY OF SERVICE PERFORMANCE

The Quality of service provided by the Utility is measured using the various indices that capture power outages and restoration times. The System Average Interruption Duration Index (SAIDI) indicator measures the average duration of hours a customer experiences without electricity per quarter. System Average Interruption Frequency Index (SAIFI) measures the number of times a customer stays without electricity per quarter. The Customer Average Interruption Duration Index (CAIDI) measures the average number of hours a customer stays without electricity per interruption per quarter. Lastly, the Average System Availability Index (ASAI) measures overall system availability.

During the years under review, ZESCO’s performance on the combined Quality of Services was 23% for 2013 and 25% for 2012, against the target scores of 25% respectively. This implied that ZESCO performed well on this KPI. However, this KPI does not explicitly capture the issue of load-shedding and going forward; this KPI will be modified to capture this aspect. This will be done in the new KPI framework that will run from 2014 to 2016.

SYSTEM LOSSES

The KPI framework also measures performance of ZESCO with regard to transmission and distribution losses. ZESCO’s performance on this KPI during the years 2013 and 2012 was 22% and 20% respectively, against a target of 25%.

OVERALL PERFORMANCE ON QUALITY OF SERVICE

The overall KPI performance of ZESCO is shown in Table 2.2. As depicted in the table, during the period 2012 to 2013, the performance of ZESCO marginally improved from 79.5% to 85.3% respectively.

<table>
<thead>
<tr>
<th>KPI</th>
<th>Assigned weight</th>
<th>2013</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Metering</td>
<td>25%</td>
<td>25%</td>
<td>22%</td>
</tr>
<tr>
<td>Cash Management</td>
<td>10%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Staff Productivity &amp; Staff costs</td>
<td>15%</td>
<td>15%</td>
<td>13%</td>
</tr>
<tr>
<td>Quality of Service</td>
<td>25%</td>
<td>23%</td>
<td>25%</td>
</tr>
<tr>
<td>System Losses</td>
<td>25%</td>
<td>22%</td>
<td>20%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
<td><strong>85.3%</strong></td>
<td><strong>79.50%</strong></td>
</tr>
</tbody>
</table>

The current KPIs frame expired on 31st March 2014 after which a new framework would be developed and implemented for another 3 year period, that is, 2014 to 2016. The new KPI framework would take into account new developments in the sector and will also focus on further improving customer satisfaction on quality of service.
2.5 PERFORMANCE REVIEW OF ELECTRICITY COMPANIES

2.5.1 COPPERBELT ENERGY CORPORATION PLC

Copperbelt Energy Corporation (CEC) is a Copperbelt Province based company that owns and operates high-voltage transmission and distribution systems that supply electricity to Zambia’s mining companies. CEC buys all its power from ZESCO via the Bulk Supply Agreement (BSA). Apart from supplying electricity to local mines, CEC since 2007, has been exporting electricity to a mine in the Democratic Republic of Congo (DRC). The performance of CEC on some its business elements, in 2013 and 2012 is depicted in table 2.3.

<table>
<thead>
<tr>
<th>Business element</th>
<th>2013</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity purchases</td>
<td>6,697 GWh</td>
<td>6,302 GWh</td>
</tr>
<tr>
<td>Domestic wheeling</td>
<td>1,495.2 GWh</td>
<td>1,495.7 GWh</td>
</tr>
<tr>
<td>International wheeling</td>
<td>730 GWh</td>
<td>580 GWh</td>
</tr>
<tr>
<td>Electricity sales to the mines</td>
<td>4,281 GWh</td>
<td>4,065 GWh</td>
</tr>
<tr>
<td>Transmission and distribution loses</td>
<td>2.84%</td>
<td>2.56%</td>
</tr>
<tr>
<td>Standby generation capacity</td>
<td>60MW</td>
<td>80MW</td>
</tr>
</tbody>
</table>

Source: CEC performance reports for 2013 and 2012.

In 2013, CEC purchased a total of 6,697 GWh of electricity from ZESCO, of which 4,281 GWh was sold to the mines, while 1,495.2 GWh was domestic wheeling on behalf of ZESCO. Similarly, in 2012 a total of 6,302 GWh of electricity was purchased from ZESCO, of which 4,065 GWh was sold to the mines and 1,495.7 GWh was domestic wheeling on behalf of ZESCO.

The 4,281 GWh sales to the mines in 2013 represented an increase of 5.3% from 2012 when 4,065 GWh were sold. In 2012, sales to the mines increased by 8.7% from 3,740 GWh in 2011 to 4,065 GWh in 2012. CEC’s international wheeling also increased by 25.9% from 580 GWh in 2012 to 730 GWh in 2013. Transmission and distribution loses stood at 2.84% and 2.56% for the years 2013 and 2012 respectively.

Meanwhile, the company’s standby installed generation capacity declined to 60MW in 2013 from 80MW in 2012. The reduction in standby installed generation capacity in 2013 was on account of one of its generators, Luano generator number one, being out of service during that year.

During the years under review, CEC was involved in various generation and transmission projects aimed at expanding its capacity in order to satisfy the requirements of its various customers and also to diversify its business portfolio. Some of the projects that CEC was actively pursuing are presented below.

2.5.1.1 CEC Electricity Projects in 2012 and 2013

a) Second Zambia – DRC interconnector project

The second Zambia-Democratic Republic of Congo (DRC) interconnector project was aimed at reinforcing the capacity of the existing interconnector. The project once completed would enhance security of supply for the Copperbelt Province based mines and Zambia in general. It will also facilitate increased electricity trading on the SAPP. This project would involve
construction of 50 kilometers of 220kV double circuit transmission line from Luano substation to the Zambia-DRC border. The project is planned to commence in 2014 with completion scheduled for early 2015.

b) Hydro Power Generation projects

CEC was involved in the development of two hydroelectric power projects during the period under review. Partial construction works have started in Kabompo district while feasibility studies were in progress on the Luapula river hydro sites. The Kabompo project involves construction of a 40MW hydro power station and a 132KV transmission line to evacuate power into the national grid. The total project cost was estimated at about US$ 210 million.

c) Other renewable energy projects

**Kitwe Kalibu 1MW biomass project**

In 2012, CEC conducted a feasibility study for the development of a biomass power generation plant. The study revealed that there was sufficient biomass consisting of waste timber and sawdust from the saw mills on the Copperbelt Province, enough to set up a 7MW power plant. In April 2013 the Zambia Environmental Management Agency (ZEMA) approved the environmental project brief for the project.

**Copperbelt solar project**

CEC intends to develop a 15MW Solar Project to be called "Riverside Solar Park" in Kitwe at a budgeted cost of about US$35 million. The project was expected to be the first grid connected Utility scale solar project in Zambia. Commissioning of the 15MW solar plant was envisaged to be in the last quarter of 2015.

2.5.1.2 Challenges and Opportunities Faced by CEC

During the two years under review, CEC faced a number of challenges and opportunities which are highlighted below:

**Challenges**

i. The cyclic nature of the price of copper continues to be a business risk to the company, as it ultimately impacts on power demand by CEC’s customers. However, CEC was diversifying its business to mitigate against this risk.

ii. CEC experienced encroachment and illegal use of CEC way-leaves by property developers, including trespass and disposal of domestic waste. This not only posed a safety risk but also compromised the security of supply to customers. In order to effectively mitigate this risk, CEC embarked on vigorous sensitization programmes for the local communities and other stakeholders.

**Opportunities**

During the period under review CEC embarked on "the rights offer" of its shares in order to raise fresh capital to finance the various capital projects and investments which the company was undertaking.

2.5.2 ZENGAMINA POWER LIMITED

Zengamina Power Limited (ZPL) is a small off-grid power generation and supply company situated in Ikelenge District, North Western Province with an installed capacity of 750kV. The company commenced initial operations in October 2008 with full commercial operations starting in April 2009.
2.5.2.1 Customer Profile

ZPL generated and supplied electricity to the localised population of Ikelenge district. The supply configuration includes residential, commercial, community and small businesses. Residential customers remain the largest block of customers, with 295 connections, of which 161 were metered and the remaining 134 were unmetered in 2012.

Since 2009, the company had continued to steadily grow its customer base. In 2012, the customer base increased by 18%, to 315 from 268 in 2011. Table 2.4 shows the breakdown of customers since 2009.

<table>
<thead>
<tr>
<th>TABLE 2.4: ZPL CUSTOMER BASE BY CUSTOMER CATEGORY, 2009-2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Category</td>
</tr>
<tr>
<td>Community service</td>
</tr>
<tr>
<td>Residential (Un-metered)</td>
</tr>
<tr>
<td>Residential (Metered)</td>
</tr>
<tr>
<td>Standard commercial</td>
</tr>
<tr>
<td>Small Business</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

Source: ZPL report 2012

2.5.2.2 Operations

In 2012, ZPL generated a total of 1.2 GWh of electricity, a reduction by 16.7% from 1.4 GWh generated in 2011. With regard to business performance, despite posting marginal increases in revenue, the company continued to register losses for four successive years since its inception in 2009. Despite this loss making position, the Utility has continued to operate mainly on the basis of a subsidy from its shareholders.

2.5.2.3 Challenges Faced by Zengamina Power Limited

i. During the periods under review, ZPL faced some challenges. The major ones being: inadequate finance to expand its grid; inadequate customer base; low income levels in the community which limits the extent to which tariffs can rise; inability to attract qualified personnel to run its operations and low revenue base to cover overheads on distribution and generation.

ii. The other challenge that the company continued to face was the severe lightning strikes during the wet seasons, which occasionally led to the loss of transformers.

2.5.3 LUNSEMFWA HYDRO POWER COMPANY

Lunsemfwa Hydro Power Company (LHPC) is another private owned electricity company involved in generation, distributing and supply of electricity. It was established in 2001 and is based in Central Province. The company has total installed generation capacity of 54MW at its two plants, namely Lunsemfwa (30.8MW) and Mulungushi (23.2MW).

During the period under review, power generation from the company increased marginally by 1.6%, from 392GWh in 2012 to 398.44 GWh in 2013. Figure 2.5 shows electricity generation by LHPC for the years 2012 and 2013.
2.5.3.1 Planned Generation and Transmission Projects

During the period under review LHPC was undertaking feasibility studies on the lower Lusemfwa and Mkushi rivers for a hydro power project. The project would involve construction of a Hydro power station with an installed capacity of 330MW. The expected completion date for the feasibility study is 2014.

2.5.3.2 Challenges Faced by Lunsemfwa Hydro Power Company

During the years under review, LHPC faced several challenges among them: the shared use of water in certain catchment areas where electricity generation competes with agriculture and other uses; and the low electricity tariffs which impacted negatively on its investment prospects.

2.5.4 Ndola Energy Company Limited

Ndola Energy Company Limited (NECL) is the newest Independent power generation company in the electricity supply sector with an installed capacity of 50MW. The company has a plant based in Ndola, Copperbelt Province and was using HFO from INDENI Petroleum Refinery Limited to produce electricity. ZESCO is the off taker of power from the plant under a Power Purchase Agreement (PPA). The plant was commissioned in November, 2013 and during its two months of operation delivered to the national grid a total of 0.03GWh of electricity. The Utility has plans to construct another plant with a capacity of 50MW in 2014.

2.5.4.1 Challenges Faced by Ndola Energy Company Limited

NECL faced some challenges in its first year of operations. According to NECL, the lack of adequate fuel testing laboratories in Zambia to compressively test HFO has meant that samples have to be shipped out of the country at great cost to the company thereby, impacting on operational turn around.
2.5.5 NORTH WESTERN ENERGY CORPORATION LIMITED

North Western Energy Corporation Limited (NWEC) owns and operates distribution and supply systems that provide electricity to serve the non-mining load of Lumwana Mine and the surrounding areas in Lumwana town, in North Western Province of Zambia. Since 2008, NWEC has been supplying electricity to the residential houses of the Lumwana mine and the surrounding communities.

During the periods under review, the Utility’s customer base stood at 864 in 2013, which was a growth of 4.3%, from 828 customers recorded in 2012. During the same period, electricity purchases increased by 23.2%, while revenues increased by 16.2%.

2.5.5.1 Major Planned Investment for NWEC

The major projects planned by NWEC were Kalumbila and Kabitaka which were scheduled for commissioning during 2014. These projects once completed will supply power to initially 1,000 households under First Quantum Minerals Limited (FQML). The investment costs are estimated at about US$3m for both Kalumbila and Kabitaka projects. During the review period, construction works had already commenced.

2.5.5.2 Challenges Faced by NWEC

NWEC cited the following challenges during the review period:

i. Lack of local finance to expand the current business operations; and

ii. Low market penetration and low opportunities for Private Public Partnerships especially with regard to new projects.

2.5.5.3 Prospects for 2014 and Beyond

NWEC planned to expand its operations in 2014 and beyond. This was because there was still a lot of potential areas for possible rural electrification within North Western Province. It was expected that the expansion of Lumwana Mine as well as the introduction Multi Facility Economic Zone (MFEZ) in Lumwana and Kalumbila would give NWEC additional customers. Furthermore, NWEC planned to raise additional capital through the Lusaka Stock Exchange which will support its growth in the short to medium term. This is in addition to NWEC’s willingness to consider new equity investors in the company so as to expand its capital base.

2.6 ELECTRICITY TARIFFS AND COST REFLECTIVITY

2.6.1 COST OF ELECTRICITY

Table 2.5 shows the applicable tariffs per customer category in 2012 and 2013. The tariff for metered residential customers ranged from K0.15 to K0.28/kWh on energy charges. The fixed monthly charge for the pre-paid tariff was K14.63. Commercial tariffs were K0.27/kWh and a fixed monthly charge of K47.75. Social tariffs were K0.24/kWh and a fixed monthly charge of K41.52. Meanwhile, maximum demand energy charges averaged K0.17/kWh will fixed monthly charges ranged from K114.50 in MD1 to K1,103.13 for MD4, these tariffs presented in the table are exclusive of taxes and levies.
### TABLE 2.5: ELECTRICITY TARIFFS IN 2012 AND 2013

<table>
<thead>
<tr>
<th>Customer Category</th>
<th>Current Tariffs (K)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. METERED RESIDENTIAL (CAPACITY 15 KVA)</strong></td>
<td></td>
</tr>
<tr>
<td>R1 - Consumption up-to 100kWh</td>
<td>Energy charge/kWh) 100</td>
</tr>
<tr>
<td>R2 - Consumption between 101 &amp; 300 kWh</td>
<td>Energy charge/kWh) 25</td>
</tr>
<tr>
<td>R3 - Consumption above 300 kWh</td>
<td>Energy charge/kWh) 41</td>
</tr>
<tr>
<td>Pre-paid Tariff</td>
<td>Energy charge/kWh) 28</td>
</tr>
<tr>
<td>Fixed Monthly Charge</td>
<td>14.63</td>
</tr>
<tr>
<td><strong>2. COMMERCIAL TARIFFS (CAPACITY 15KVA)</strong></td>
<td></td>
</tr>
<tr>
<td>Commercial</td>
<td>Energy charge/kWh) 27</td>
</tr>
<tr>
<td>Fixed Monthly Charge</td>
<td>47.75</td>
</tr>
<tr>
<td><strong>3. SOCIAL SERVICES</strong></td>
<td></td>
</tr>
<tr>
<td>Schools, Hospital, Orphanages, churches,</td>
<td>Energy charge K/kWh 24</td>
</tr>
<tr>
<td>water pumping &amp; street lighting</td>
<td>Fixed Monthly Charge 41.52</td>
</tr>
<tr>
<td><strong>4. MAXIMUM DEMAND TARIFFS (MD)</strong></td>
<td></td>
</tr>
<tr>
<td>MD1- Capacity between 16 - 300 kVA</td>
<td>MD charge/kVA/Month 11.69</td>
</tr>
<tr>
<td>Energy charge /kWh</td>
<td>0.17</td>
</tr>
<tr>
<td>Fixed Monthly Charge</td>
<td>114.50</td>
</tr>
<tr>
<td>MD2- Capacity 301 to 2,000 kVA</td>
<td>MD charge/kVA/Month 21.87</td>
</tr>
<tr>
<td>Energy charge /kWh</td>
<td>0.14</td>
</tr>
<tr>
<td>Fixed Monthly Charge</td>
<td>228.99</td>
</tr>
<tr>
<td>MD3- Capacity 2,001 to 7,500kVA</td>
<td>MD charge/kVA/Month 39.72</td>
</tr>
<tr>
<td>Energy charge /kWh</td>
<td>0.13</td>
</tr>
<tr>
<td>Fixed Monthly Charge</td>
<td>551.56</td>
</tr>
<tr>
<td>MD4-Capacity above 7500kVA</td>
<td>MD charge/kVA/Month 39.94</td>
</tr>
<tr>
<td>Energy charge /kWh</td>
<td>0.11</td>
</tr>
<tr>
<td>Fixed Monthly Charge</td>
<td>1,103.13</td>
</tr>
</tbody>
</table>

#### 2.6.2 COST REFLECTIVITY

In 2006 the ERB commissioned a Cost of Service Study (CoS) for ZESCO intended to determine the cost incurred by the Utility in generating, transmitting, distributing and supplying electricity to its various customers and at various supply points. Table 2.6 shows the proposed path to cost reflectivity based on the findings of the 2006 CoS.
TABLE 2.6: COST OF SERVICE BASE CASE TARIFF

<table>
<thead>
<tr>
<th>Customer Category</th>
<th>Average Price US¢/kWh</th>
<th>2006/07 (Current Tariff)</th>
<th>2007/08 (Proposed one-off increase)</th>
<th>2011/12</th>
<th>2013/14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining</td>
<td>2.34</td>
<td>3.01 (28.5%)</td>
<td>4.27</td>
<td>5.38</td>
<td></td>
</tr>
<tr>
<td>Residential</td>
<td>3.05</td>
<td>7.55 (147.6%)</td>
<td>9.42</td>
<td>11.27</td>
<td></td>
</tr>
<tr>
<td>Large Power</td>
<td>2.07</td>
<td>3.03 (46.3%)</td>
<td>4.43</td>
<td>5.49</td>
<td></td>
</tr>
<tr>
<td>Small Power</td>
<td>3.14</td>
<td>3.68 (17.4%)</td>
<td>5.13</td>
<td>6.47</td>
<td></td>
</tr>
<tr>
<td>Commercial</td>
<td>5.87</td>
<td>6.01 (2.4%)</td>
<td>7.22</td>
<td>8.54</td>
<td></td>
</tr>
<tr>
<td>Services</td>
<td>3.97</td>
<td>4.23 (6.3%)</td>
<td>5.69</td>
<td>7.05</td>
<td></td>
</tr>
<tr>
<td>Exports</td>
<td>2.87</td>
<td>3.27 (14.0%)</td>
<td>3.85</td>
<td>5.49</td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>2.66</td>
<td>3.87 (45.4%)</td>
<td>5.10</td>
<td>6.10</td>
<td></td>
</tr>
</tbody>
</table>

The CoS, which was concluded in 2006, determined that tariffs for all of ZESCO’s customers were below cost. In order to reach cost reflectivity in one step the study recommended that, the base tariff needed to go up by an average of 45.4%. With such a rise the residential customers would have carried the largest incidence of the tariff increase at 147.6% followed by large power customers at 46.3%. The least incidence would have been borne by commercial and services customers at 2.4% and 6.3% respectively. However, by following the recommended migration path, using specified increments per year, the average tariff would have progressed to US cents 5.1 per kilowatt hour in 2012 and US cents 6.1 per kilowatt hour in 2013.

Following this study, ZESCO made three separate tariff applications resulting in the ERB approving average tariff increases of 27%, 35% and 26% in 2008, 2009 and 2010 respectively. This amounted to an average cumulative increase of 96% over the period. This increase enabled ZESCO to raise sufficient revenue to meet its costs and earn a reasonable return on assets.4

Table 2.7 shows approved tariff increases across ZESCO’s different customer categories over the three years, 2006 to 2010.

---

4 ZESCO earned a return on assets of 6% (K 346 million) during the financial year ended 31st March 2012.
Although the CoS study recommended a steady annual progression path, this plan could not be adhered to because ZESCO did not apply for tariff increases consistently for each year as envisaged. Following the study, ZESCO separately negotiated tariff increases of 30% and 35% for its mining customers and with CEC in 2008 and 2011, respectively.

Future prospects with regard to migration towards cost reflectivity showed that tariffs would progressively increase over the coming years to account for more expensive power coming from new power projects. During the period under review, there is substantial investment expected in new power generation projects with varied generation mixes such as hydro, solar, coal, biomass and HFO plants.

Tariffs from these new projects are projected to be in range of US$c 7/kWh to US$c 14/kWh at the time of each project’s completion and commissioning. To take care of this new development and implication on cost reflectivity, the ERB would commission another industry-wide CoS that would consider the new generation mix. Table 2.8 shows a summary of the projects under construction and the estimated or projected average tariffs at the time of each project’s commissioning.

### Table 2.8: Planned Electricity Tariffs for New Projects

<table>
<thead>
<tr>
<th>Project</th>
<th>Capacity (MW)</th>
<th>Cost (US$ Million)</th>
<th>Estimated Average Tariff</th>
<th>Commercial Expected Operation date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project 1</td>
<td>50</td>
<td>60</td>
<td>US$c13.23/kWh</td>
<td>2013</td>
</tr>
<tr>
<td>Project 2</td>
<td>360</td>
<td>420</td>
<td>US$c5.16/kWh</td>
<td>2013</td>
</tr>
<tr>
<td>Project 3</td>
<td>300</td>
<td>650</td>
<td>US$c9.83/kWh</td>
<td>2014</td>
</tr>
<tr>
<td>Project 4</td>
<td>120</td>
<td>240</td>
<td>US$c7.39/kWh</td>
<td>2016</td>
</tr>
<tr>
<td>Project 5</td>
<td>600</td>
<td>1,500</td>
<td>US$c10.54/kWh</td>
<td>2016</td>
</tr>
</tbody>
</table>

Source: ERB 2013

### 2.7 Comparative Regional Tariffs

The Southern African Power Pool (SAPP) has twelve member Countries represented by their respective electric Utilities organized through SADC. The SAPP established the Short Term Energy Market (STEM) in April 2001. From January 2004, the SAPP started the development of the competitive electricity market for the SADC region. The new market is in form of a Day-Ahead Market (DAM). As part of information sharing among the various member utilities, SAPP has carried out a survey.
of the obtaining average tariffs in the Member Countries. Figure 2.6 shows tariff details for the rest of the Countries in SAPP. As depicted in the figure, Swaziland has the highest average tariffs at UsC11.5/kWh followed by Zimbabwe, South Africa and Namibia in that order at UsC9.8/kWh, UsC8.7/kWh and Us8.6/kWh respectively. The lowest average tariffs were recorded in DR Congo, Zambia, Lesotho and Angola in ascending order. The results suggest that very few countries in Southern African Development Community (SADC) have tariffs that are close to cost reflectivity.

Notably, even though SADC Countries, in 2008 undertook to migrate tariffs to cost reflective levels over a period of five (5) years to 2013, none of the Members states have fully migrated tariffs to cost reflective levels for various reasons.

2.8 TARIFF REVIEWS AND DETERMINATION

2.8.1 TARIFF REVIEWS

During the periods under review, three (3) Utilities, namely, ZESCO, ZPL and CEC applied to the ERB for tariff reviews. All the applications were still under review by the close of 2013. ZESCO applied for a multiyear tariff increase for the period 2012 to 2016. Specifically for 2012, ZESCO applied to increase electricity tariffs by an average of 26% for all customer categories, broken down as follows: 32% for Residential, 11% for Large Power, 24% for Small Power, 24% for Commercial and 18% for the Services customer category. The application did not cover mining and export customers.

ZPL applied for an average annual increase of between 8.3% to 12.13% over a three year period from 2012 to 2015, broken down by customer and tariff bands. Meanwhile, CEC applied to increase electricity tariffs for residential customers in the CEC village by 31%, 34% and 31% for the Residential 1 (R1), Residential 2(R2) and Residential 3 (R3) consumption bands, respectively. CEC also proposed to increase the fixed monthly charges by 100%. CEC further applied to introduce a pre-paid consumption tariff at the rate of K0.21/kWh.
2.8.2 TARIFF DETERMINATION

The ERB uses the Revenue Requirement (RR) Methodology otherwise known as the Rate of Return (RoR) or the Cost of Service approach in determining electricity tariffs. The main principle of RoR is that revenues of the regulated companies have to cover their operating expenses, taxes and depreciation, and have to ensure a fair rate of return (profit) on assets utilised for production and supply of electricity and energy services. The generic formula for RR is shown below:

$$RR = O + D + T + r*B$$

Where;
- **RR** = Revenue Requirement
- **O** = Operating and maintenance expenses
- **D** = Depreciation
- **T** = Taxes
- **R** = allowed rate of return
- **B** = Rate Base (or Regulatory Asset Base)

To arrive at a tariff, ERB reviews and verifies all information related to the components that make up the revenue requirement in the Utility’s tariff application. The applicable formula for tariff determination is shown below:

$$TF = RR/ E$$

Where:
- **TF** = average tariff per customer category
- **RR** = Utility’s revenue requirement attributable to that customer category
- **E** = energy demand in kilowatt hours

The principles underlying RR and tariff determination are the following:

i. Recovery of prudently incurred costs by the Utility, that is, only just and reasonable costs incurred wholly and exclusively for the provision of electricity are allowed in the tariff determination process;

ii. Recognition of used and useful Utility assets, that is, only assets currently used by the utility to provide electricity to its customers are included in the rate base;

iii. Financial sustainability of the Utility, that is, the applicable tariffs should enable the utility cover both capital and operational costs as well as earn a reasonable return;

iv. The need to attain cost reflective tariffs, that is, the determined tariff must be consistent with the Government’s National Energy Policy (NEP) 2008 that advocates for cost reflective pricing of all energy services and products;

v. Delivery of quality service, that is, the determined tariff must be accompanied by noticeable improvements in the quality of services provided; and

vi. Social considerations for customers with low income levels, that is, the tariff must remain accessible and affordable. (In the case of Zambia R15 is a proxy for a lifeline tariff).

2.9 RURAL ELECTRIFICATION AUTHORITY

The Rural Electrification Authority (REA) is a statutory body with the mandate to electrify the rural communities in Zambia. The latest official rural access rate was estimated at 5% as at 2010 by the...
During the periods under review, REA successfully executed nine (9) electrification projects. Notably, in the renewable energy sub-sector, REA implemented the first ever commercial solar project in Samfya District, Luapula Province called Mpanta Solar Mini Grid Project.

The Mpanta project involved the construction of a 60KW solar mini-grid system to supply power to a cluster of fishing villages on the shores of Lake Bangweulu with an estimated population of 6,000. The capital cost for the project was estimated at K7 million.

The peak generation capacity for Mpanta is sixty (60) kilo Watts. With an irradiance of five (5) hours a day, the project is able to provide 172,800Wh per day and is expected to benefit a total of 489 customers, of which 447 are residential, 8 are commercial and 34 are services customers. The primary use for the electricity is lighting, refrigeration, phone charging and powering of radios and televisions. During the years under review, REA conducted willingness and ability to pay survey that showed that the average willingness to pay for electricity was estimated at K51.13 per household per month, based on the current average monthly expenditure on alternative energy sources. Thus, Mpanta project tariffs range between K30 to K60 per month for residential and social customers; and between K60.00 to K100.00 for light commercial or business customers.

2.10 ELECTRICITY STANDARDS DEVELOPMENT

One key mandate of the ERB is to design standards with regard to the quality, safety and reliability of supply of energy products and services. During 2012 and 2013, ERB developed several standards which are discussed below:

2.10.1 POWER QUALITY MEASUREMENT

The ERB spearheaded the development of Zambia Power Quality and reliability standards in the early 2000’s. However it was established at the time that there was no baseline data on which to base the standards for some of the power quality parameters. A need was therefore identified to collect power quality data on the system in order to obtain a power quality baseline of the power system. However, for a long time there was no consensus among the industry players on the mode of conducting and verifying power quality. It was only until 2009 when an understanding was reached to engage an independent consultant to collect the baseline power quality data.
Subsequently, in 2013, ERB contracted a consultant to undertake a Power Quality Benchmark Study on the Zambian power grid. A total of 1) power quality recorders were installed across the Zambian power grid the required power quality parameters were monitored for a period of three months. The 18 sites were geographically spread around the country covering Southern, Lusaka, Eastern, Copperbelt, Northern, Luapula and North-Western provinces.

Principally, the study indicated that the main problems of power quality on the Zambian grid relate to interruptions and voltage regulation (low and high voltage) especially in Luapula, Eastern and Northern provinces which are fed primarily by long radial lines. The Copperbelt and North-western provinces also were found to experience power quality problems associated with the major loads in these areas which are mainly the mines.

The results of this study provided the basis for the ERB to set compatibility levels for the power quality parameters in the standards and to develop guidelines for the power quality management system for the Zambian power system. These guidelines will among other things provide for the following:

i). The rights, responsibilities and obligations of licensees and their customers with regards power quality management;
ii). Selection of sites for the installation of power quality recorders;
iii). Data collection and reporting mechanisms covering:
- The type of data to be collected
- Data reporting formats
- Frequency of reporting
- Verification of the quality of the data reported
- Publication of annual power quality statistics and progress in terms of the plan laid out in the guidelines, including comparative power quality performance statistics for the various utilities
iv). Mechanisms for the resolution of power quality complaints and disputes;
v). Managing the process of revising the power quality and reliability standards in line with prevailing conditions in the industry;
vii). Methodology for investment in improvements of licensees’ networks to improve power quality performance; and
vii). Establishment of an enforcement or incentive mechanism to promote power quality improvement.

2.10.2 STANDARD FOR THE ELECTRICAL WIRING OF PREMISES

During the review period, the ERB developed the Wiring of Premises – Code of Practice (ZS791) standard to ensure compliance in the wiring of dwelling places and general buildings. The Zambian Code of Practice for Wiring of Premises (ZS791) provides rules for the design, selection, erection, inspection and testing of electrical installations. The rules are intended to provide for the safety of persons, livestock and property against dangers and damage which may arise in the reasonable use of electrical installations and to provide for the proper functioning of these installations.

This standard applies to electrical installations such as those of: residential premises, commercial premises, public premises, industrial premises, agricultural and horticultural premises, prefabricated buildings, caravans, caravan sites and similar sites, construction sites, exhibitions, fairs and other installations for temporary purposes, marinas, external lighting and similar installations, medical locations, mobile or transportable units, photovoltaic systems and low
- voltage generating sets.

The development of ZS791 was as a result of challenges encountered with regards to safety of persons, livestock and property in the use and proper functioning of electrical installations. The following are some of the initiatives that will be instituted following implementation of this standard:

i) Only qualified and registered technical personnel will be permitted to carry out wiring of premises;

ii) All electrical installations and premises will have to be issued with a certificate of wiring and suppliers of electricity will not provide supply to premises without a valid wiring certificate;

iii) The wiring certificate will have a specified validity period and will only be renewed upon undergoing and passing the periodic inspections.

This standard, as with all other standards and codes developed by the ERB, shall form part of the licence conditions for the respective distribution and supply licences. Further, the ERB will be engaging the Zambia Bureau of Standards to ensure that the standard is adopted as a mandatory national standard. The draft revised Electricity Supply Regulations, which is subsidiary legislation to the Electricity Act, specifically requires all electricity consumers to provide, install and maintain their premises in accordance with this standard among other requirements.

2.10.3 REGULATORY FRAMEWORK FOR OWN USE GENERATION

During 2012 and 2013, The ERB revised the regulatory framework for generation of electricity for own use. The framework recognises two classes of own use generators namely:

i) Standby generation and;

ii) Embedded generation.

Standby generation relates to generation facilities of installed capacity greater than 100kW, which are not connected to the grid and are only used to supply electricity for own consumption when the primary electricity supply from the grid fails or is reduced.

Such supply is primarily and specifically meant for the use of the owner or operator of that plant in instances where there is reduced or no supply from the grid and not for connecting to the electricity grid. In this respect, issues of ensuring facilitating co-ordination with existing or future utilities do not arise.

In an effort to reduce the regulatory burden on standby generators while providing for some rules to govern such generators, such undertakings will only be required to obtain a permit for standby generation which will have less onerous requirements than the traditional generation license.

Meanwhile, embedded generators are power generation facilities of installed capacity greater than 100kW which are intended primarily for own consumption, but can be synchronised and connected to the grid and can deliver surplus power into the grid. The conditions and technical requirements for the connection of embedded generators to the grid are comprehensively outlined under the network chapter of the Distribution Code.

Where the embedded generator has the intention of supplying the surplus power into the grid, the embedded generator shall enter into an agreement with the grid operator for the supply
of such power. This agreement shall also stipulate the rates at which this power shall be sold to the grid operator. In this regard, such generators shall be required to obtain a licence for embedded generation with conditions slightly different from the traditional generation licence.

Consequent to this development, ERB in 2013 developed two separate licences, that is, for own use generation (to cover standby generation) and for embedded generation.

2.11 ELECTRICITY REGULATION ENHANCEMENT PROJECT (EREP II)

During the periods under review, the Swedish International Development Cooperation Agency (Sida) agreed to extend the Electricity Regulation Enhancement Project Phase II (EREP II) which will be executed by the ERB for the period December 2014 to June 2016. The main focus of the project was to further strengthen the ERB’s regulatory capacity and will cover the following work streams:

i. Conducting a new industry-wide Cost of Service Study for the electricity industry sector;
ii. Formulation of the Transmission Tariff Pricing Framework to determine transmission tariffs to be charged and paid by transmission network users; and
iii. Formulation of a Regulatory Framework for Renewable Energies for the ERB.

Furthermore, EREP II will strengthen the capacity of ERB staff through knowledge transfer especially with regard to: review and evaluation of independent power projects and regulation of Off-Grid Systems. Implementation of the project will commence in 2014.

2.12 INVESTMENT FACILITATION IN THE POWER SECTOR

Zambia’s growth in real GDP has been driven by expansion in agriculture, construction, manufacturing, transport, finance and other sectors, all which require energy products and services. ERB works in collaboration with other agencies to promote investment.

One such institution is the Office for Promoting Private Power Investments (OPPPI) which was created under the Ministry of Mines Energy and Water Development to interface directly with investors and spearheads support for private-sector power projects. OPPPI identifies projects, undertakes feasibility studies through consultants, develops solicitation strategies, procures developers and facilitates negotiations of implementation agreements between Government and the Developers. The OPPPI works within the context of the existing regulatory and policy frameworks to attract investment into the sector.
Internally, ERB has put in place mechanisms that facilitate investment such as, issuance of Investment Endorsements (IE); approval of Power Purchase Agreements (PPAs) and issuance of operating licenses.

### 2.12.1 INVESTMENT ENDORSEMENT

ERB issues an IE prior to actual investment in the power sector. The IE is issued at the investment proposal stage and is valid for a specific period. The IE, among other things, indicates that the project estimated tariffs and the underlying assumptions will make the project viable once implemented. The IE is not a legal provision, but assures the investor of issuance of an operating license upon commissioning of the infrastructure. During the periods under review, one IE was issued to an investor.

### 2.12.2 POWER PURCHASE AGREEMENTS

The ERB’s role in new projects includes the review and approval of Power Purchase Agreements (PPAs). These PPAs are allowed for a longer period of time and could be signed with the national Utility or other large-scale consumers, such as mines. During the periods under review, ERB approved two and three PPAs in 2012 and 2013 respectively. ZESCO-ESCOM, MALAWI and CEC-CHINA COPPER MINES were approved in 2012 while ZESCO LTD AND SOCIETE NATIONALE d’ELECTRICITE, DRC; ZESCO LTD AND ELECTRICIDADE DE MOZAMBIQUE; and ZESCO LTD AND ZIMBABWE ELECTRICITY TRANSMISSION AND DISTRIBUTION COMPANY were approved in 2013.

### 2.12.3 LICENSING

The ERB issues licenses whose validity periods are as follows: generation (30 years); transmission (30 years); distribution (15 years); Supply (5 years) and manufacture, supply, installation and maintenance of solar systems (5 years). During the period under review the following licenses were issued as depicted in table 2.9.

<table>
<thead>
<tr>
<th>License type</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generation</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Transmission</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Distribution</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Supply</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Solar(^7)</td>
<td>4</td>
<td>8</td>
</tr>
</tbody>
</table>

### 2.13 POLICY CHANGES AFFECTING THE ELECTRICITY SUB-SECTOR

#### 2.13.1 STATUTORY INSTRUMENTS NUMBER 33 AND 78

During the years under review, Government introduced Statutory Instrument (SI) Number 33 which prohibited quoting, paying or demanding to be paid or receiving foreign currency as legal tender for goods, services or any other domestic transactions.

Based on feedback from the industry there was a mixed reaction to this measure. Specific to the energy sector, it was noted that the measure created foreign exchange risks for projects were income was to be denominated in Kwacha, but obligations such as loan repayments were

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\(^7\)For manufacture, supply, installation and maintenance of solar energy systems
denominated in foreign currency. This is because the majority of the existing private and public sector agreements had been signed using the dollar as reference currency prior to the SI. Industry made submissions to the ERB and follow-up negotiations were undertaken between the Industry and Government to revisit the contentious legislation, which investors observed had resulted in project delays and investor uncertainty.

In view of the foregoing, the Government signed SI 78 of 2012. According to Regulation 2A (i) of the SI 78, international transactions were exempt from the requirement to quote, demand, pay or receive foreign currency as a legal tender. Based on the definition of international transactions, this included the sale or purchase of power to another country. An amendment was later signed through SI No. 56 of 2013 which enables IPPs who enter into PPAs with electricity supply utilities, such as ZESCO or CEC, to quote their PPA tariffs in foreign currency.

Whilst, SI 78 had resolved some of the concerns, some industry players still felt that there was need to grant a special exemption to the Power sector as a whole from complying with this piece of legislation.

2.13.2 THE GRID CODE

During the periods under review, ERB finalized the Zambian Grid Code (ZGC) and its attendant regulations which were officially launched on 31st October 2013. The development of the Grid Code is an important milestone towards an open access regime in the electricity sub-sector. It outlines the rules of engagement when connecting to the transmission network and levels out the playing field for all players without giving undue advantage to ZESCO as the owners of the infrastructure.

2.14 REGIONAL DEVELOPMENTS IN THE ELECTRICITY SUB-SECTOR

2.14.1 REGIONAL SUPPLY AND DEMAND OF ELECTRICITY

Southern Africa generates about 74% of its electricity from coal-powered stations. Save for hydropower that accounted for about 20% of SADC’s total energy generation, other renewables such as wind and solar were not considered as major contributors to the region’s electricity needs.

According to SADC, Sub-Saharan Africa is home to almost 42% of people who lack access to energy and that 78% of these used traditional biomass for cooking and heating. SADC also notes that the region has lagged behind its sister Regional Economic Communities (RECs) in respect of overall access to electricity. For instance, 24% of SADC residents had access to electricity compared to 36% in the Eastern Africa Power Pool (EAPP) and 44% in the West African Power Pool (WAPP).

Furthermore, since 2007, the SADC region still faces an electricity deficit. In view of this, measures were agreed, by Member States, to identify power supply gap strategies that would close the deficit by 2015. Indications are, however, that implementation of such projects has lagged behind the planned dates due to lack of funding or lack of PPAs which were crucial to project financing.

According to SADC, between 2012 and 2013, the Southern African Power Pool (SAPP) had an

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8 The 33rd Meeting of the SADC Ministers responsible for Energy was held in Lesotho, Maseru on the 16th May, 2013.
available capacity of 51,702 MW against a demand of 59,411 MW, which includes, peak demand, suppressed demand and reserves. SAPP statistics indicated that the region had a capacity shortfall of 7,709 MW.

SADC has planned that energy adequacy would be achieved by 2017 as a total of approximately 19,000MW of new generation was expected to be commissioned between the period 2013 to 2016 of which 3% would be renewable energy (wind and solar). According to SADC, the region would have sufficient generation capacity reserves after 2017 but only if all projects were commissioned as planned. Most projects are delayed as a result of delayed signing of PPAs, for example, Zimbabwe-Zambia-Botswana-Namibia (ZIZABONA) transmission project, and also delays in signing key project documents such as Memorandum of Understanding (MOU).

On the renewable energies front, SADC expects to achieve a renewable energy mix in the regional energy grid of at least 32% of the total energy produced by 2020, which was projected to rise to 35% by 2030.

### 2.14.2 REGIONAL ELECTRICITY REGULATORS ASSOCIATION

During the period under review, the ERB continued to be a member of Regional Electricity Regulators Association of Southern Africa (RERA). This is a formal association of electricity regulators in the SADC region that promotes capacity building; information sharing; and facilitation and coordination of regional Electricity Sector Industry (ESI) Policy. RERA has continued to provide the requisite skills and capacity to the ERB staff which has proved to be beneficial to the conduct of energy regulation. During the periods under review, some of the key capacity building activities were in the following areas: training in mini-grids policy and regulatory options; and PPA and regional power trade capacity programmes.
3. PETROLEUM SUB-SECTOR

This section discusses the structure of the Petroleum industry, development, prospects and challenges during the period under review.

3.1 CONSUMPTION OF PETROLEUM PRODUCTS IN 2012 AND 2013

3.1.1 CONSUMPTION OF PETROLEUM PRODUCTS BY TYPE

The consumption of fuel at national level, between the periods 2007 to 2013, generally increased. Specifically, between 2012 and 2013, consumption increased by 3%, from 1,035,006MT to 1,067,460MT. This movement is depicted in figure 3.1.

Annual consumption of diesel, petrol and kerosene for the year 2012 was as follows: diesel (675,756 MT); petrol (234,224 MT); and kerosene (14,669 MT). Similarly in 2013 consumption was: diesel (676,078 MT); petrol (275,604 MT); and kerosene (12,315 MT). Consequently for the stated periods, annual consumption rose for diesel and petrol as follows: diesel (0.05%); petrol (17.7%); while the consumption of kerosene dropped (15.8%). HFO recorded a reduction in consumption of 15.7% while Jet A1 recorded a marginal increase of 0.3%.

![Above: Service station on Kafue Road](image)

FIGURE 3.1: TRENDS IN NATIONAL CONSUMPTION OF FUEL BY TYPE, 2007-2013

<table>
<thead>
<tr>
<th>Year</th>
<th>Fuel Oils</th>
<th>LP Gas</th>
<th>JET A1</th>
<th>Kerosine</th>
<th>Unleaded Petrol</th>
<th>Diesel</th>
<th>Total Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>65635</td>
<td>2072</td>
<td>30639</td>
<td>9729</td>
<td>123780</td>
<td>352030</td>
<td>583885</td>
</tr>
<tr>
<td>2008</td>
<td>63911</td>
<td>2124</td>
<td>38729</td>
<td>12532</td>
<td>130705</td>
<td>408935</td>
<td>656936</td>
</tr>
<tr>
<td>2009</td>
<td>59951</td>
<td>2097</td>
<td>29655</td>
<td>15574</td>
<td>152443</td>
<td>445431</td>
<td>705149</td>
</tr>
<tr>
<td>2010</td>
<td>46845</td>
<td>1848</td>
<td>29130</td>
<td>17330</td>
<td>160982</td>
<td>496568</td>
<td>752704</td>
</tr>
<tr>
<td>2011</td>
<td>49461</td>
<td>2424</td>
<td>32593</td>
<td>19898</td>
<td>182123</td>
<td>577836</td>
<td>864335</td>
</tr>
<tr>
<td>2012</td>
<td>60222</td>
<td>658</td>
<td>49477</td>
<td>14669</td>
<td>234224</td>
<td>675756</td>
<td>1035006</td>
</tr>
<tr>
<td>2013</td>
<td>50793</td>
<td>3021</td>
<td>49613</td>
<td>12315</td>
<td>275604</td>
<td>676078</td>
<td>1067460</td>
</tr>
</tbody>
</table>

Source: ERB

Some companies did not report their consumption of LPG during the year 2012.
In terms of daily consumption, diesel was highest for the periods under review. The daily consumption of diesel in litres\(^{10}\) was 2.20 million and 2.21 million for 2012 and 2013 respectively. Similarly, the daily consumption of petrol per liter was 0.86 million and 1.01 million for 2012 and 2013 respectively. As for kerosene the daily consumption per liter was 51,000 and 43,000 for 2012 and 2013 respectively. The consumption of other fuels in 2013 was as follows: LPG at 8 MT per day; Jet A-1 at 134 MT per day and HFO at 139 MT per day.

### 3.1.2 CONSUMPTION OF PETROLEUM PRODUCTS BY ECONOMIC SECTOR

Figure 3.2 shows the consumption of white products (diesel, petrol, kerosene and jet A-1) by sector respectively in 2012 and 2013. In both years, the retail sector accounted for the greatest proportion of white products consumed followed by the mining sector. The two sectors accounted for 74% and 71% of national annual consumption of white products in 2012 and 2013 respectively. The consumption of fuel by the rest of the sectors remained almost the same between 2012 and 2013. A significant change was noticed for the sector labelled ‘other’ moving from 3% in 2012 to 8% in 2013.

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\(^{10}\) To convert metric tonnes to liters, divide the weight in metric tonnes by product density and multiply by one thousand (1,000). Density for diesel is 0.84kg/liter, petrol is 0.75kg/liter and kerosene is 0.80kg/liter.
Note: Consumption by sector denotes the quantities of petroleum products that are delivered directly to the defined sectors. For example, fuel delivered to retail service stations is classified under Retail Sector while that which is delivered directly to the mining houses is classified under Mining Sector. The figures denoted as zero percent (0%) have been rounded off to the nearest percentage.

3.1.3 CONSUMPTION OF PETROLEUM PRODUCTS BY PROVINCE

Figure 3.3 depicts the national level consumption of key petroleum products by province. In both years, 2012 and 2013, the pattern of consumption by Province is similar. The major consumers of petroleum products are Lusaka and Copperbelt Provinces. Moderate consumers are Southern, Central and Eastern Provinces while the least consumers are Luapula, Muchinga and Western Provinces.

Generally the consumption pattern for petroleum products is consistent with the number of retail sites and economic activities in the area. With regard to petrol consumption in 2013, the leading provinces were Lusaka and Copperbelt accounting for 48% and 23% respectively. The least consumers of petrol were Luapula Province at 1.7% and Muchinga Province at 1.5%.
With regard to diesel consumption in 2013, the leading provinces were Lusaka and Copperbelt accounting for 33% and 25% respectively. The least consumers of petrol were Luapula Province and Muchinga Province at 1% each.

For kerosene consumption in 2013, the leading provinces were Lusaka, Copperbelt and Luapula accounting for 37%, 22% and 20% respectively. The least consumers of kerosene were Western Province at 0.7% and Muchinga Province at 0.5%.

North Western Province was the highest consumer of low sulphur diesel in 2013 due to the increased mining activities in the province.

3.2 RETAIL SERVICE SITES

3.2.1 LOCATION OF RETAIL SERVICE STATIONS

The country has in recent years seen the proliferation of filling stations in urban areas, especially Lusaka and the Copperbelt provinces. Siting of filling stations in any geographical location is mainly driven by the demand for petroleum products in that area. Therefore, towns or provinces with high economic activity and high number of vehicle population such as Lusaka and the Copperbelt are a target for potential investors in the petroleum sub-sector.

Conversely, the low turnover in rural areas caused by low economic activity and vehicular population renders them unattractive for infrastructure investment and hence the occasional fuel supply deficiency experienced in these regions. While a high concentration of filling stations in a particular location is beneficial in terms of offering more options to consumers, the trend has downside consequences on the profitability of the individual sites due to competition and also increases safety and environmental risks.

During 2012 and 2013, the ERB developed a number of regulatory intervention measures aimed at reversing the trend of over concentrating service stations in few geographical areas.
For example, no service station would be approved for development if it is within a radius of one (01) Kilometer of an existing service station in an urban, built-up or residential area unless it can be clearly demonstrated that the need exists otherwise and that no significant impacts will occur.

During the review periods, ERB also developed appropriate regulatory interventions to promote the setting up of service stations in rural or fuel deficit areas. The proposed measures shall be complimentary to the existing ZS 703: Rural Filling Stations: Specifications. This standard stipulates more lenient technical requirements (than the requirements for conventional service stations) without compromising on safety, health, environmental protection and product quality. The standard is applicable to filling stations located a minimum of 50Km from the nearest operating station.

### 3.2.2 PETROLEUM RETAIL SITES

During the periods under review, the number of retail service stations increased from 249 in 2012 to 275 in 2013. Tables 3.1a and 3.1b show the number of service stations and operators in 2012 and 2013 respectively.

<table>
<thead>
<tr>
<th>Operator</th>
<th>Operator</th>
<th>Lusaka</th>
<th>C/Belt</th>
<th>Southern</th>
<th>Central</th>
<th>Eastern</th>
<th>Northern</th>
<th>Luapula</th>
<th>N/Western</th>
<th>Western</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odys Oil Zambia</td>
<td>OMC</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Ravazia Petroleum</td>
<td>OMC</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>L.K.Motors Dealer</td>
<td>Dealer</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
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Source: ERB
**TABLE 3.1B: NUMBER OF RETAIL SERVICE STATIONS BY OPERATOR AND LOCATION IN 2013**

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<th>Operator</th>
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<th>Central</th>
<th>Eastern</th>
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Source: ERB

In both years under review, Puma Energy Zambia Plc had the highest number of retail sites and had presence in all the 10 provinces. This was followed by Total Zambia Limited, Engen and Kobil in 2012. The hierarchy was similar in 2013 in terms of OMCs ownership of retail sites for the first, second and third except for the fourth place where Kobil was overtaken by Mount Meru.

In both years, the bulk of the service stations were located in Lusaka followed by Copperbelt, Southern and Central provinces. In 2012, the provinces with the least number of retail service stations were Luapula, North Western and Western. While in 2013 the least number of retail stations were in Muchinga, North Western and Western provinces.

Generally, in terms of spread, 80% of the retail sites were in urban areas. In terms of ownership 99% of retail sites were owned by OMCs in both 2012 and 2013.
3.3 MARKET SHARE OF PETROLEUM PRODUCTS

3.3.1 MARKET SHARE OF WHITE PRODUCTS

As at 31st December 2013, there were 27 Oil Marketing Companies (OMCs) trading in white petroleum products. As was the case in 2012, Puma Energy Zambia Plc and Total Zambia Limited continued to dominate the market share of white petroleum products in 2013. Puma Energy Zambia Plc had the highest market share of 27.0% in 2013 and 31.4% in 2012 followed by Total Zambia Limited with a market share of 26.7% in 2013 and 25.3% in 2012.

As such Puma Energy Zambia Plc and Total Zambia Limited were the two top OMC’s and jointly accounted for 53.7% and 56.7% market share in 2013 and 2012 respectively. The two OMC’s were followed by Engen and Mount Meru who jointly accounted for 15.9% of the market share in 2013.

The rest of the OMC’s (23) accounted for the balance of the market share in 2013 at 30.4%. The detailed data on market share in 2013 is depicted in figure 3.4.

<table>
<thead>
<tr>
<th>Company</th>
<th>Market Share (2013)</th>
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<td>Puma Energy Zambia</td>
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<tr>
<td>Total (Z) Limited</td>
<td>26.7%</td>
</tr>
<tr>
<td>Engen Petroleum</td>
<td>8.3%</td>
</tr>
<tr>
<td>Mount Meru</td>
<td>7.6%</td>
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<tr>
<td>Spectra Oil Zambia</td>
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</tr>
<tr>
<td>Kobil Zambia Limited</td>
<td>4.8%</td>
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<tr>
<td>Petroda Zambia</td>
<td>3.9%</td>
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<td>SGC Investments</td>
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<td>Suban Petroleum</td>
<td>2.2%</td>
</tr>
<tr>
<td>Lake Petroleum Ltd</td>
<td>1.9%</td>
</tr>
<tr>
<td>Pegasus Energy (Z) Ltd</td>
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<tr>
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<tr>
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<tr>
<td>Ravasia Petroleum Ltd</td>
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</tr>
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<td>Samfuel Ltd</td>
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<td>Petrotech Oil</td>
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</table>

Source: ERB

3.3.2 MARKET SHARE OF JET A-1

Jet A-1 is mostly sold to the public and private aviation industry while a sizeable quantity is sold to other sectors such as agriculture. Figure 3.5 shows market shares of Jet A-1 by OMCs for 2012 and 2013. As depicted, Total Zambia Limited and Puma Energy Zambia Plc were the main distributors of Jet A-1 in 2012 and 2013. Collectively, the two companies recorded shares of 96.8% and 94.6% in 2012 and 2013 respectively.
The rest of the OMCs who deal in Jet A-1, that is, Mount Meru Petroleum Limited, Oryx Energies (Z) Limited, Petroda Zambia Limited and Spectra Oil Corporation Limited together accounted for the remaining 5.4% market share in 2013. This market share for the remaining companies was close to the share held in 2012 (3.2%).

With respect to individual company market share, Total Zambia commanded a share of 49.9% and 55.1% in 2012 and 2013 respectively. Puma Energy Zambia Plc was next and accounted for 47% and 39.5% in 2012 and 2013 respectively.

The third leading company in 2012 was Spectra Oil Corporation Limited which accounted for 3%. However, Spectra’s share dropped to 0.6% share in 2013. In 2013 the third leading company became Oryx Oil with a share of 4.5% from nothing in the previous year.

### 3.3.3 MARKET SHARE OF LUBRICANTS

The market share of lubricants by OMCs and other licensees are shown in figure 3.6. Puma Energy Zambia Plc led the market in 2013 with a share of 39.7%. It was followed by Spectra Oil Corporation with a share of 26.9%. Total Zambia Limited was third with a share of 12.9%. The balance of the market share was collectively accounted for by the other companies as depicted in figure 3.6.
As depicted in figure 3.6, Puma Energy Zambia Plc remained dominant in the years under review although its market share gradually declined between 2012 and 2013. Spectra Oil Corporation is gradually increasing its market share while Total Zambia Ltd did not make any significant improvement during the period under review.

3.4 FEEDSTOCK IMPORTATION, PROCESSING AND STORAGE

3.4.1 FUEL IMPORTATION

a) Procurement of fuel

In 2012, the Ministry of Mines, Energy and Water Development, imported seven (7) shipments of petroleum feedstock at a total cost of US$634 million. In 2013, the Ministry imported (7) shipments of petroleum feedstock at a total cost of US$635 million. Details of the cargos received in 2012 and 2013 are shown in Tables 3.2a and 3.2b respectively.
TABLE 3.2B: PETROLEUM FEEDSTOCK IMPORTS IN 2013

<table>
<thead>
<tr>
<th>Cargo Name</th>
<th>Month</th>
<th>Tonnage (MT)</th>
<th>Cost (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT Olympic Spirit</td>
<td>February</td>
<td>85,373</td>
<td>82,737,985.62</td>
</tr>
<tr>
<td>MT Euro Sea</td>
<td>March</td>
<td>89,900</td>
<td>89,746,294.00</td>
</tr>
<tr>
<td>MT Vermilion Energy I</td>
<td>May</td>
<td>88,400</td>
<td>99,866,475.87</td>
</tr>
<tr>
<td>MT Vermilion Energy II</td>
<td>June</td>
<td>88,000</td>
<td>87,831,365.11</td>
</tr>
<tr>
<td>MT Vermilion Energy III</td>
<td>July</td>
<td>83,138</td>
<td>86,128,152.50</td>
</tr>
<tr>
<td>MT Afra Laurel</td>
<td>October</td>
<td>83,452</td>
<td>90,829,808.62</td>
</tr>
<tr>
<td>MT Afra Hawchorn</td>
<td>December</td>
<td>88,200</td>
<td>97,849,400.97</td>
</tr>
</tbody>
</table>

606,463 634,989,483

Source: TAZAMA Pipeline Limited

b) TAZAMA Pipelines Limited

TAZAMA Pipelines Limited (TAZAMA) is responsible for the conveyance of feedstock to Ndola Fuel Terminal (NFT) in Ndola, from the tank farms in Dar-es-Salaam via a 1,710 km pipeline. Since inception, the pipeline which has had a capacity of 700,000 MT per year, has undergone major rehabilitation. During 2012 and 2013, the throughput was 596,094 MT and 615,916 MT respectively. Notably, the Throughput for the two (2) years under review was below the installed capacity. Figure 3.7 shows the throughput trends for the period 2009 to 2013.

FIGURE 3.7: TAZAMA THROUGHPUT TREND, 2009 -2013

During the periods under review, TAZAMA carried out an intelligent pigging exercise from Kigamboni Pumping Station in Tanzania to Ndola. The exercise was completed in November 2013 at a cost of US$2.3 million. This exercise exposed corroded areas and weaknesses in the pipeline that needed to be repaired in order to improve the operation of the pipeline.

In 2013, TAZAMA continued with its rehabilitation programme which resulted in the complete overhaul at Kigamboni Pumping Station at a cost of US$4.5 million. This was in addition to

Pigging in the context of pipelines refers to the use of devices known as pigs to perform various maintenance operations on the pipeline without disruption of the flow of the crude feedstock.
other works that were commenced at Elphons Pass Pumping Station which cost about US$6.2 million. Other works include the electrification of Elphons Pass Station and the surrounding villages. Once all the rehabilitation projects are completed and commissioned, TAZAMA is expected to have enhanced operational efficiency.

### 3.4.2 FUEL PROCESSING

During the periods under review, INDENI Petroleum Refinery Limited remained operational for the most part of the year and experienced relatively few shut downs. All the shut downs were as a result of either scheduled maintenance works or unexpected delays in crude oil feedstock delivery.

INDENI has a plated capacity of 750,000MT. Figure 3.8 shows the trend in the processed quantity of feedstock over the past six years.

![Figure 3.8: Throughput of INDENI, 2008 to 2013](image)

As depicted in figure 3.8 INDENI processed 655,000MT of feedstock during 2012. This represented a decrease of 2.1% (14,000MT) from the quantity processed in 2011 (699,000MT). Meanwhile, in 2013, INDENI processed 627,000MT of petroleum feedstock during the year, that is, a decrease by 4.27% or 28,000MT, from the quantity processed in 2012 (655,000MT).

INDENI from inception had been producing bitumen. However, ten (10) years ago the plant was shut down because it became economically unviable. Since then, Zambia has been importing bitumen to meet local demand. However, in 2012 INDENI commenced the rehabilitation of the bitumen plant at an estimated cost of US$20.7 million. This was in response to the improved economic environment and expected operational viability of the bitumen plant.

The expected completion date is mid June 2014. In response to this development the ERB developed a pricing framework for bitumen.
3.4.3 FUEL STORAGE

a) Ndola Fuel Terminal

The Ndola Fuel Terminal, which was established in 1973 with the capacity of 114,000M³, underwent significant rehabilitation and upgrading during the periods under review. The major works undertaken were to the existing terminal storage tanks and construction of a new road and rail loading gantries.

b) Lusaka fuel storage depot

The Lusaka Fuel Storage Depot was commissioned in May 2013 at a total cost of US$24 million. It has a storage capacity of 25,000M³ disaggregated as follows; 14,000M³ for diesel, 10,000M³ for petrol and 1,000M³ for kerosene. The depot partly contributed to the reduced congestion at the Ndola Fuel Terminal during 2013.

c) Mpika fuel storage depot

Construction of the Mpika Fuel Storage Depot was completed in 2013. It is expected to be fully operational in 2014. The new depot will have a storage capacity of 4,000m³ for diesel, 2,000 m³ for petrol and 500m³ for kerosene. The total cost for this project was about US$23.2 million.

d) Solwezi fuel storage depot

The construction of the Solwezi fuel storage depot commenced during the period under review. Once completed, the storage depot will have capacity of 10,000m³ for diesel, 5,000 m³ for petrol and 1,000 m³ for Kerosene. The project was expected to cost about US$25 million and is expected to be completed in June 2015.

e) Mongu fuel storage depot

During the periods under review, plans to construct the Mongu fuel storage depot had reached an advanced stage. The depot is planned to have storage capacity of 4,000m³ for diesel, 2,000m³ for petrol and 500m³ for kerosene. The cost was estimated at US$23.2 million and completion is expected in June 2015.
3.5 PRICING OF PETROLEUM PRODUCTS

3.5.1 WHOLESALE AND PUMP PRICES

The wholesale and pump prices of petroleum products are reviewed for each cargo of feedstock procured and received. The ERB determines the prices of petroleum products in Zambia using the Cost Plus Model (CPM). The CPM Model is used to determine the prices of petroleum products by adding all the costs along the supply value chain. The main factors that influence the domestic fuel prices are the exchange rate of the Zambian Kwacha against the United States Dollar and the international oil price.

3.5.2 INTERNATIONAL OIL PRICES

Zambia imports crude oil mainly from the Middle East. It imports mostly Murban crude and sometimes Oman crude. Figure 3.9 shows the trend in international oil prices from January 2012 to December 2013 for Murban, Brent and West Texas Intermediate (WTI) crude.

![Figure 3.9: Crude Oil Price of Murban, WTI and Brent Crude (US$/Barrel)](image)

Source: Abu Dhabi National Oil Company Limited, US Energy Information Administration

During the review periods, the Murban crude prices were consistently higher than Brent crude and WTI crude. WTI crude was the lowest, closing the year at 97.63 US$/barrel\(^{12}\) in December 2013 from 79.79 US$/barrel in December 2012. Murban crude and Brent crude on the other hand closed the year 2013 at 113.85 US$/barrel and 110.76 US$/barrel in December 2013 from 110.75 US$/barrel and 110.74 US$/barrel in December 2012 respectively.

3.5.3 EXCHANGE RATE MOVEMENT

Figure 3.10 shows the trend in exchange rates for the periods under review. As depicted in figure 3.10, the average Bank of Zambia inter-bank exchange selling rate has been weakening since July 2012. The Kwacha depreciated by 7.16% from a monthly average of ZMW4.87/US$ in July 2012 to ZMW5.28/US$ in December 2012.

After the rebasing of the Zambian Kwacha at the beginning of January 2013, the local currency continued to lose value against the United States dollar trading at an average of ZMW5.33/US$ (ZMK5.33/US$).

\(^{12}\) A barrel is equivalent to 129 liters
Overall in 2013, the Zambian Kwacha to United States Dollar exchange rate depreciated by 5% moving from K5.29/US$ in January and closing at K5.53/US$ in December.

### 3.5.4 UNIFORM PUMP PRICING

Uniform Pump Pricing (UPP) entails that the price of fuel at all retail sites throughout the country is the same for particular products. Prior to the introduction of the UPP in September 2010, the cost of petrol, diesel and kerosene at retail sites furthest from the NFT was higher than the price obtaining at sites closer to the NFT. The UPP is administered through a transport cross subsidy mechanism. OMCs or independent dealers delivering fuel to retail sites within the Copperbelt are required to remit the transport differential for each litre of fuel into the UPP fund. OMCs or independent dealers delivering fuel to sites out of the Copperbelt are reimbursed the transport differential for each litre of fuel. By the close of 2013, the margins per litre were: OMC (K0.40); Dealers (K0.26) and Transporters (K0.18).

During 2012 and 2013, ERB commenced an exercise to review interim margins of OMCs; Dealers and Transporters. This was a follow-up to heightened complaints by these value chain players regarding the inadequacy of the margins, as the margins were last reviewed in May 2010. The review was premised on how the extra transport differential saving from the Lusaka depot and later the Mpika depot could be shared amongst the players through an interim margins revision.
The interim margins would be developed and implemented in 2014 and hold until a comprehensive review is undertaken.

3.5.5 TREND IN DOMESTIC PRICES OF PETROLEUM PRODUCTS

The domestic fuel pump prices of unleaded petrol, diesel and kerosene remained unchanged during the year 2012 at K8.16, K7.57 and K5.15 respectively. The prices remained the same in 2013 until May when there was an upward adjustment of 21.5% for unleaded petrol and diesel and 32.66% for kerosene.

The fuel adjustment was necessitated by the removal of fuel subsidies by the Government and changes in the exchange rate and global oil price. The prices remained unchanged for the rest of the year at the adjusted prices of K9.91 for unleaded petrol, K9.20 for diesel and K6.83 for kerosene. Figure 3.11 shows the historical price trend in domestic pump prices from 2000 to 2013.

3.5.6 REGIONAL COMPARATIVE PRICES OF PETROLEUM PRODUCTS

Figure 3.12 shows the comparison of pump prices in Zambia to pump prices in other countries in the region as at December 2013. Relative to other countries in the region, the pump price of petroleum products in Zambia are relatively high, close only to Malawi. However, the price of fuel in each country is driven by several factors which include the mode of importation, price model and cost lines and the overall structure and conduct of the petroleum value chain. These factors that influence the final price differ from country to country and therefore make it difficult to rank countries solely on price. For example, Zambia imports crude oil which unavoidably triggers the cost of pumping, storage and refinery whilst Zimbabwe imports only finished products and therefore is not affected by refinery costs.
### 3.5.7 STRATEGIC RESERVE FUND

The Strategic Reserve Fund (SRF) cost line was created to contribute towards the development of the petroleum subsector infrastructure in order to have reliable supply of petroleum products in the country. The ERB continued to manage the SRF in 2012 and 2013. The ERB is responsible for the collection of SRF fund from OMCs at the rate of K0.15 per litre or per kg as the case may be. The SRF is used to support various developmental projects and programs in the petroleum subsector. Some of these included the following:

- Importation of finished petroleum products;
- Price support for petroleum products imported by OMCs;
- Construction of fuel storage depots;
- Road works around fuel storage depots;
- Rehabilitation of tanks and purchase of firefighting equipment at Ndola Fuel Terminal; and
- Rehabilitation of upstream infrastructure, for example, the bitumen plant at INDENI.

### 3.6 PETROLEUM STANDARDS DEVELOPMENT

#### 3.6.1 FUEL MARKING PROGRAMME

ERB will introduce fuel marking in Zambia from 2015 and onwards. Fuel marking involves the introduction of a bio-chemical invisible marker into petroleum products, and subsequent monitoring of marker concentration levels using appropriate detection equipment. Monitoring of marker concentration is carried out at various points in the supply chain at predetermined frequencies, to rule out any malpractices. During 2012 and 2013, ERB undertook studies of fuel marking and established that it is the most effective intervention to control, minimize and eliminate fuel adulteration and dumping.

The main objectives of a fuel marking programme were:

1. To minimize dumping/smuggling of tax exempted and/or transit petroleum products onto the domestic market;
ii. To control adulteration of petrol or diesel with lower taxed kerosene. Adulteration compromises the quality of petroleum products resulting in damage to vehicle engines, leading ultimately to increase in maintenance costs and negative environmental and health impacts from adulterated fuel fumes; and

iii. To maintain a level playing field in the downstream operations by eliminating perceived benefits associated with unfair practices in the petroleum industry.

The ERB shall be responsible for monitoring and enforcement of the programme in order to maintain some measure of control and also assure the integrity of the marking process.

3.6.2 ZAMBIA QUALITY CONTROL AND MONITORING GUIDELINES

The Zambia Quality Control and Monitoring (ZQCM) Guidelines were first developed and implemented in 2008 through a consultative process involving a number of stakeholders. The Guidelines provide for systems and procedures that ensure that the quality of petroleum products is monitored and assured at different stages of the supply chain. Implementation of the ZQCM Guidelines revealed weaknesses in the systems which made enforcement difficult. This prompted a review of the Guidelines.

The review process was concluded during 2013 and all recommendations will be implemented beyond 2014. The revised ZQCM Guidelines have incorporated quality assurance responsibilities for all stakeholders along the supply chain including responsibilities for transporters whose role was not covered in the initial Guidelines. There is also a new and clear requirement for document maintenance to address the issue of chain of custody of petroleum products as they are transferred from one point of the chain to the next. The revised ZQCM Guidelines have been included as a license condition in the respective licenses. Non-adherence to the requirements stipulated in the Guidelines shall attract enforcement action.

3.6.3 MOBILE TESTING OF PETROLEUM PRODUCTS

During 2012 and 2013, ERB remained committed to ensuring the provision of quality energy services and products with the ultimate goal of protecting the consumer. The provision of quality of petroleum products is governed by a number of mandatory Zambian Quality Standards including but not limited to ZS 369 – Automotive Gasoil; ZS 718 – Low Sulphur Gasoil; ZS 395 – Unleaded Petrol; and ZS 394 – Jet A1.

In fulfillment of this function, the ERB regularly conducts compliance monitoring inspections which involve sampling and testing of the various petroleum products at retail sites and other points along the supply chain. Samples collected are tested at INDENI Refinery, a private laboratory, Zambia Bureau of Standards laboratories and occasionally laboratories outside Zambia. The laboratory results obtained from these sampling audits are compared with the requirements stipulated in the Zambian standards. Suppliers of any non-conforming products are subjected to ERB enforcement action as determined by the ERB.

Over the years, the ERB has faced a number of challenges in carrying out its quality assurance function. The main challenge can be attributed to the delays experienced between submissions of samples and reporting of results by the laboratory. Delayed reporting often give rise to the contaminated fuel being consumed before appropriate intervention measures can be taken by the ERB.

In a bid to overcome this challenge, the ERB, during 2012 and 2013, procured a portable petrol
(gasoline) analyzer or on-site sampler. The analyzer shall be useful for on-site determination of the indicative quality of petroleum products with failed results obtained from the analyzer being subjected to conventional laboratory analysis. It is envisaged that this approach shall reduce on reporting turnaround time alluded to above.

3.7 CHALLENGES FACING THE PETROLEUM SUB-SECTOR

During 2012 and 2013, the key challenges in the petroleum subsector were the poor state of infrastructure and the uneven distribution of service stations.

3.7.1 POOR STATE OF INFRASTRUCTURE

The main infrastructure that supports the petroleum supply value chain had existed for a long time and most of them are in needed rehabilitation. For example, the pipeline, the refinery and the fuel terminal were over forty years old and require additional investment to make them more efficient and more competitive. Furthermore, the refinery is unable to meet the specifications for cleaner fuels such as low-sulphur diesel.

3.7.2 DISTRIBUTION OF PETROLEUM PRODUCTS

During 2012 and 2013, most rural areas continued to suffer from inadequate service stations and depended on unlicensed suppliers. OMCs prefer to build service stations in urban areas especially Lusaka and the Copperbelt Provinces. Meanwhile, far flung areas have become susceptible to persistent fuel deficits and are inevitably serviced by illegal fuel vendors.

3.8 PETROLEUM SUB-SECTOR FUTURE PROSPECTS

Future prospects for the petroleum sub-sector are bright. MMEWD, during 2012 and 2013, started the process of reviewing the supply options of petroleum products in Zambia. This was in response to the on-going debate on whether the country should close the refinery and import finished products or continue with the current supply situation. The MMEWD were to engage a consultant to review the supply of petroleum products in the country. The objectives of the study were to investigate options that would:

- Ensure that the country’s supply system meets its petroleum requirements up to the year 2030;
- Implement the best options for meeting the country’s supply requirements; and
- Ensure that petroleum products are supplied efficiently and at the most economic costs to the country, taking into account the current strategic development objectives.
APPENDICES

APPENDIX 1: ZESCO’S KEY PERFORMANCE INDICATORS

I. METERING CUSTOMERS
■ All unmetered customers are metered by March 2013;
■ Meter 25,000 prepaid customers per quarter; and
■ All new standard residential meter installations should be done within 30 days after customer pays from April 2011.

II. CASH MANAGEMENT
■ Non-GRZ trade receivables should not exceed 17% of revenue by March 2013;
■ GRZ trade receivables should not exceed 25% of revenue by March 2013;
■ Reduce Non-GRZ debtor days to not more than 60 days by March 2013;
■ Reduce GRZ debtor days to not more than 90 days by March 2013; and
■ Improve the debt-equity ratio to 70:30 by March 2016. Kindly note that this will just be monitored during this period and will not be scored.

III. STAFF PRODUCTIVITY
■ Improve the customer-employee ratio to 100:1 by March 2012; and
■ Reduce staff costs to 45% or less of total costs by March 2013.

IV. QUALITY OF SERVICE SUPPLY
■ Maintain the Dry Season System Average Interruption Duration Index (DS-SAIDI) i.e. from April to September, at 27 hours or less from April 2011 onwards;
■ Maintain the Wet Season SAIDI (WS-SAIDI) i.e. October to March the following year, at 36 hours or less from April 2011 onwards;
■ Maintain the DS- System Average Interruption Frequency Index (DS-SAIFI) at 5 times or less from April 2011 onwards;
■ Maintain the WS-SAIFI at 5.5 times or less from April 2011 onwards;
■ Maintain the DS Customer Average Interruption Duration Index (DS-CAIDI) at 5 hours or less from April 2011 onwards;
■ Maintain the WS-CAIDI at 7 hours or less from April 2011 onwards; and
■ Maintain the Average System Availability Index (ASAI) at 90% or more from April 2011 onwards.

V. SYSTEM LOSSES
■ Maintain transmission losses at 5% or less; and
■ Reduce distribution losses to 14% by March 2012.
APPENDIX 2: STATUS OF POWER GENERATION PROJECTS

<table>
<thead>
<tr>
<th>Project</th>
<th>Cost (US Dollars)</th>
<th>Developer</th>
<th>Capacity (MW)</th>
<th>Status</th>
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<td>Kafue Gorge Lower Power Project</td>
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<td>ZESCO with Participation of Private sector</td>
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<td>Navah Bharat and ZCCM-IH</td>
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**PROJECTS AT PREFEASIBILITY AND FEASIBILITY STUDY LEVEL**

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<td>Ngonye Power Project</td>
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<td>6</td>
<td>Lelwa Power Project</td>
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**TRANSMISSION PROJECTS**

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