BOTSWANA ENERGY REGULATORY AUTHORITY

Regulating Energy with Integrity

LIQUEFIED PETROLEUM GAS MARKET STUDY

FINAL REPORT **May 2021**

Team composition

The study was undertaken by the following team:

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Acronyms

ASTM:	American Society for Testing and Materials
BEE	Black Economic Empowerment
BERA:	Botswana Energy Regulatory Authority
BOBS:	Botswana Bureau of Standards
BOL:	Botswana Oil Limited
BOS:	Botswana Standard
BPIPMA:	Bulk Petroleum Infrastructure and Product Management Agreement
BURS:	Botswana Unified Revenue Services
CCA:	Competition and Consumer Authority
CEF:	Central Energy Fund
CIPA:	Companies and Intellectual Properties Authority
COMESA:	Common Market for Eastern and Southern Africa
CP:	Contract Pricing
CSC:	Coastal Storage Cost
ERB:	Energy Regulation Board
FOB:	Free on Board
GRS:	Government Reserves Storage
HLS:	High Level Strategy
IOC:	International Oil Companies
LCV:	Landed Cost Value
LPG:	Liquefied Petroleum Gas
MITI:	Ministry of Investment Trade and Industry
MMGE:	Ministry of Mineral Resources, Green Technology and Energy Security
MRGP:	Maximum Refinery Gate Price

NDP:	National Development Policy
NEP:	National Energy Policy
OMC:	Oil Marketing Companies
PO:	Policy Objectives
PR:	Prime Rate
PS:	Policy Statement
SADC:	Southern African Development Community
SANS:	South African National Standard
SB:	Statistics Botswana
SD:	Standard Deviation
SFC:	Stock Financing Cost
VAT:	Value Added Tax
ZERA:	Zimbabwe Energy Regulatory Authority

Executive Summary

The Botswana Energy Regulatory Authority (BERA) conducted a Market Study into the supply and distribution of Liquefied Petroleum Gas (LPG) in Botswana with the overall objective of establishing the baseline in terms of how the market operates. Therefore, the following activities have been undertaken as integral part of the assessment:

(a) Assessment of the entire value chain covering importation, storage, distribution and retailing of LPG;

(b) Identification of possible sources and routes of supply of LPG into Botswana;

(c) Review of institutional and regulatory governance frameworks;

(d) Benchmarking with some regional member states on the application of different LPG pricing methodologies;

(e) Data collection covering commercial, financial and technical operations at wholesale, distribution and retail levels; and

(f) Make recommendations on the better regulation of the local LPG industry based on the findings of the study.

A mix of quantitative and qualitative research paradigm was adopted for this study. The target population for this study was all players involved in the Liquefied Petroleum Gas (LPG) supply chain, excluding the end users of the product. The players included wholesalers, distributors and retailers. A complete census was done for wholesalers and distributors while sampling was only used to determine the number of retailers to be contacted for data collection since their numbers were large to be considered for a whole census. Therefore, Cluster Sampling Method (CSM) was used through which a total of 55 places were sampled for data collection at the retail level.

A review of institutional and regulatory governance frameworks was undertaken as part of the study to prioritise and address issues of national concern in addition to regulatory matters. Reference was made to the National Energy Policy, 2021; Draft Botswana Oil and Gas Sector Strategy, 2013; and the Botswana Energy Regulatory Authority Act, 2016.

In terms of LPG pricing, a high-level desktop review of pricing mechanisms was undertaken for selected member states including the Republics of South Africa, Zimbabwe and Zambia.

The availability of online LPG market information was the determining factor in selecting those countries. The outcome of the pricing review was meant to inform the development of LPG pricing framework.

A situational analysis of the local LPG market was undertaken, and the following observations were made:

(a) The gas that is consumed in Botswana comes mainly from and through the Republic of South Africa and is transported into the country by either rail or road;
(b) Botswana consumes on average 21,000,000 kilograms (21,000 tons) of LPG annually;
(c) The total average storage capacity for LPG importers and distributors amounts to 851,500 litres and 607,000 litres, respectively;
(d) Botswana operates a downstream LPG market which is oligopolistic in nature. Oligopolistic markets tend to be prevalent with uncompetitive and predatory pricing practices;
(e) There is limited citizen participation in the market, especially at the supply and distribution levels;
(f) The local gas market is not appropriately structured and there is limited segregation with regard to supply, distribution and retailing;
(g) There is limited competition at the supply and distribution levels with possible barriers to entry;
(h) LPG prices are currently not regulated and these vary from one place to another based on factors such as proximity to major supply centres and number of market players in an area;
(i) Botswana does not have a national standard which stipulates gas quality specifications;
(j) There is reported cross-filling of competitor cylinders; and

Some of the key recommendations developed include the following:

(a) The local LPG industries must be reorganised to attain the much-needed efficiencies and value for money. Therefore, the existing levels where there are

wholesalers/suppliers, distributors and retailers should be revised to two (2) levels being suppliers and retailers.

(b) Expand to existing government reserves storage infrastructure to accommodate LPG strategic stocks.

(c) LPG regulations should be approved as a matter of urgency to facilitate efficient regulation of the sector.

(d) The filling of gas cylinders of any size and type at a retail facility should be strictly prohibited for health, safety and environmental consideration.

(e) The retail space will be reserved for Batswana in line with the trade regulations therefore no foreign owned company will be allowed to trade in that space.

(f) Further work on LPG pricing should be undertaken to determine best international benchmarks for the optimal pricing framework.

(g) In the absence of a national standard on LPG quality specifications, the South African National Standard on LPG quality specification should be adopted as an interim measure while a move for regional harmonization of standards is pursued in the long term.

(h) The existing petroleum testing laboratories should be upgraded to include testing capabilities for gas quality.

(i) A rigorous public awareness campaign should be undertaken to sensitize the public on proper handling and use of gas.

1. Introduction

1.1 Background

The Botswana Energy Regulatory Authority (BERA) conducted a Market Study into the supply and distribution of Liquefied Petroleum Gas (LPG) in Botswana. The local LPG market has been unregulated prior to establishment of BERA. Thus, the Authority considered it necessary to undertake this study as a base for informing decisions on the proper regulation of the LPG sub-sector. The decisions to be made have to speak to the attainment of the Authority's powers and functions as encapsulated under Section 9 of the BERA Act, which include amongst others, the following;

(a) Protect and promote the interests of customers, consumers and other users of the services in the regulated sector, particularly in respect of: the tariffs charged, the availability and quality of services and products; and where appropriate, the variety of services and products offered throughout the country;

(b) Where relevant and so far as is practicable, ensure that the regulated entities have and maintain the resources to provide services and are otherwise fit and proper persons to provide the service;

(c) Monitor the performance of the regulated entities in relation to the levels of investment, availability, quantity, quality and standards of service, pricing, costs of services, efficiency of production, distribution and supply of service and any other matter decided upon by the Authority;

(d) Enhance public knowledge, awareness and understanding of the regulated sector;

(e) Impose administrative sanctions, issue and follow up enforcement procedures to ensure compliance with conditions of licenses, permits and authorisations;

(f) Promote efficiency and economic growth in the regulated sector;

(g) Hear complaints and disputes from customers, consumers and regulated entities and resolve the disputes and complaints or facilitate dispute resolution;

(h) Ensure that the needs of low income, rural or disadvantaged groups or persons are taken into account; and

(i) Take regulatory decisions in an open, transparent, accountable, proportionate and objective manner.

1.2 Objectives of the study

The overall objective of the study was to undertake detailed baseline assessment of the local LPG market with the view of understanding how the market currently operates. Only with a clear understanding of the status of the market can the study define a road map to achieve transparent and objective regulatory decisions. Therefore, the following activities were undertaken as integral part of the assessment:

a) Assessment of the entire value chain covering importation, storage, distribution and retailing of LPG;
b) Identification of possible sources and routes of supply of LPG into Botswana;
c) Review of institutional and regulatory governance frameworks;
d) Benchmarking with some regional member states on the application of different LPG pricing methodologies;
e) Undertake country-wide data collection covering commercial, financial and technical operations at wholesale, distribution and retail levels; and
f) Make recommendations on the better regulation of the local LPG industry based on the findings of the study.

1.3 Study approach, scope and methodology

A quantitative and qualitative research paradigm was adopted for this study. This approach permits for a broader study, involving a greater number of subjects and it also enhances generalisation of the results. Having knowledge on the kind of data to be gathered was the initial step towards determining the appropriate methodology to be used for the study. Appropriate questions were then formulated to inform the design of the study. Thus, the study used a cross-sectional survey design whose defining feature is the ability to compare different population groups at a single point in time.

The target population for this study was all players involved in the Liquefied Petroleum Gas (LPG) supply chain, excluding the end users of the product. The players included importers, distributors and retailers. It was established at the beginning of the study that there were 6 importers, 9 distributors and approximately 450 retailers of LPG operating in Botswana. A complete census was conducted for wholesalers and distributors because it is generally

understood that the larger the sample size, the more statistically significant it is. Sampling was only used to determine the number of retailers to be engaged for data collection since their numbers were fairly large to be considered for a whole census.

Cluster Sampling Method (CSM) was used to develop the sample for the study mainly at retail level. According to this method, the entire population is divided into geographical groups or clusters (Taherdoost, 2016). Subsequently, a random sample is taken from these clusters, all of which are used in the final sample (Wilson, 2010). Cluster sampling is advantageous in those instances where study subjects are fragmented over large geographical areas and where there are no existing official statistics, as it saves time and money (Davis, 2005). Botswana is made up of 17 administrative districts comprising 10 rural districts and 7 urban districts. The rural districts include South East, Southern, Kweneng, Kgatleng, Central, Kgalagadi, Gantsi, North East, North West and Chobe. The urban districts include the 2 cities of Gaborone and Francistown; the towns of Lobatse, Orapa, Jwaneng, Selebi Phikwe and Sowa township. For purposes of sampling, all the administrative districts were considered as clusters from which a sample was to be obtained. All the 7 urban districts were included in the sample. Therefore, a total of 55 places drawn across all the districts, cities and towns were selected using a simple random sampling method. The selected places are presented at Table 1 below.

Table 1: Places sampled for the study.

District No.	District Name	Selected/Town/City villages
1	South East	Ramotswa, Tlokweng
2	Southern	Kanye, Ramatlabama, Goodhope
3	Kweneng	Metsimotlhabe, Lentsweletau, Molepolole, Letlhakeng, Lephephe
4	Kgatleng	Mochudi, Pilane, Artesia, Oodi
5	Central	Palapye, Serowe, Bobonong, Mahalapye, Nata, Letlhakane, Mmadinare, Lerala, Sefhope, Tumasera, Tutume, Maitengwe, Sowa
6	Kgalagadi	Tsabong, Hukuntsi, Kang, Sekoma, Werda, Bokspits
7	Gantsi	Gantsi, Charleshill, Mamuno, Ncojane
8	North East	Masunga, Tati Siding
9	North West	Maun, Gumare, Sehithwa, Shakawe, Seronga, Nata
10	Chobe	Kasane, Kazungula, Pandamatenga
11	Cities and urban districts	Gaborone, Francistown, Lobatse, Jwaneng, Selebi-Phikwe, Sowa, Orapa

2. Assessment of regulatory governance frameworks

2.1 Policy and regulatory instruments

A review of relevant policy and regulatory instruments was undertaken to ensure that the analysis and recommendations of the study succinctly addressed national priorities in addition to regulatory matters. These issues of national concern are encapsulated in the country's Vision 2036 and the National Development Plan (NDP) 11 and include the following:

(i) Eradicating extreme poverty;

(ii) Strengthening human development outcomes;

(iii) Generating export-led diversified growth and employment;

(iv) Managing trade-off between income generation and environment;

(v) Citizen economic empowerment

(vi) Deepening democracy outcomes and strengthening government institutions.

The review of policy and regulatory instruments was also meant to ensure that the study report was not merely a piece of theoretical research but that it brought some positive impact in terms of advancing national (government) and sector priorities of economic development, equity and environmental responsibility.

2.1.1 National Energy Policy

The National Energy Policy (NEP) was recently approved during the Second Session of the 12th Parliament. The Policy outlines government's intents for an effectively harmonized development and management of the energy sector. It is founded on three guiding principles being economic development, equity and environmental protection, with a view to contribute towards achievement of ***National Prosperity, Sustainable Economic Development and Sustainable Environment*** in line with the country goals outlined in the Botswana Vision 2036 and the eleventh National Development Plan (NDP 11).

The ***Vision*** of the Policy is to create an energy system that would ensure secure and reliable supply of modern energy services for all the sectors of the economy and to significantly reduce energy-related atmospheric emissions by the year 2040. The overall ***Goal*** of the NEP

is to provide energy security for the country and to improve access to reliable and adequate supply of energy in order to facilitate a sustainable and low carbon economic development.

The Policy acknowledges that any future developments in the energy sector of Botswana will be shaped by the realities of the ***past development performances*** of the sector, the ***availability of energy resources*** and the ***global context*** within which the government operates. On that note, 20 policy statements were crafted in that regard, covering the various energy sub-sectors. For purposes of this study, only the policy statements for the petroleum sub sector are presented as per Table 2 below:

Table 2: The NEP policy statements for the petroleum sub-sector

Policy No.	Policy Statement
1	Petroleum products will be sourced and stored in a reliable and sustainable manner to ensure security of supply
2	Prices for petroleum products will be set in a manner that will balance the interests of suppliers, retailers and consumers
3	Citizen participation in the petroleum subsector will be facilitated to ensure economic countrywide supply of fuels
4	Adequate primary transport and secondary distribution infrastructure will be provided to increase access to petroleum fuels

The objective, analysis and the recommendations made for this report had to be seen to speak to or address the above policy statements if the study was to be viewed as relevant, reliable and impactful. This was even more significant for the LPG market which had been self-regulating for quite a long time, albeit presenting with the following challenges, inter alia;

(a) Severe shortages of LPG especially during the winter season;
(b) Too much reliance on one source and route of supply of LPG from the Republic of South Africa into Botswana;
(c) Limited investment into the gas infrastructure, especially for storage and distribution;
(d) Poorly structured LPG market;
(e) Erosion of safety, health and environmental considerations;

(f) Prices that are often seen as unreasonably too high;

(g) Unfair market practices; and

(h) Low citizen participation.

The review of the NEP has revealed that the policy does not present any detailed analysis of the local LPG industry, except to mention that the "price of LPG is not regulated although the BERA Act provides for its regulation" (p.6). This is understandably so since LPG is classified as a petroleum product. Hence, the general characteristics of the market and principles, prospects and choices that are required for market optimisation will normally follow a similar path to that of the ground fuels (petrol, diesel and paraffin). However, in terms of the high-level implementation strategies, the Policy advocates for *"promoting the use of global best practices in the storage, handling and transportation of Liquefied Petroleum Gas (LPG)".* Therefore, this study came in handy to fill the existing knowledge gap and further expand existing strategies. Thus, it is anticipated that the results of the study will go a long way to establish the much-needed baseline, provide guidance in terms of promulgation of national policy pronouncements, and cultivate informed regulatory decisions in terms of market restructuring and licensing, economic and technical regulation, amongst others. That notwithstanding, the NEP outlined high level implementation strategies for different energy sub sectors. Strategies for the petroleum sub-sector were reproduced as per Table 3. These strategies were considered to varying degrees in the formulation of the recommendations of the study.

Table 3: The NEP policy statements, objectives and high-level strategies for petroleum sub sector for 2020 - 2040

POLICY STATEMENT	POLICY OBJECTIVES	HIGH LEVEL STRATEGY
PS.1 *Petroleum products will be sourced and stored in a reliable and sustainable manner to ensure security of supply*	***PO1.1*** *To ensure security of supply of petroleum products* ***PO1.2*** *To ensure equitable access to petroleum products*	***HLS1.1.1*** *Construct government-owned storage facilities in the country and facilitate access to storage facilities within the region* ***HLS1.1.2*** *Oil industry participants will be legislated to maintain set levels of commercial buffer stocks.* ***HLSS1.1.3*** *Promote utilisation of alternative supply routes and sources for petroleum products* ***HLS1.1.4*** *Facilitate development of domestic sources of fuel such as renewable fuels and liquid fuels derived from coal* ***HLS1.2.1*** *Reform the institutional arrangement to promote increased access to petroleum products*
PS2 *Prices for petroleum products will be set in a manner that will balance the interests of suppliers, retailers and consumers*	***PO2.1*** *To ensure continued citizen and private sector participation in the retailing and wholesaling of petroleum products.* ***PO2.2*** *To continue regulating petroleum pump prices to ensure affordability.*	***HLS2.1.1*** *Manage the impact of the volatility of the petroleum products prices on the economy.* ***HLS2.1.2*** *Apply where necessary, cross subsidies between petroleum products to achieve specific national development objectives.* ***HLS2.2.3*** *Regulate selected petroleum products prices in a manner that promote countrywide availability.* ***HLSS2.2.4*** *Ensure appropriate measures in place to guarantee affordable petroleum product prices.*
PS3 *Citizen participation in the petroleum subsector will be facilitated to ensure economic countrywide supply of fuels*	***PO3.1*** *To promote meaningful citizen participation in the petroleum industry*	***HLS3.1.1*** *Facilitate and promote participation of cooperatives in the distribution of petroleum products to remote areas through the national oil company* ***HLS3.1.2*** *Promotion of investment in the upstream, midstream and downstream activities in the petroleum value chain*
PS4 *Adequate primary transport and secondary distribution*	***PS4.1*** *To ensure adequate petroleum products storage capacity, and extend petroleum products distribution*	***HLS4.1.1*** *Development of a legal framework for the petroleum sector in order to facilitate*

infrastructure will be provided to increase access to petroleum fuels	*infrastructure to all parts of the country.* ***PS4.2** To promote safe transportation, storage and handling of petroleum products*	*investment in petroleum products infrastructure.* ***HLS4.2.1** Promote use of global best practices in the storage, handling and transportation of Liquefied Petroleum Gas (LPG).*

2.1.2 Draft Botswana Oil and Gas Sector Strategy, 2013

The Draft Botswana Oil and Gas Sector Strategy of 2013 defined strategic actions that would be required in the next 5 to 10 years in the country's pursuit of its oil and gas sector aspirations and in some instances, reflected a trade-off between competing aspirations in order to achieve a balance or optimal outcome. The strategy outlines a number of key issues that are still pertinent to date:

(a) The majority of Botswana's petroleum requirements are met through imports from or through the Republic of South Africa, a situation that is likely to continue into the near future;

(b) Procurement, supply and distribution of petroleum products in Botswana have traditionally been undertaken by international oil companies (IOCs). The government's role is currently limited to ensuring security of supply through maintenance of strategic stocks and regulating some liquid fuels prices;

(c) The country has faced a number of challenges in meeting its growing demand for petroleum products caused by the following:

- Inequitable supply and distribution of the products, especially to the rural areas, which are considered financially unattractive for investment by private companies;
- Fuel shortages, caused amongst others largely by limited regional supply capacity, distribution bottlenecks and limited storage capacity;
- Limited supply of fuel to rural and low-density areas;
- Dominance of local industry by multinational oil companies and limited participation by citizen companies in the petroleum value chain; and
- High and volatile petroleum product prices.

A whole bouquet of strategic choices was developed to bring about reforms in the local oil and gas industry. These are listed as follows:

- Clearly defined regulatory and legislative framework;
- Regulate appropriate liquid fuels;
- Licensing of petroleum activities;
- Citizen Economic Empowerment;
- Active state market participation;
- Synthetic fuel production;
- Local biofuels production;
- Transparent cost reflective prices and margins;
- National product price unification;
- Consolidation of procurement of products;
- Joint sourcing and shared transport of the products;
- Management of volatility of the retail pump prices;
- Use of dedicated levies to fund development;
- State sponsored energy research;
- State to coordinate energy efficiency programmes;
- Cooperatives as retailers of fuel for rural and low-density areas;
- Prohibition of self-service in the retailing of products;
- Prohibition of vertical integration across the supply value chain;
- Investment in coastal logistical infrastructure;
- Prohibition of direct bridging;
- Regulation and monitoring of fuel specifications;
- Licensing and regulation of storage and supply infrastructure;
- Security of supply framework;
- Promote use of most economic primary and secondary mode of transport;
- Prohibition of ownership of consumer tanks by wholesalers;
- Commercial fuel pricing should be left to the market forces;
- Independent pricing of the product (Regulator instead of Department);
- Elimination of secondary storage in the pricing framework; and
- Regulation and licensing of minimum consumer tanks.

The coming into operation of the Botswana Energy Regulatory Authority in September 2017 has assisted to address issues relating to the regulation of the petroleum sub sector; including licensing, pricing and monitoring of the industry. However, other strategic choices have also been considered for this study, albeit to varying degrees.

2.1.3 Botswana Energy Regulatory Authority Act, 2016

The Act provides for the establishment of BERA, its mandate, the regulation of the energy sector, and for matters incidental thereto. The Authority is established in terms of Section 3 of the Act and is responsible for economic regulation of the energy sector. The energy sector is defined in the Act to mean sectors dealing with electricity, petroleum products, coal, natural gas, bio-energy, solar energy, renewable energy resources and other energy sources. LPG is classified as a petroleum product. Functions of the Authority are as follows:

(a) Ensure sustainable and secure supplies in the regulated sector;
(b) Set and maintain service standards;
(c) Ensure that tariffs in the regulated sector are fixed on the basis of a tariff methodology that has been set up in a transparent manner taking into account Government policy on cross subsidies between classes of consumers;
(d) Ensure that interests between consumer, customer and licensee are adequately balanced;
(e) Protect and preserve the environment; and
(f) Ensure that the regulation of the energy sector is done in accordance with the best international regulatory practice.

Section 37(1) specifies petroleum sector activities for which a license is required, and these are:

(a) Construction and operation of petroleum pipeline;
(b) Transportation of petroleum products over a pipeline;
(c) Storage, construction and operation of storage facilities for petroleum products;
(d) Construction, operation and maintenance of loading or discharge facilities;
(e) Construction and operation of a retail service station;
(f) Manufacturing of petroleum products; or

(g) Import and export of petroleum products.

Section 52 of the Act empowers the Authority to supervise and monitor a licensee to ensure the following:

(a) Compliance with the BERA Act and the terms and conditions of a licence;
(b) Implementation of tariffs including allowable revenues; and
(c) Implementation of the regulatory decisions and instructions issued by the Authority to the licensee.

When exercising its supervisory function, the Authority may in accordance with the Act, carry out the following:

(a) Investigate the licensee;
(b) Site inspections and audit of the licensee's operations;
(c) Request for any information from the licensee, as the Authority considers necessary; and
(d) Impose compulsory administrative measures and fines including penalties for failure to comply with the BERA Act or licence conditions.

Section 58 of the Act requires the Authority to develop and publish a tariff methodology which shall include the following:

(a) The principles on which the methodology is based;
(b) The form of tariff regulation and method for calculating the tariff;
(c) The frequency of periodic review of the tariff; and
(d) Any other matter that the Authority considers relevant for calculation of the tariff or for collecting information for the tariff.

It is important to note that effective implementation of the Act depends largely on completion and implementation of regulation developed in line with Section 74, which states that:

"The Minister may, after consultation with the Authority, make regulations for the better carrying out of the provisions of this Act. The regulations may include codes and rules of conduct; standards applicable to the regulated activities and services; complaints procedures; and any matter required to be prescribed under this Act".

The Authority has developed two sets of regulations on Petroleum Products and Liquefied Petroleum Gas Operations and these are still at drafting stage with the Attorney General Chambers. These regulations should be completed and approved as a matter of urgency.

2.1.4 Draft BERA Liquefied Petroleum Gas Regulations, 2018

The Botswana Energy Regulatory Authority Liquified Petroleum Gas Regulations are still at the drafting stage. These Regulations, once completed, shall regulate the activities related to LPG business including wholesale, retail, storage, transportation and consumer installation.

2.2 Institutional set up

2.2.1 Ministry of Mineral Resources Green Technology and Energy Security

The Ministry of Mineral Resources, Green Technology and Energy Security (MMGE) is mandated to:

(a) Coordinate and oversee the development of mineral and energy sectors;

(b) Promote the use of green technology which relates to, amongst others, the use of renewable energy and cleaner technologies for sustainable development; and

(c) Promote use of a mix of alternative energy sources that will ensure energy security.

The Ministry's mission is to create opportunities and an enabling environment for the mineral and energy sectors to ensure the sustainable socio-economic development and opportunities for Batswana through the following;

(a) Developing appropriate policies and regulatory instruments;
(b) Ensuring optimal and accountable mineral development and beneficiation to grow revenues;
(c) Promoting investment in and diversification of mineral and energy sectors;
(d) Ensuring security of energy supply through conventional and renewable sources; and
(e) Enabling the development and use of green technology to meet current and future needs of the country.

2.2.2 Department of Energy

The Department of Energy (DoE) is the lead policy-making authority of Government on all matters of energy supply and demand management. The department is responsible for the formulation and coordination of national energy policy and programmes.

2.2.3 Botswana Oil Limited

The National Oil Company, Botswana Oil Limited (BOL) ensures security of supply of petroleum products; operation and management of the government strategic petroleum reserves and is also mandated to promote meaningful citizen participation in the petroleum and gas sectors.

2.2.4 Botswana Energy Regulatory Authority

The Botswana Energy Regulatory Authority (BERA) is responsible for providing an efficient regulatory framework for the energy sector in accordance with the BERA Act, with the primary mandate of providing the economic regulation of the sector.

3 Benchmarking of regional pricing methodologies

Botswana's LPG market is currently not price regulated despite the BERA Act empowering the Authority to regulate such prices. A high-level benchmarking review of pricing mechanisms for selected regional member states has been undertaken to draw lessons which will assist in the possible development of a gas pricing framework for Botswana. The following countries were analysed:

3.1 South Africa

The Government of the Republic of South Africa (RSA), through the Petroleum Products Act, 1977 developed Regulations in respect of the Maximum Refinery Gate Price (MRGP) for Liquefied Petroleum Gas. The refinery gate price is the maximum price at which a refinery or an importer is permitted to market those quantities of LPG produced or imported for consumption within the Republic of South Africa. The MRGP is based on the import parity pricing and comprise the following elements:

(i) Saudi Contract Price;
(ii) Freight;
(iii) Insurance;
(iv) Storage;
(v) Demurrage;
(vi) Cargo dues; and
(vii) Stock financing.

The Ministry of Mineral Resources and Energy gazetted regulations in respect of MRGP on 29th May 2020 and the rules to calculate such were developed as follows:

(a) Reference Markets

The South African LPG imports originate from either Houston in the United States of America (USA) or Ras Tanura in Saudi Arabia. The price of LPG in the USA at times could be cheaper than the price in the Middle East region due to seasonality. However, due to the longer voyage from USA to South Africa compared to the Middle East, it could cost more to land LPG at South African Ports. Therefore, the Free on Board (FOB) prices of LPG in South Africa will be

calculated based on 100% Ras Tanura (Saudi Arabia) to Richards Bay. The reference markets will be reviewed annually.

(b) Saudi Propane and Butane Contract Prices

The majority of stakeholders support the utilisation of Saudi Aramco (Saudi CP) official selling price for Propane and Butane to calculate the Maximum Refinery Gate Price. Saudi Aramco publishes these prices on the first day of each month and the previous month number will be used in the calculations.

The contract price in US Dollars to be applied in the MRGP is then calculated as follows in line with the predetermined percentages in the LPG mix of propane 60% and butane 40%, For example: Propane, USD 280/ton and Butane, USD 260/ton.

- Propane: USD280/ton*60%=USD 168.00/ton
- Butane: USD260/ton*40%=USD104/ton

Saudi Contractual Price to be utilised in MRGP calculation: (USD168.0/ton + USD 104/ton) = **USD272.0/ton.**

The price of USD 272.0/ton is converted to SA Rands utilising the average Rand/US Dollar exchange rate of previous fuel price review period. The Rand/$ exchange rates are published by the Johannesburg Stock Exchange (JSE) at 11h00 daily.

(c) Freight, Demurrage and Cargo Dues

The freight cost from Ras Tanura (Saudi Arabia) to Richards Bay is based on a monthly average of the Argus “South Africa LPG Ras Tanura Richards Bay freight plus costs” index, which appears in the Argus International LPG report. It is calculated using a Time Charter Equivalent methodology that covers the cost of chartering and fuelling a medium sized LPG carrier (21,000t cargo) from Ras Tanura to Richards Bay and back on a route that avoids the piracy risk zones along the East African coast and includes discharge costs and applicable port fees in Ras Tanura and Richards Bay. The calculation will include six (6) days for loading and offloading of the LPG cargo as follows:

(i) The time a vessel is required

- Distance from Ras Tanura to Richards Bay including sea margin, avoiding piracy areas: 5,172 nautical miles
- Divided by average speed of 360 nm per day = 14.37 days (one way)
- Multiplied by two for round trip, plus 5 days in port (two days loading, one day bunkering and two offloading) = total voyage days of 34.
- Multiply this by daily time charter rate.

Add 1.25% broker fees to the Freight

(ii) The ports and logistical charges

- Ras Tanura port charges (1 Riyal per tonne of cargo)
- South Africa port charges for 38,000 gross tonnage vessels based on 1.5 discharges and one bunkering visit to Durban, including VAT
- Additional logistics for 1.5 port visits

(iii) The fuel (0.5% sulphur fuel oil - 28t/day at sea, 8t/day in port) costs

- Ras Tanura-Richards Bay (Fujairah prices $259/t) multiplied by consumption of 402.29t;
- Richards Bay-Ras Tanura (Durban prices $369.50/t) multiplied by consumption of 402.29t;
- Fuel cost on round trip Richards Bay-Durban to refuel; and
- Fuel cost during 6 days in port.

Add (i), (ii) and (iii) to get Total Freight

Divide the Total Freight by 21000t to get $/t rate

(d) Demurrage

The Time Charter rate includes all the cost associated with shipping and offloading LPG at South African port. Therefore, this element will be zero because there are no additional costs.

(e) Cargo dues

The cost to utilise these harbour facilities is based on the tariff set by the National Ports Authority of South Africa and will be adjusted annually in April. The calculation is included under the Freight in 3.2 above.

(f) Insurance

An element of 0.15 percent of the FOB-value and freight to cover insurance as well as other costs such as letters of credit, surveyors' and agents' fees and laboratory costs.

(g) Evaporation

LPG is transported in pressurised vessels with no evaporation. Therefore, this element will be excluded from the calculations.

(h) Coastal Storage cost

The storage is regarded as that storage utilised after the cargo was discharged. This is to recover the cost of providing storage and handling facilities at coastal terminals. To be based on the tariff set by the National Energy Regulator of South Africa (NERSA) effective from 01 April each year. The calculations will be based on the weighted average of all the coastal storage used to receive LPG imports. The information will be sourced from NERSA.

Note: Formula: **CSC = (Tariff Richards Bay + Tariff Saldanha)/2**

Where CSC – Coastal Storage Cost and Ave Tariff – Weighted Average of the NERSA tariff.

NB: Apply conversion factor of **0.535** to change cubic metres to tonnes

(i) Stock Financing Cost

The stock financing cost is based on (i) the landed cost values of LPG, (ii) seven (7) days of stockholding and (iii) the ruling prime interest. Formula: **SFC = [LCV x (PR) x 7/365]**

Where SFC – Stock Financing Cost, LCV – Landed Cost Value, PR – Prime rate.

(j) Maximum Refinery Gate Price

The MRGP will be calculated as the sum of [(b) to (i)] in cents per kilogram.

(k) Frequency and amount of adjustment

The adjustment will take place monthly at 00h01 on the first Wednesday of every month and will be announced publicly by the Department and Central Energy Fund (Pty) Ltd on the Friday or Monday prior to the price adjustment.

(l) Audit by independent auditors

CEF (Pty) Ltd will perform the calculations for determination of amounts for the monthly price change in terms of these Working Rules. An independent auditor appointed by the Department of Mineral Resources and Energy will, in terms of guidelines issued by the Department of Mineral Resources and Energy, audit the relevant calculations and certify them to be correct.

(m) Announcement of price adjustment

The Department of Mineral Resources and Energy and CEF (Pty) Ltd will publicise the audited price adjustments on the Friday or Monday before it become effective.

3.2 Zimbabwe

The use of Liquefied Petroleum Gas is gaining momentum as an alternative source of energy in Zimbabwe. The product is widely used by consumers of various backgrounds from industrial, domestic, commercial and agriculture. The sector is still regarded as young in terms of uptake thus presenting opportunities for investors who may set up various infrastructure as importers, wholesaler, retailers or manufacturers and revalidation of cylinders.

The Zimbabwe Energy Regulatory Authority (ZERA) is a statutory body established by the Energy Regulatory Authority Act [Chapter 13:23] of 2011. The Act mandates ZERA to regulate the procurement, production, transportation, transmission, distribution, importation and exportation of energy derived from any energy source. ZERA is also responsible for licensing of petroleum companies as provided for in the Energy Regulatory Authority Act [Chapter

13:23] of 2011, read together with the Petroleum Act [Chapter 13:22] of 2006 and subsequent amendments.

Information on regulation of LPG prices was not available online. Therefore, there is need to contact relevant officers within ZERA to assist with the information. This will require some additional time beyond the time-frame allocated for this study.

That aside, ZERA is established to achieve the following key result areas:

(a) Increase Access and Security of Supply

(i) promote the procurement, production, transportation, transmission and distribution of energy in accordance with public demand and recognized international standards;
(ii) ensure the maximization of access to energy by consumers that is affordable and environmentally sustainable; and
(iii) promote coordination and integration in the importation, exportation and pooling of energy from any source in the SADC and COMESA region.

(b) Regulation and Licensing

(i) regulate the procurement, production, transportation, transmission, distribution, importation and exportation of energy derived from any energy source;
(ii) exercise licensing and regulatory functions in respect to the energy industry;
(iii) ensure that prices charged by licensees are fair to consumers in the light of the need for prices to be sufficient to allow licensees to finance their activities and obtain reasonable earnings for their efficient operation; and
(iv) establish or approve operating codes for safety, security, reliability, quality standards and any other sector related codes and standards for the energy industry or any sector thereof.

(c) Energy Efficiency and the Environmental Protection

(i) advise and educate consumers and licensees regarding the efficient use of energy; and

(ii) assess, promote studies of and advise the Minister and licensees on the environmental impact of energy projects before licensing.

(d) Market Reform and Competition

(i) maintain and promote effective competition within the energy industry; and

(ii) create, promote and preserve an efficient energy industry market for the provision of sufficient energy for domestic and industrial use.

(e) Research and Development

(i) promote, identify and encourage the employment and development of sources of renewable energy;

(ii) undertake such other things which it considers is necessary or convenient for the better carrying out of or giving effect to the functions of the Authority; and

(iii) promote and encourage the expansion of the energy industry and the advancement of technology relating thereto.

(f) Key stakeholder Advisory

(i) advise the minister on all matters relating to the energy industry;

(ii) establish appropriate consumer rights and obligations regarding the provision of energy services;

(iii) arbitrate and mediate disputes among and between licensees and consumers; and

(iv) represent Zimbabwe internationally in matters relating to the energy industry.

The Authority has developed and is implementing the Petroleum (Liquefied Petroleum Gas) Regulations, also known as Statutory Instrument 57 of 2014. The regulations address, amongst other things:

(a) licensing of LPG businesses;

(b) powers of inspection;

(c) reporting of accidents and fires;

(d) LPG minimum quality specifications;

(e) LPG skills certification;

(f) LPG cylinder manufacture and testing; and

(g) General penalty.

ZERA continued to put more effort to increase compliance to LPG licencing regulations with the primary focus being to make the retail operators in the sector licenced (ZERA Annual Report, 2019). Table 4 below shows that the number of licenced LPG operators had increased between 2015 and 2019, hence the need for more regulatory focus in subsequent years.

Table 4: Number of licensed LPG operators; 2015 - 2019

Licensee Category	**Year**				
	2015	2016	2017	2018	2019
Retail	39	80	110	134	122
Wholesale	14	17	16	17	13
Total	**53**	**97**	**126**	**151**	**135**

Source: ZERA Annual Report, 2019

3.3 Zambia

The production and supply of LPG involves many players in the value chain as shown in Fig. **1**:

Fig. 1: LPG Value Chain in Zambia

The first stage in the LPG value chain is supply which mainly comprise of production of LPG at INDENI Refinery and importation of the product. LPG players licensed to import bring in the

product mainly from South Africa into the country. The import market has several buyers (LPG dealers) and several suppliers (LPG global market), while local production is only at INDENI. The LPG produced at INDENI is stored, distributed and marketed by the Government Agent (TAZAMA).

The second stage involves the purchase of the LPG from TAZAMA or from the OMCs that have imported and later re-sell the product. This market has several buyers and the market is intermediary in nature as the LPG dealers resell the product to commercial customers, export markets and among LPG dealers through the commercial market [Business to Business (B to B)].

In addition, the LPG dealers act as suppliers and sell to commercial, export market and retail customers. In the case of sales to commercial and retail customers, the distribution ends there. Meanwhile, for the export market and the sale to other LPG dealers, the market is intermediary. The product is later resold to the final consumer. The market is final in nature as retail customers purchase LPG for final consumption. This market is characterized by many suppliers and many buyers.

The pricing of LPG in Zambia is threefold; the wholesale price set by the ERB using the Cost-plus Model and the export price set by TAZAMA. Meanwhile, the retail price for imported LPG is determined by the trader or importer of the product. The ERB does not set retail prices for LPG. The rationale for such pricing was premised on the fact that until recently, LPG utilisation has predominantly been confined to commercial sectors of the economy, while the retail sector was still in its infancy. It was, therefore, assumed that these commercial LPG consumers can negotiate the prices with their suppliers. Nonetheless, with more households switching to LPG, the need to set LPG benchmark margins and retail prices has become imperative to ensure that consumers are not unnecessarily over-charged. In this regard, the ERB approved a light-handed regulation for pricing of LPG. The approval of the light-handed regulation was preceded by a consultative process with OMCs on developing the pricing framework for LPG. In summary, the light-handed regulation entails the following:

(i) OMCs to submit their detailed proposed retail price adjustment to the ERB for scrutiny.

(ii) OMCs to furnish the ERB with information relating to pricing of LPG, such as Price build – ups; commercial invoices of the LPG procured, Bill of lading; and any other information deemed necessary.

These are reviewed to establish that the retail price set earn reasonable returns and customers are not exploited.

4 Situational analysis of local LPG Market

4.1. Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis

The study used Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis as a technique for assessing the performance, competition, risk, and potential of the sector. An identification of the sub-sector's internal strengths and weaknesses, as well as its external opportunities and threats is presented in Table 5 below. The SWOT analysis provides a good outlook of the issues/circumstances the sector finds, or might find itself in. The identified weaknesses and threats should be addressed or managed as part of the LPG sector transformation agenda.

Table 5: SWOT Analysis

Strengths	**Weaknesses**
Steady supply of gas under normal circumstances	Inefficiently structured market
Noticeable investment in gas infrastructure	Existence of unlicensed operators, especially at retail
	Some retailers operating from homes (residential places)
	Price discrimination
	Limited competition at supply and distribution
	Market mostly oligopolistic at supply and distribution
	Cross-filling of competitor cylinders
	Unsafe loading and transportation of gas cylinders
	Poorly constructed storage (cages) at retail
	Limited investment into gas logistical infrastructure
	Gas of indeterminate quality, especially from alternative markets
	Limited or expensive gas supply to rural areas
	Health and safety concerns (explosions/accidents)
	Unskilled/untrained industry personnel dealing with gas, especially at retail
	Absence of LPG Association
	Lack of locally trained and certified LPG installers
Opportunities	**Threats**
Establishment of Energy Regulator	Lack of appropriate gas quality standard
Increase LPG use in some government institutions	Lack of enforcement of safety and quality specification
Approved National Energy Policy	Smuggling/illegal cross-boarder trading of LPG cylinders
	Theft/stealing of cylinders
	Intermittent gas supplies from the Republic of South Africa
	High and unaffordable gas prices

	Government not keeping strategic stocks for LPG
	Heavy reliance on road for primary transportation
	Dominance of international gas companies at supply and distribution levels
	Volatility of international oil prices (affect price of LPG)
	Heavy reliance on one source of supply (Republic of South Africa)
	Limited participation by citizen companies
	Botswana is a landlocked country, highly dependent on transit states for gas supply
	Delayed approval of LPG regulations
	Use of substitutes (CBM, biofuels, electricity, etc)
	Limited capacity at the Regulator
	Lack of public awareness on safe handling and use of LPG
	Small size of the Botswana market renders the country unattractive for investment
	Impact of Covid-19 on trade
	Underfilling of gas cylinders
	Rebranding/repainting of competitor cylinders

4.2. LPG Value Chain

The supply of LPG involves many players in the value chain as shown in Figure 1:

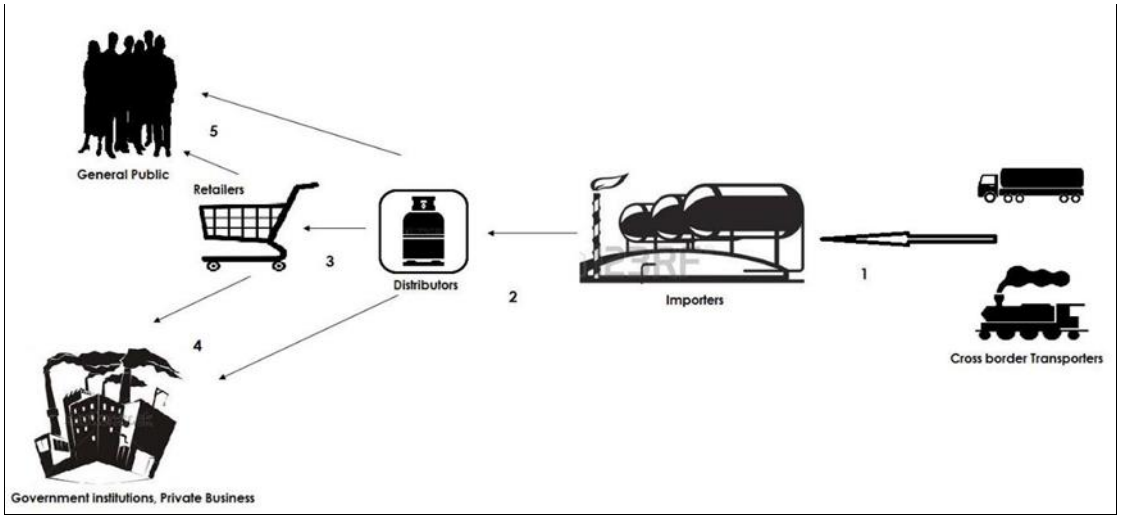

Fig. 2: LPG supply chain Source: CCA, 2016

4.2.1 Importation

The first stage in the LPG value chain is importation of gas. The gas that is consumed in Botswana comes mainly from and through the Republic of South Africa. Notable sources

include Oryx Oil South Africa, Total Gas South Africa, Easi Gas South Africa and Afrox South Africa. South Africa is a net importer of the gas owing to reduced refining capacity and inability to meet the local demand. Therefore, some of the gas is imported from international markets, especially from Ras Tanura in Saudi Arabia and Houston in the United States, and it is delivered at one of South Africa's largest harbour at Richards Bay. LPG is transported across the border into Botswana by rail. One of the importers (Easigas Botswana) indicated that they used to bring LPG by rail but that was discontinued due to challenges with Transnet. LPG importers sell the gas to distributors and bulk consumers.

4.2.1.1 Imported volumes

The data on imported volumes were sourced from wholesalers and this is because the volumes that wholesalers import, are the same volumes that are distributed to retailers who then sell to consumers. This part deals with four (4) sets of data as follows:

(a) Volumes received from the Botswana Unified Revenue Service

The Authority requested for import volumes of LPG from the Botswana Unified Revenue Service (BURS) with the understanding that every product that enters the borders should be appropriately declared and cleared. Furthermore, the BURS is viewed as the competent authority to provide such information without bias. The information provided by BURS was for the years 2018 to 2020 and it is presented at Table 5 below.

Table 5: Import volumes captured by BURS from 2018 - 2020

LIQUEFIED PETROLEUM GAS (KGM)			
MONTH	**2018**	**2019**	**2020**
JANUARY	577,625	659,077	1,033,680
FEBRUARY	694,507	1,121,616	760,238
MARCH	626,512	624,036	785,254
APRIL	866,985	666,835	445,286
MAY	448,582	334,284	553,257
JUNE	580,474	762,362	668,220
JULY	860,724	660,045	559,458
AUGUST	1,459,222	996,686	486,092
SEPTEMBER	960,143	723,685	1,057,480
OCTOBER	951,536	820,510	420,953
NOVEMBER	537,535	793,399	167,612
DECEMBER	774,309	896,782	434,601
TOTAL	**9,338,154**	**9,059,316**	**7,372,131**

Source: BURS Tax clearance database 2021

The same information is graphically presented in Figure 3 below.

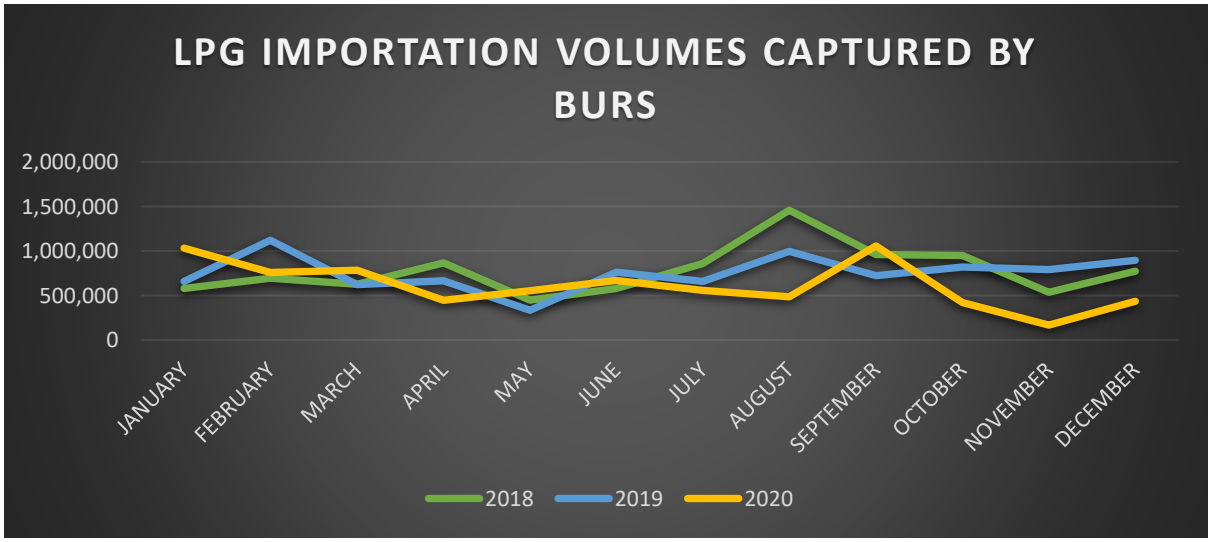

Fig. 3: Import volumes captured by BURS from 2018 – 2020

(b) Volumes reported in the Consumer and Competition Authority (CCA) study of 2016

The volumes reported in the CCA market study are as per Table 6 below:

Table 6: Imported volumes reported by CCA from 2011 to 2016

Year	Net Weight (KG)
2011	14 694 884
2012	14 802 189
2013	14 073 637
2014	16 167 699
2015	15 345 182
2016	17 449 336

(c) 2016 Volumes reported by Statistics Botswana

The data sourced from Statistics Botswana was only for 2016. The data is highly aggregated and does not allow for in-depth analysis. The data is presented in Table 7 below.

Table 7: Volumes reported by BURS, 2016

YEAR	VOLUMES
2016	17 600 000

Source: Statistics Botswana through CCA, 2016

(d) Volumes captured during data collection for this study

Table 8 shows import volumes of gas as captured by the Authority during the data collection exercise that was conducted between August and September 2020.

Table 8: LPG import volumes, 2010 to 2019

YEAR	QUANTITY
2010	7 929 400
2011	15 893 390
2012	16 968 147
2013	18 360 119
2014	18 110 695
2015	19 788 244
2016	19 749 516
2017	20 426 337
2018	21 805 702
2019	21 712 945

Source: BERA data collection, 2020

The information is also presented graphically as per Figure 4 below.

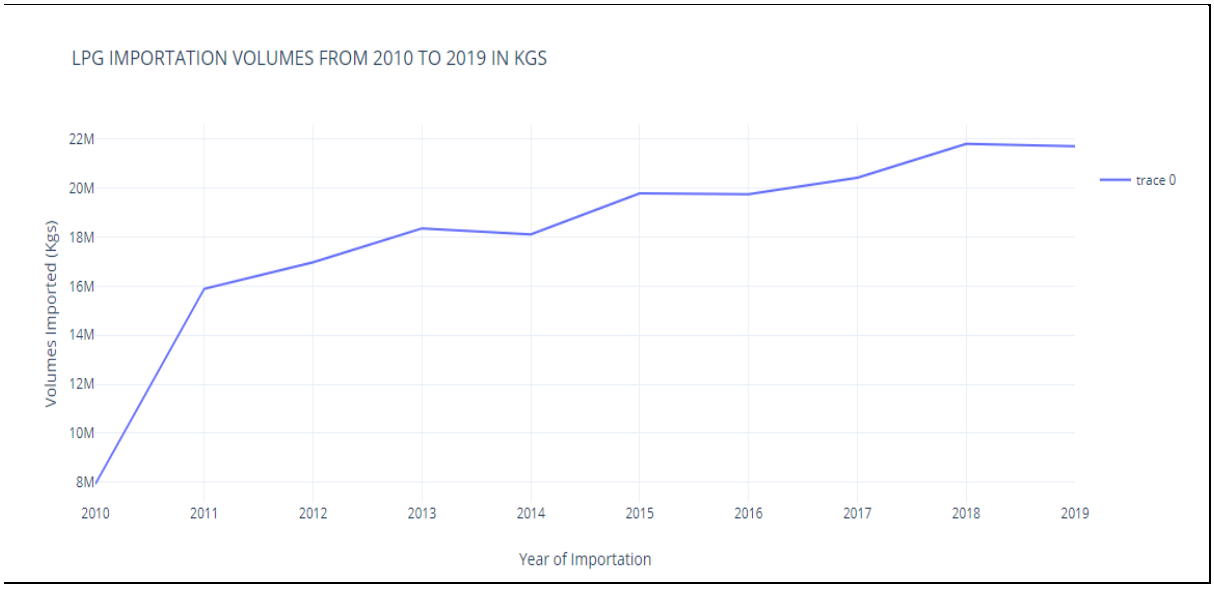

Fig 4: LPG import volumes, 2010 to 2019

Only one company (Afrox Botswana) reported volumes for 2010. Imports increased rapidly from 2010 to 2013 and these were attributed to three wholesalers (Afrox Botswana, Easi Gas Botswana and Quick Gases). The tremendous increase in LPG imports was triggered by the

decline in fuel wood usage over the years (Statistics Botswana, 2012). There was a decrease in imported volumes in 2014 because of the latent effects of the world recession that started in 2008. The volumes of LPG increased again from 2015 onwards. This is attributed to new market entrants, namely Tswana Gas and Simsa Gas.

A comparison of the four data sets is presented in Table 9 below.

Table 9: Comparison of the 4 data sets (volumes in kgs)

Year	BURS	CCA	SB	BERA
2010				7 929 400
2011		14 694 884		15 893 390
2012		14 802 189		16 968 147
2013		14 073 637		18 360 119
2014		16 167 699		18 110 695
2015		15 345 182		19 788 244
2016		17 449 336	17 600 000	19 749 516
2017				20 426 337
2018	9,338,154			21 805 702
2019	9,059,316			21 712 945
2020	7,372,131			

It was not possible to make sound and robust comparisons because of the different reporting periods. However, the following comparisons could be made:

(i) CCA and BERA volumes, 2011 to 2015

The data captured by CCA and BERA shows an increase in volumes of LPG imported into the country. Volumes kept increasing from 2011 to 2016and this is attributed to households switching from the use of firewood to cooking gas.

(ii) CCA, SB and BERA volumes, 2016

There is a difference of approximately 2,000,000 kilograms of gas between the volumes reported by BERA and those reported by both CCA and SB. This difference is caused by a new

entrant (Tswana Gas) which entered the market in 2016. However, the impact was mostly felt from 2017 and the company now holds 9.9% of the market share.

(iii) BURS and BERA volumes, 2018 to 2019

Volumes captured by BURS are far less compared to volumes reported by importers during this study. The volumes captured for this study are more than double the volumes reported by the BURS. The causes of the disparity have not been established. However, an incident relating to false declarations at the border may not be ruled out. This is a potential risk area which once identified, will call for increased enforcement by the Authority and its cooperating partners to ensure that proper declarations are made and that goods are appropriately cleared as they enter the country. False declarations have the effect of depriving government of the much-needed revenue because gas companies are required to pay Value Added Tax (VAT) on imported products.

4.2.2 Storage

Upon entry and clearance at the border, the gas is stored in bulk storage tanks of different capacities belonging to the six (6) local importers. Table 10 shows the available storage capacities for all the LPG suppliers in Botswana.

Table 10: Storage capacities for all six (6) LPG suppliers

Company	**Storage location**	**Total storage capacity (litres)**
Easi Gas Botswana	Gaborone (Phakalane)	180,000
Afrox Botswana	Gaborone & Francistown	578,000
Quick Gases	Pilane	75,000
Simsa Gas	Palapye	182,000
Air Liquide	Gaborone & Selebi Phikwe	67,500
Tswana Gas	Mmamashia & Francistown	97,000
	Total	**1,179,500**

Key processes that take place at the gas depot include the discharge of gas into storage tanks and the filling of cylinders on site. A specially equipped depot will have the following features:

(a) a safe working environment;
(b) operation to a recognised Quality Management System;
(c) a formalised management of change approval process;
(d) manual, and other handling facilities;
(e) access to expert technical support; standard and emergency operating procedures;
(f) loading and unloading facilities, with safe access and egress for vehicles;
(g) a cylinder marshalling area, with storage for empty and full cylinders;
(h) process for the pre-fill inspection of cylinders;
(i) process and facilities for the rejection and quarantine of unserviceable cylinders;
(j) appropriately designed filling line(s);
(k) cylinder decanting equipment;
(l) a bulk supply of the products being filled;
(m) process for post fill inspection, including cylinder wash bay, marking and labelling;
(n) adequate fire-fighting equipment; and
(o) adequate site security.

The operating procedures ensure that each gas cylinder being filled is compliant with all relevant Regulations and standards and, once filled, is safe for future transportation and use.

4.2.3 Distribution

This stage involves the bulk purchase of LPG from wholesalers by distributors and bulk consumers into their storage tanks. Distributors also have bulk storage tanks from which the gas is filled into different cylinder sizes and sold to retailers, government institutions, private companies and the general public. The processes that take place at a distribution depot are almost similar to those at a wholesale depot, albeit at a reduced scale. Table 11 shows the available storage capacities for all LPG distributors in Botswana.

Table 11: Storage capacities for LPG distributors

Company	Storage location	Total storage capacity (litres)
BC&LM (Pty) Ltd	Kanye	45,000
BC&LM (Pty) Ltd	Mahalapye	22,500
BC&LM (Pty) Ltd	Selebi Phikwe	45,000
Sefalana Cash & Carry	Tsabong	45,000
Seahorse Investments	Phakalane	90,000
Viking Voyagers (Pty) Ltd	Maun	67,500
	Letlhakane	90,000
Salubrious	Serule	200,000
Nari (Pty) Ltd	Maun	22,500
Calvin Technology	Mogoditshane	45,000
City Gas	Francistown	40,000
Lobatse Gas Works	Lobatse	135,000
**Yaraana (Pty) Ltd	Charleshill	22,500
Total		**830,000**

**Did not form part of the analysis because no data was collected.

4.2.4 Retail

The retail space comprises of numerous small businesses that sell the gas to consumers only. Retailers basically fall into two broad categories. The first category is all those retailers who specifically deal with LPG and do not trade in any other product. These are licensed as per the BERA Act. The second category of retailers are those who operate the hardware business and therefore trade in other products in addition to LPG. These retailers are issued with a hardware licence by the Councils in line with trade regulations. Currently, the Authority facilitate the licensing of these retailers by conducting an inspection of the cage and issuing clearance letter to the relevant Council upon satisfying itself that the facility complies with the applicable standard. Despite the above, BERA is established with the legal mandate to license activities in the petroleum sector, amongst other functions. The above arrangement whereby two centres of authority exist to license LPG businesses brings confusion and undue

burden to the industry who have to move between the Authority and the Council to get a licence. Furthermore, the arrangement creates unnecessary bureaucracy resulting in long turnaround times. This does not augur well for the country's aspiration of improving the ease of doing business. Therefore, it is important that trade regulations are amended with the view to expunge the regulation on the licensing of LPG at a hardware, to give way for the BERA Act as the only applicable licensing instrument.

The CCA study reported about 450 retailers (Consumer and Competition Authority, 2016). This study sampled only 184 retailers; the majority of who have been licensed by local authorities. Retailers typically use cages of varying sizes to store gas cylinders. Some retailers do re-fill smaller size consumer owned cylinders, commonly known as "cadacs", from 48kg cylinders.

4.3. Companies' shareholding structure

Botswana currently operates a downstream LPG market which is oligopolistic. There are currently six (6) LPG suppliers and nine (9) distributors. Information sourced from the Companies and Intellectual Property Authority (CIPA) website revealed that five (5) of the six (6) suppliers were 100% foreign owned and only Tswana Gas had 2 Batswana holding combined majority shares of 57.4% and 42.6%. The information is provided as per Table 12 below.

Table 12: showing all LPG suppliers, their shareholding and directorship

Number	Supplier	Location	Shareholding	Directorship
1	Afrox	Gaborone, Francistown	100% Foreign	1 Motswana & 1 Foreigner
2	Easigas	Gaborone, Lobatse, Serule	100% Foreign	1 Motswana & 2 Foreigners
3	Simsa Gas	Gaborone, Palapye	100% Foreign	100% Foreign
4	Tswana	Gaborone	57.4% Citizen, 42.6% Foreign	2 Batswana & 2 Foreigners
5	Quick Gases	Pilane	100% Foreign	100% Foreign
6	Air Liquide	Selebi Phikwe	100% Foreign	100% Foreign

Furthermore, three (3) of the companies had all the Directors being foreigners whereas the other three companies had at least one (1) Motswana as part of the Directors. Table 13 shows that among nine (9) of the known distributors, only Calvin Technology was 100% citizen owned. Seahorse Investments, Viking Voyagers and BC&LM were 100% foreign owned. Four (4) of the companies were owned by a partnership between Batswana and foreigners. Information relating to Nari Gas could not be found on the CIPA website.

Table 13: Known LPG distributors, their shareholding and directorship

Number	Distributor	Location	Shareholding	Directorship
1	Lobatse Gas Works	Lobatse	70% India/Botswana and 30% Foreign	2 India/Botswana; 3 Foreigners
2	Calvin Technology	Mogoditshane	100% Citizen	2 Batswana
3	BC&LM	Selibe Phikwe, Kanye, Mahalapye, Gaborone, Francistown	100% Foreign	100% Foreign
4	Viking Voyagers	Maun	100% Foreign	100% Foreign
5	Sefalana Tsabong	Tsabong	Sefalana Holding Company Limited (100%)	1 Motswana and 1 India/Botswana
6	Nari Gas	Maun	Not available on CIPS website	Not available on CIPA website
7	Salubrious	Serule	80% India/Botswana, 20% Foreign	2 India/Botswana; 2 Foreigners
8	City Gas	Francistown	80% India/Botswana; 2 Foreign	2 India/Botswana; 2 Foreigners
9	Seahorse Investments	Phakalane	100% Foreign	100% Foreign

The foregoing dissection of the structure of the local gas market presents an interesting and yet worrisome state regarding meaningful citizen participation in the LPG industry. According

to the Competition Authority Study (2016), the supply value chain in this sector comprised importers and distributors selling directly to the public. That might lead to competition between both importers and distributors, and retailers. The phenomenon could also be seen at retail level, since some distributors also owned retail outlets. With the market being highly concentrated and dominant firms being integrated along the supply value chain, that might facilitate infringements, such as the margin squeeze, refusal to deal, excessive pricing and price fixing.

Furthermore, in many instances, the relationships between the supplier and distributor was such that a distributor provided the land (space) while the importer provided, installed and maintained the gas refilling equipment. That gave importers some level of control at the distribution level because the initial capital investments were quite high for one to consider changing the supplier (importer). As such, that created an entry barrier and the arrangement might facilitate anti-competitive practices such as limiting market access to new entrants or promoting exclusive dealings. Insights could be drawn from the extensive work done especially in Australia, focused on facilitating meaningful citizen participation by removing obstacles in the real economy. It is widely believed that at a broad level, encouraging active citizen participation would entail addressing the administrative and legal structures required to facilitate participation of citizens in the mainstream economy.

4.4. Trading and Market segregation

One of the strategic choices included in the 2013 Draft Botswana Oil and Gas Sector Strategy, to bring reforms to the local oil and gas industry relates to the prohibition of vertical integration across the supply value chain. The concept of “vertical integration” as applied globally to competition law, referred to the degree of integration between a firm’s value chain and the value chain of its suppliers and distributors. The prohibition of vertical integration was also applied to the local liquid fuels industry whereby wholesalers were prohibited to go into retailing. Furthermore, Trade Regulations under the Ministry of Investment, Trade and Industry (MITI) have reserved retailing of petroleum products to locals. As a petroleum product, LPG is also affected by this condition. However, this study revealed the lack of vertical integration between some importers, distributors and retailers of LPG. The

delineation amongst market players was found to be somehow misty in the sense that one single player might be involved across the entire value chain. The practice negatively impacted retailers because they ended up having to compete to sell the gas to the same end-users or consumers with importers and distributors from which they bought the gas. Therefore, the practice needed to be addressed to protect small retail businesses against big corporations.

4.5. Market share and concentration index

Market share reflected a portion of the local market controlled by a particular company. Figure 5 shows the market share for each supplier using the data on sales.

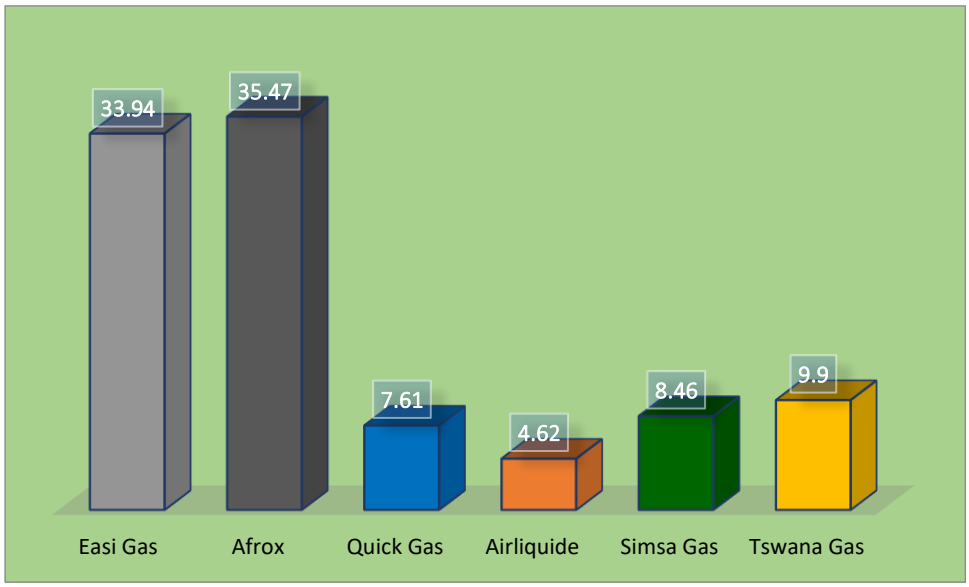

Fig 5. Botswana LPG suppliers' market share

The study revealed that the market was dominated by two (2) foreign owned companies, namely Afrox and Easigas with market shares of 35.47% and 33.94%, respectively. Based on the study conducted by the CCA in 2016, both Afrox and Easigas had market shares of 45% each. However, these have now reduced by 9.53% and 11.06% for Afrox and Easigas, respectively. That notwithstanding, Afrox remained the leading player in the local LPG market. Tswana Gas, the only company with majority citizen shareholding, had the third largest

market share at 9.9% followed by Simsa Gas (8.46%), Quick Gases (7.61%) and Air Liquide (4.62%).

This study also used the *Herfindahl Hirschman Index* (HHI), the most common method used to calculate market concentration. The index is calculated by adding the squares of the percentage of market share of each individual company in the industry. For example, the HHI for Company AB will be calculated as:

$HHI\ (AB) = (Market\ share\ of\ AB)^2$

The international threshold for HHI was 1800. Whenever the threshold calculated was higher than 1800, it meant that the market was highly concentrated with less competition. Therefore, the squares of the market shares for all the six (6) LPG suppliers in Botswana were added to obtain the value of 2659 as shown below:

$(Easigas\ share)^2+(Afrox\ share)^2+(Quick\ Gases)^2+(Air\ Liquide)^2+(Simsa\ Gas)^2+(Tswana\ Gas)^2$

$33.94^2 + 35.47^2 + 7.61^2+4.62^2+8.46^2+9.9^2 = 2659$

The figure of 2659 indicated that the local LPG market at the supply level was highly concentrated with less competition. The few companies at the supply level might indicate the presence of barriers to entering the market at that level. Therefore, the existing arrangement might also give rise to uncompetitive behaviours and predatory pricing practices as companies might seize the opportunity to collude and control the market. Owing to the above, further work was required to comprehensively identify and address barriers impeding entry into the local gas market. This should be undertaken with the objective of enhancing competition within the sector.

4.6. Pricing analysis

LPG prices have not been regulated prior to promulgation of the BERA Act. This meant that the determination and application of prices was left to the industry. Therefore, it was important that this study analysed the prices of LPG as they currently obtained on the ground. The study investigated the pricing of gas across the major districts of Botswana and used some statistical parameters as shown in Appendix D, to describe the behavior of pricing and prices. The appendix has been treated as a master table from which specific information was extracted to bring clarity to the discussion of issues under this sub-heading.

4.6.1 LPG selling prices per district

The minimum and maximum selling prices for gas in selected districts are presented in Table 14 below. The table shows that prices of gas were largely influenced by proximity of the district/area to main supply centres. Gas prices in Kweneng, Central, Kgatleng, South East and North East were generally lower because of the proximity of these areas to gas wholesale and distribution depots as well as an expanded network of retailers. Conversely, gas was mostly expensive in those areas that were far from main supply centers. These included Kgalagadi, Ghanzi, North West and Chobe.

Table 15: Minimum and maximum gas selling prices per district

District	**Maximum and Minimum Price (BWP) per cylinder size**							
	9kg		**14kg**		**19kg**		**48kg**	
	Min.	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**
Kweneng	160	210	270	300	360	400	850	1000
Kgalagadi	173.85	267	273.85	350	363.75	563	889.65	1200
Ghanzi	195	280	295	380	395	480	960	1250
North West	220	288.15	330	445.95	430	585.95	955	1400
Chobe	205	370	325	495	470	550	1105	1200
North East	170	250	280	350	360	450	880	1200
Central	162	250	249	350	329	450	848	1056
Kgatleng	170	200	270	300	350	385	790	965
South East	170	235	266	350	350	485	850	1199.5
Southern	168	265	204	410	350	549	850	1400

Table 16 below is derived from table 15 above and it shows the average gas prices per cylinder size per district. It is interesting to note that average gas prices were the lowest in Kgatleng District. The area was mainly supplied by Quick Gases which was located in Pilane and the company was believed to be offering competitive prices. On the other hand, 48 kg cylinders were more expensive in the Kgalagadi, Ghanzi, North West and Chobe districts.

Table 16: Average LPG prices per cylinder size per district

District	Price (BWP) per cylinder size			
	9kg	**14kg**	**19kg**	**48kg**
Kweneng	193	290	383	954
Kgalagadi	214	375	442	1072
Ghanzi	224	334	443	1108
North West	253	366	472	1140
Chobe	262	384	491	1179
North East	204	306	404	997
Central	197	298	391	948
Kgatleng	186	281	364	893
South East	188	288	381	948
Southern	190	290	394	976

4.6.2 Price variability

Just like with liquid fuels, prices would normally differ from one district/area to another based on the transportation cost. However, it was observed that LPG prices also differed within the same district. Therefore, variance and standard deviation as measures of variability, were used to determine the degree of spread of prices. Variance was calculated by taking the average of squared deviations from the mean. The Standard deviation (SD) was derived from variance and it showed, on average, how far each value lied from the mean. It is the square root of variance. Table 17 shows price variability per cylinder size per district.

Table 17: Price variability per cylinder size per district

District		Price variability per cylinder size per district									
	9kg			14kg			19kg			48kg		
	Mean	Variance	SD	Mean	Variance	SD	Mean	Variance	SD	Mean	Variance	SD
Kweneng	192.89	153.19	12.38	290.07	93.80	9.68	382.65	159.77	12.64	953.65	2341.92	48.39
Kgalagadi	213.90	587.17	24.23	375.48	39005.34	197.50	441.89	2069.46	45.49	1072.10	8394.22	91.62
Ghanzi	223.75	1522.92	39.02	333.75	1289.58	35.91	442.50	1441.67	37.97	1107.50	16425.00	128.16
North West	253.01	424.59	20.61	365.75	901.84	30.03	472.42	1535.55	39.19	1140.00	14944.92	122.25
Chobe	262.00	4407.50	66.39	384.00	4292.50	65.52	491.00	1105.00	33.24	1179.00	1730.00	41.59
North East	204.42	445.86	21.12	305.86	402.47	20.06	404.38	544.55	23.34	997.45	6457.36	80.36
Central	196.71	318.70	17.85	297.71	524.63	22.90	390.82	750.52	27.40	947.55	2320.02	48.17
Kgatleng	185.63	81.70	9.04	281.25	133.93	11.57	364.38	138.84	11.78	893.13	2920.98	54.05
South East	188.00	204.67	14.31	288.45	282.07	16.79	381.41	715.11	26.74	948.48	6548.49	80.92
Southern	190.05	296.03	17.21	290.19	1199.79	34.64	393.56	1203.85	34.70	975.94	9626.79	98.12

SD – Standard deviation

The general principle is that prices were considered to be normal if the variance was less or equal to the mean. That is, the degree of spread was normal. However, prices were abnormal if the variance was above the mean. Normal price variability is indicated with the green colour whereas abnormal price variability is indicated with red colour. Assuming transportation cost to be a constant in each district/area, the expectation was that the degree of variability of prices should fall in the normal range in each district/area. The prices for 9kg, 14kg and 19kg gas cylinders were considered normal for the Kweneng and Kgatleng districts. However, prices for 48kg gas cylinders were abnormal. South East district exhibited normal prices only for 14kg gas cylinders. Prices of gas cylinders for all other districts were abnormal. Abnormal pricing could result from several factors such as over-pricing and a small number of service providers resulting in limited choices for consumers. These were not fully investigated but it was certainly an area that should be addressed through market research going forward.

4.6.3 Pricing Components

This study investigated how businesses were pricing the gas. Figures 6, 7 and 8 present components that were considered by importers, distributors and retailers when pricing the gas.

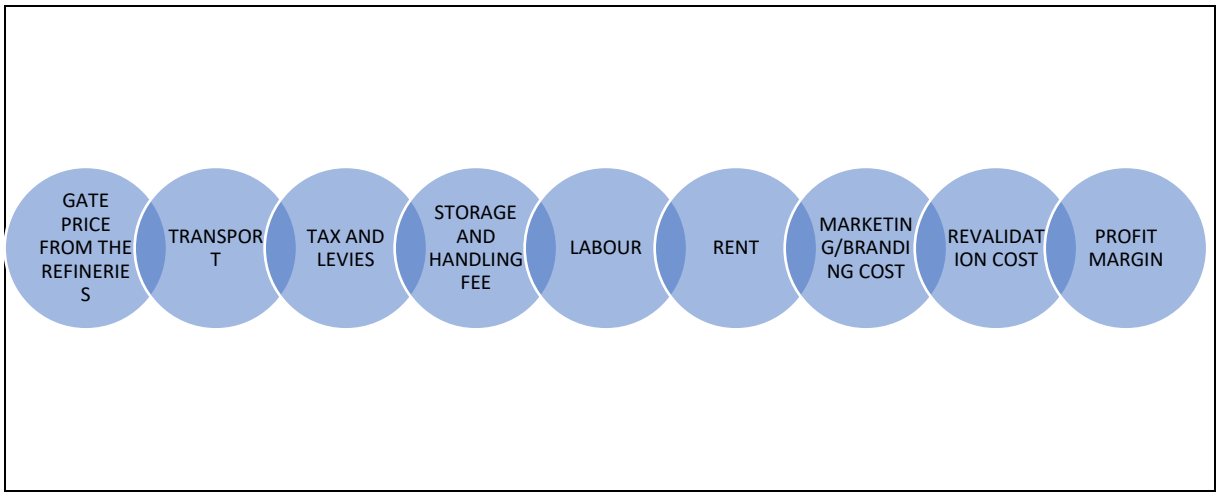

Fig 6: Pricing components for importers.

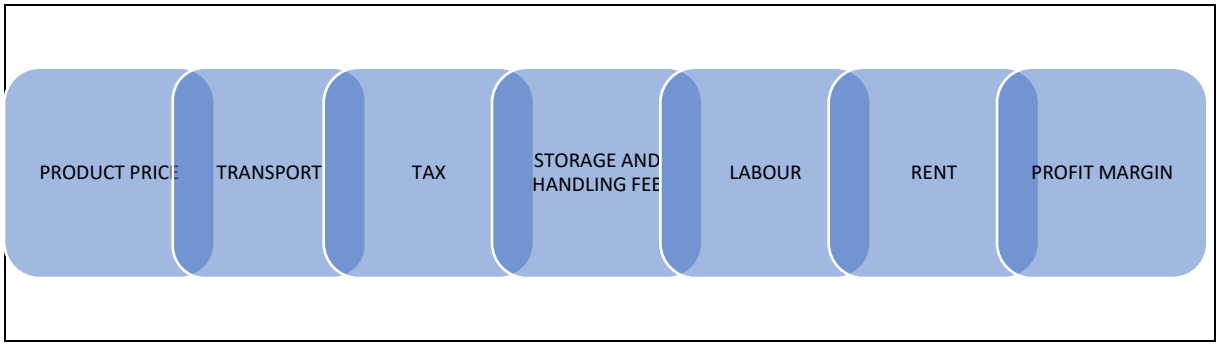

Fig 7: Pricing components for distributors

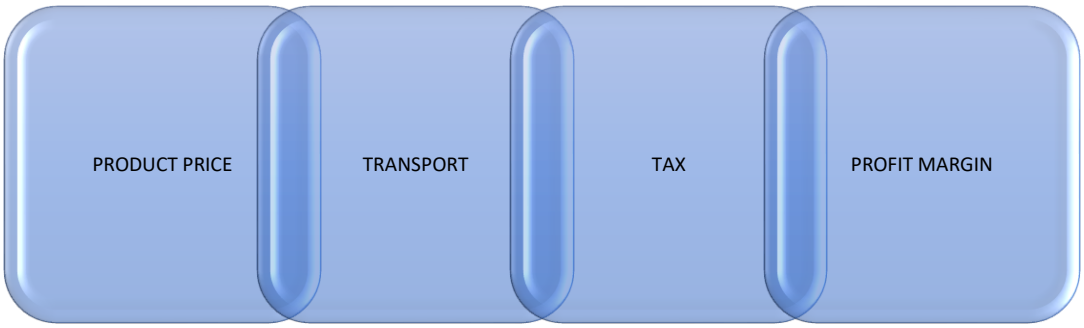

Fig 8: Pricing components for Retailers

Almost all the cost parameters at distribution level were similar to those at importer level. It would therefore be important to investigate whether replication of these elements would bring meaningful benefits to the consumer in terms of the value add. The study was not able to fully interrogate the current pricing by businesses mainly because the information provided was either incomplete or not provided at all. More work is needed to firm up the pricing of LPG and this would include, amongst others:

(a) Defining the optimum point to source the Free on Board (FOB) price of LPG;

(b) Compensation for prudently incurred costs;

(c) Enhancing economy, efficiency and effectiveness (Value for money) in the supply of LPG; and

(d) Developing an appropriate pricing framework for LPG.

(e) Testing functionality and operational integrity of the pricing framework.

4.7. Quality of gas

It is the interest of government to ensure that companies supply clean burning gas that provides all users with a safe, efficient and economical alternative for a diverse range of applications. One could not talk of the quality of gas without referring to its chemical composition and properties.

4.7.1 Chemical composition of LPG

Atoms of hydrogen (H) and carbon (C) combine to form hydrocarbon molecules which can be made up of different numbers of hydrogen and carbon atoms, hence the term 'hydrocarbon'. A molecule containing three carbon atoms and eight hydrogen atoms, as shown in Figure 9, is called propane (C_3H_8).

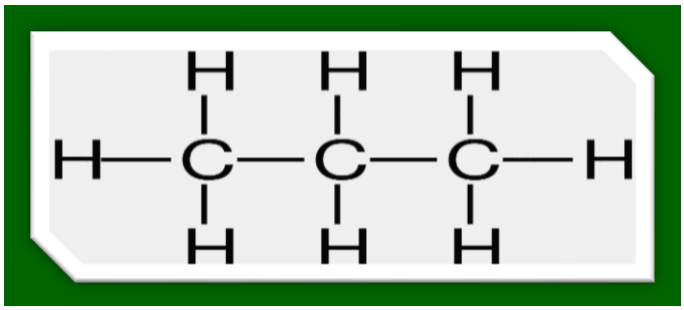

Fig 9: Propane molecular structure

In like manner, four carbon atoms bonded to 10 hydrogen atoms forms butane (C_4H_{10}) as shown in Figure 10.

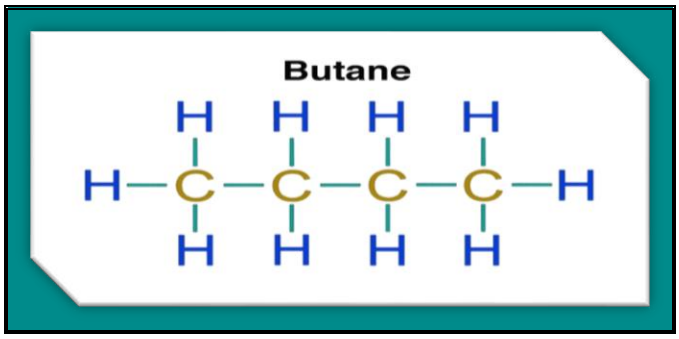

Fig 10: Butane Atom Structure

There are two possible configurations for the butane molecule. The above arrangement consists of a straight C-chain and is called normal butane or n-butane. If the C-chain is

branched, it is called iso-butane. Such a re-arrangement of the atoms is known as isomerisation and has no significant effect on the fuel properties. Hydrocarbons with single carbon bonds are known as saturated hydrocarbons while those with double or triple bonds are unsaturated hydrocarbons. Examples of saturated hydrocarbons are methane (CH_2), ethane (C_2H_6), propane (C_3H_8) and butane (C_4H_{10}). Unsaturated hydrocarbons include ethylene (C_2H_4), propylene (C_3H_6), butylene (C_4H_8) and acetylene (C_2H_2).

4.7.2 Physical properties of LPG

The properties of LPG mixtures can usually be calculated from the properties of the individual constituents (propane, butane, etc.) provided the proportions of the constituents are known.

Table 18: presents the physical properties of LPG mixtures.

Property	Propane	Butane	LPG Mix**
Molecular weight	44,09	58,12	49,7 (av.)
Carbon content (wt%)	81,72	82,66	82,15
Hydrogen content (wt%)	18,28	17,34	17,85
Carbon content: hydrogen ratio by weight	4,47	4,77	4,60
Density of liquid at 15ºC (kg/l)	0,510	0,575	0,536
Boiling point of liquid at atm. pres. (ºC)	-42.1	-0.5	-42,1 -0.5
Density of gas at 15ºC & atm. pres. (kg/m3)	1,86	2,46	2,10
Volume ratio of gas: liquid at STP*	274:1	233:1	258:1
Volume of gas from 1 kg liquid at STP (l)	537	405	484
Mass ratio of gas:air at 15ºC & atm. pres.	1,52:1	2,01:1	1,716:1
Latent heat of vaporisation at 15ºC (kJ/kg)	20,43	21,27	20,77
Vapour pressure at 20ºC (kPa abs.)	710	110	500
Sp. heat of vapour at atm. pres. (cal/g.ºC)	0,388	0,397	0,392
Net calorific value at 25ºC (MJ/kg)	46,0	45.6	45.8
Gross calorific value at 25ºC (MJ/kg)	49,8	49.4	49.6
Wobbe number (kcal/Nm3)	19000	21600	
Limits of flammability in air (vol% gas)	2,2-10	1.8-9	1.8-10
Limits of flammability in oxygen (vol% gas)	2-50	2-50	2-50
Max. flame temperature in air (ºC)	1930	1900	1900
Max. flame temperature in oxygen (ºC)	2740	2700	2700
Max. flame speed in 25 mm tube (cm/sec)	82	82	82
Air reqd for combustion at STP (m3 /kg LPG)	12,10	11,93	12,03
Air:gas vol. ratio for combustion at STP	22,5	29.5	24.9
O2 vol. for combustion at STP (m3 /kg fuel)	2,56	2,51	2.54

*STP: Standard Temperature & Pressure, defined as 0ºC and 100 kPa absolute

**Based on 60/40 Propane to Butane ratio.

Source: Afrox South Africa; Product Reference Manual - Section 5 - Liquefied Petroleum Gas

The quality of gas imported and consumed in the country is of paramount importance, more especially during an era where independent importers were entering the local market and procuring the gas from other markets other than South Africa. The gas might contain impurities such as sulphur which impacts human health. Therefore, the gas had to conform

to available standards of quality. The list of approved LPG Botswana Standards is presented in Table 19 below.

Table 19: List of approved LPG Botswana Standards

Standard	Tittle	Scope
BOS 3-3	The handling, storage and distribution of LPG - Part 3: LPG installations involving vessels exceeding 500 litres	This part of the Botswana Standard specifies requirements for the layout, design and installation of liquefied petroleum gas equipment and of storage vessels of individual water capacity exceeding 500 ℓ and associated vaporizers, pipe work and fittings up the outlet of the first pressure reduction stage in the line. Recommendations are also given in regard to the fitting of automatic and other devices (operative in the event of physical damage to the installation) for the purpose of ensuring maximum security, for the storage of the gas from a design point of view, and for limiting the escape of liquid through normal pressure-relief fittings.
BOS 3-7	The handling, storage and distribution of LPG - Part 7: Storage & filling sites for refillable LPG containers < 48kg	This part of BOS 3 specifies the minimum requirements for the location and installation of and operations at storage and filling sites for refillable liquefied petroleum gas (LPG) containers of capacity not exceeding 9 kg and the storage of individual gas containers of capacity not exceeding 48 kg. It identifies safe methods of filling and storing refillable containers and makes recommendations towards safe working procedures that cover all aspects of the storage and filling of refillable containers. This standard also covers the storage of non-refillable containers
BOS 3-4	The handling, storage and distribution of LPG - Transportation of LPG in bulk by road	This part of the BOS 3 gives requirements for the design, construction, inspection, fittings and the filling ratio of pressure vessels (mounted onto vehicles or rail wagons), including ISO containers and skid tanks, used in the transportation of liquefied petroleum gas (LPG), the design of vehicles and ancillary equipment, and operating practice
BOS 3-2	The handling, storage and distribution of LPG - Installation of caravans, mobile units & other small non-permanent buildings	This part of BOS 3 gives the installation requirements, materials, method of construction and the installation of the equipment used in liquefied petroleum gas applications for mobile units, including but not limited to caravans, motor homes, park homes, mobile kitchens, trailers and semitrailers. It also includes the safety requirements for gas on recreation vehicles and mobile ablution facilities.

Botswana did not have a national standard on recommended LPG quality specifications. Therefore, greater inference could be drawn from the South African National Standard (SANS

1774:2016) on Liquefied Petroleum Gases. Other valid international Standards included the following:

(a) ASTM D1267, *Standard test method for gauge vapor pressure of liquefied petroleum (LP) gases (LP-gas method)*.

(b) ASTM D1657, *Standard test method for density or relative density of light hydrocarbons by pressure hydrometer*.

(c) ASTM D1838, S*tandard test method for copper strip corrosion by liquefied petroleum (LP) gases*.

(d) ASTM D2158:2011, *Standard test method for residues in liquefied petroleum (LP) gases*.

(e) ASTM D2163, *Standard test method for determination of hydrocarbons in liquefied petroleum (LP) gases and propane/propene mixtures by gas chromatography*.

(f) ASTM D2598, *Standard practice for calculation of certain physical properties of liquefied petroleum (LP) gases from compositional analysis*.

(g) ASTM D2784, *Standard test method for sulfur in liquefied petroleum gases (oxy-hydrogen burner or lamp)*.

(h) ASTM D3246, *Standard test method for sulfur in petroleum gas by oxidative microcoulometry*.

(i) ASTM D3700, *Standard practice for obtaining LPG samples using a floating piston cylinder*.

(j) ASTM D5305, *Standard test method for determination of ethyl mercaptan in LP-gas vapor*.

Based on the above standards and others not identified by this study, it is imperative that a national standard on Liquefied Petroleum Gas is developed to address issues relating to gas quality. Furthermore, the BERA's petroleum testing laboratories do not have the capability to conduct any of the above-mentioned tests, neither does the country have any laboratory that can do such tests. Therefore, there is need to further develop the available laboratories to enhance capacities for testing the quality of LPG.

4.8 Quantity of gas

The widely adopted method of LPG trade is by mass and this is also used locally. The Weights and Measures Act required that where weight/mass was used for sale, the equipment (scales)

must be regularly calibrated and verified by a competent authority. That notwithstanding, retailers who were interviewed during the study stated that the most prevalent consumer complaint from the public related to the underfilling of gas cylinders. This was believed to be one of the reasons why gas finished quicker than expected. Whilst longevity might also depend on the nature of use, it was nevertheless important that the above-mentioned perception is managed. Field visits to retail outlets revealed that most retailers did not have a measuring scale by which the cylinder could be weighed as a form of verification that indeed the gas sold to a customer was of the right quantity. Furthermore, none of the "bakkie boys" carried a scale when they delivered the gas to households. There is need for resellers of LPG to possess some form of verification equipment when they sell the gas to customers.

4.9 Cylinder swapping

Cylinder swapping refers to the exchange of cylinders between and among LPG companies such that consumers could gain broader choices when it comes to purchasing their cooking gas. Consumers could bring any brand of empty LPG cylinder to any retail outlet and use it to purchase another brand of LPG cylinder carried by the retail outlet. Beyond the swapping of LPG cylinders across industry players, safety in the use of the product as well as its handling would have to be assured, hence the need to introduce measures to prohibit certain acts and institute corresponding penalties to discourage irregular trade practices and activities in the sector.

At a local level, the shortcomings of the cylinder swapping and exchange practice was recently exposed after one of the importers, Quick Gases, ceased operations owing to the matter of deceased estate. Many Batswana holding Quick Gases cylinders were left in the latch after other companies refused to swap because of the risks and costs associated with storage and handling of empty cylinders belonging to Quick Gases. Therefore, it was imperative that a long-lasting solution was engineered to mitigate against instances where consumers ended up suffering in the event that one or more companies ceased operations.

Consumers who wanted to purchase a cylinder were charged a refundable cylinder deposit fee. This is a once-off fee meant to instil a sense of fiduciary care on the cylinder. The deposit fee does not transfer ownership of the cylinder to the customer. Ownership of cylinders is

still retained by the supplier. The study revealed that the cylinder deposit fee differed from one business to another. Cylinder deposit fees were generally low in urban centres and areas close to major supply centres of LPG. Out of the 184 retailers sampled, 121 of them sold an empty cylinder. The lowest price was P150.00 and the highest selling price was P600.00, thus presenting an average price of P405.08.

5 Findings and recommendations

5.1. Importation

The bulk of the country's Liquefied Petroleum Gas requirements is met primarily through imports from and through the Republic of South Africa. These volumes are normally augmented by supplies from international markets during periods of supply shortfalls from South Africa. The supply shortfalls are often caused by planned or unplanned maintenance of petroleum refineries and occasional civil unrest in South Africa, and the gas supply and demand mismatch. The gas procured from international markets (Ras Tanura in Saudi Arabia) is transmitted through South Africa, thus showing that Botswana is heavily reliant on only one source and route of supply of LPG. Botswana has not effectively used alternative routes of supply mainly because of the high cost involved in the use of such routes.

Unlike with the liquid fuels, the country does not maintain strategic stocks of LPG. In 2010, the Government of the Republic of Botswana approved the establishment of a National Oil Company, Botswana Oil Limited (BOL) with the mandate to:

(a) Ensure security and efficiency of supply and the distribution of petroleum products in Botswana;
(b) Manage state owned petroleum strategic storage facilities, strategic stocks, bulk distribution facilities; and
(c) Facilitate the meaningful participation of citizens in the oil industry.

Subsequently in December 2018, Government through the Ministry of Mineral Resources, Green Technology and Energy Security (MMGE) and Botswana Oil Limited, signed the Bulk Petroleum Infrastructure and Product Management Agreement (BPIPMA) with the following objectives:

(a) Define the roles and responsibilities of MMGE and BOL in the overall Government objective of achieving the national energy security of supply and facilitating the participation of local companies in the Botswana oil industry;
(b) Formalise the operation and management of the Strategic Reserves petroleum infrastructure between MMGE and BOL; and

(c) Develop a framework within which the Parties may cooperate on matters of mutual interest and pursue any opportunity.

Petroleum products covered by the signed Agreement include unleaded petrol, diesel, aviation gasoline, Jet Fuel, Liquefied Petroleum Gas and illuminating paraffin received at Government Reserves Storage (GRS) Depots. However, the Government does not maintain strategic stocks of LPG. In fact, BOL has never traded in LPG. The above cited issues are highly likely to compromise the country's security of supply objectives with regard to LPG use.

5.1.1 Recommendations

(a) The Botswana Energy Regulatory Authority in consultation with LPG importers, should identify and map alternative sources and routes of supply of LPG into the country.

(b) Botswana Oil Limited should be encouraged to explore opportunities in the gas market, including developing the necessary competencies to trade in LPG.

5.2. Bulk storage capacity

The combined storage capacity for LPG wholesalers is 1,179,500 litres. Furthermore, the combined storage capacity for LPG distributors amounts to 830,000 litres. Therefore, the total available capacity in the country for both wholesalers and distributors amounts to 2,009,500 litres. Almost all this available storage capacity is in the south-eastern and northern part of the country. There is need to encourage investments in other parts of the country, especially the western parts of the country.

5.2.1 Recommendation

(a) Review the licensing requirements to facilitate investments into the development of the gas infrastructure in the country;

(b) Expansion of the Government Reserves Storage (GRS) infrastructure to accommodate trading of LPG. Through Public Private Partnership (PPP), the government could attract private investors for the development of storage facilities and other infrastructure such as pipelines.

5.3. Shareholding structure, market share and concentration index

The analysis of LPG companies shareholding structures and directorship, market shares and business concentration assessment has revealed the existence of an oligopolistic market with its inherent opportunities for uncompetitive behaviours and predatory pricing practices. Therefore, there is need to enhance competition within the sector by identifying and addressing barriers impeding entry into the local gas market, especially by Batswana. For the Authority to fully enforce against these practices, LPG regulations need to be finalised and approved as a matter of urgency to allow for efficient regulation of the above issues.

5.3.1 Recommendations

(a) A rapid identification and assessment of factors impeding entry into the local gas market should be undertaken in furtherance of this study. The assessment should be used to guide formulation of strategies to better enhance competition in the market.

(b) The Draft Botswana Oil and Gas Sector Strategy of 2013 should be reviewed to provide policy direction on the development of the local gas market. Of particular interest should be the development of clear strategies aimed at facilitating and mainstreaming Batswana into the gas market. The strategy should adopt a holistic approach, aimed at bringing synergy on sectorial cross cutting issues to enable coherent and long-lasting solutions. The impact of emerging energy sources such as Coal Bed Methane (CBM) and biogas on LPG usage should also be analysed for inform strategic position on the energy mix and the extent to which investments in the sector would be pursued.

(c) In an endeavor to ensure meaningful citizen participation in the gas sector, BOL should consider commencing implementation of commitments under the Bulk Petroleum Infrastructure and Product Supply Agreement to encompass LPG trading.

(d) A holistic review of the regulatory licensing framework and other applicable legal instruments should be undertaken to facilitate penetration of Batswana companies into the local gas market and that any identified bottlenecks are addressed.

(e) LPG regulations should be approved as a matter of urgency and implemented accordingly to ensure efficient regulation of the sector.

5.4. Market structure

There is no clear demarcation between LPG wholesalers, distributors and retailers. Some wholesalers sell gas to both retailers and individual customers who under normal circumstances, should be served by retailers. Thus, wholesalers, distributors and retailers compete for the same customers. In the process, it is retailers who suffer the most because they are outpriced by the more dominant distributors and wholesalers.

Furthermore, both wholesalers and distributors conduct almost similar processes without any significant value addition that can be passed to the consumer. In fact, the existence of the distribution level could be viewed as adding more burden to consumers in terms of increased price of the commodity. There is need to reorganise the market to achieve efficiencies and value for money.

5.4.1 Recommendation

a) The local LPG industry should be reorganised to attain the much-needed efficiencies and value for money. Therefore, the existing 3-tier model where there are wholesalers/suppliers, distributors and retailers should be revised to a 2-tier model comprising suppliers and retailers. Distributors who operate filling facilities should upgrade to the wholesale/supplier level and those who do not have filling facilities will be accorded the opportunity to decide which level they are interested to occupy.

A wholesaler/supplier means any person who imports, stores, handles, re-fills, decants and sells LPG directly to a bulk consumer or a retailer. A retailer, on the other hand, means any person conducting LPG business at a place where the gas is sold or offered for sale to a consumer on retail basis. The following prohibitions are thus put in place to bring order and stability into the market:

(i) The filling of gas cylinders of any size and type at a retail facility will be strictly prohibited for health, safety and environmental considerations;

(ii) Cross filling of competitor cylinders is strictly not allowed and this is in line with BOS 3-3;

(iii) The sale of gas to individual consumers by wholesalers is strictly not allowed; and

(iv) The retailing space is reserved for citizens in line with trade regulations.

b) Both retailers and suppliers are obliged to enter into formal agreements/contracts to govern their business working relationships.

5.5. LPG Pricing

The introduction of price regulation is a sensitive matter which if not properly conceived, could pose challenges relating to the profitability, efficient operations and sustainability of businesses. It is important that price regulation is introduced once the LPG market is properly structured. This is to avoid distortions that arises because of embedded inefficiencies that may come along with the unstructured market. Furthermore, a framework that is developed for the pricing of LPG should take into consideration the source of origin (reference markets) of the gas, supply routes with their associated costs, and applicable taxes and levies. It was reported that the gas consumed in Botswana may be originating from three locations, namely; South African refineries, Ras Tanura in Saudi Arabia and the US Gulf Coast.

While there is no doubt about South African refineries being one of the supply sources, additional time is required to validate the other two sources as the correct international benchmarks or reference markets. To do that, there will be need to analyse the volumes coming from the two locations and determine the right split. It is generally understood that the product that comes from international markets cost more compared to the one at South African refineries. This is so because the imported gas from international markets comes as a finished/refined product and has other costs such as insurance and freight already forming part of the unit landed cost at Richard's Bay, South Africa. It is important that additional time is granted to assess the proportions of gas coming out of the three locations and the adequacy of LPG market data published through S&P Global Platts relating to Free-on-Board (FOB) prices.

A virtual meeting held on 22 April 2021 between BERA officials and representatives of Platts revealed that Platts publishes monthly rates on the Saudi Contract Price (adopted by the Republic of South Africa). Platts also publishes daily rates for the gas coming out of the US. However, in terms of volumes, Platts representatives indicated that large volumes of LPG

were being sourced from the US Gulf Coast. Therefore, it is important that BERA closely interrogate the data and any underlying assumptions from these reference markets to arrive at the more relevant FOB price. This work needs some additional time to conclude. Based on the foregoing submission, work on LPG pricing is still inconclusive as further assessment still needs to be done to develop an appropriate pricing framework.

The assessment will include benchmarking with some of the leading countries in LPG pricing which include amongst others; South Africa, Morocco, Tunisia, Egypt, Tanzania, Malawi and Zambia. Benchmarking will entail thorough appreciation and interrogation of pricing frameworks applied in these countries as well as sources and types of data fed into the models. Benchmarking will further equip the staff of BERA involved in LPG with the much-needed skills and expertise to undertake LPG pricing. All the remaining works, including finalisation of the pricing framework are expected to take three (3) months from approval of this market study report. Notwithstanding the above, it is anticipated that the framework would, at a high level, comprise the following cost elements:

(a) FOB price – to be based on the appropriate combinations of the identified reference markets (Saudi Arabia and United States)
(b) Freight
(c) Insurance
(d) Coastal storage
(e) Demurrage
(f) Cargo dues
(g) Stock financing
(h) Transportation from the Republic of South Africa to Botswana
(i) Storage and handling fees
(j) Industry margins (wholesale and retail); and
(k) Applicable taxes and levies.

5.5.1 Recommendation

Undertake further research and benchmarking on LPG pricing to conclude work on the pricing framework within a period of three (3) months from approval of this market study report. The additional work will lead to achievement of the following:

(a) Determining reference markets and international benchmarks for the calculation of Free-on-Board (FOB) price for LPG;
(b) Determination of prudently incurred costs along the LPG value chain;
(c) Development of pricing rules to act as a guideline to the industry; and
(d) Finalisation of an appropriate pricing framework for LPG.

5.6. Quality of gas

Botswana does not have a national standard to measure the quality of gas imported and consumed in the country. The development of a national gas quality standard would ensure that the gas which is sourced from other markets other than South Africa, conforms to laid down quality parameters. Furthermore, the development of a national quality standard should be accompanied by the development of testing facilities and capabilities to enforce regulatory requirements relating to gas quality

5.6.1 Recommendation

(a) BERA through the Botswana Bureau of Standards should develop a National Standard (Botswana Standard) on LPG quality specifications;
(b) BERA should expand the existing petroleum testing laboratories capabilities to include testing for the quality of gas.

5.7 Quantity of gas

Most retailers did not have a measuring scale by which the cylinder could be weighed as a form of verification that indeed the gas sold to a customer is of the right amount. According to the feedback received from retailers, the most prevalent complaint from members of the public relates to under-filling of gas cylinders.

5.7.1 Recommendation

(a) Retailers are required to install or carry an apt measuring scales and weigh a cylinder that is sold to a consumer as a way of verifying the amount of gas in that cylinder;

(b) Scales should be suitable for gas cylinders and should be maintained and calibrated regularly;

(c) Public awareness drive is required to help consumers understand how to make calculations to ensure that they are not ripped off.

5.8 Cylinder swapping

The cylinder swapping or exchange system is not adequately enforced resulting in anti-competitive behaviours and disservice to the public. Furthermore, the price of an empty cylinder ranged from P150.00 to P600.00 regardless of the size of the cylinder. Cylinder deposit fees differed from one business to another.

5.8.1 Recommendation

(a) Establishment of industry trust fund to enable the public to swap cylinders in instances where one company suspends operations or close shop. The cylinder deposit fees are to be collected into the trust account. The management of the trust account shall be determined in consultation with the industry;

(b) The cylinder deposit fee is standardised and is capped at P405. This means that LPG companies will be able to sell an empty gas cylinder for a price up to that amount.

5.9 LPG Association

The local LPG industry is currently not organised for purposes of collective bargaining and addressing issues of mutual interest. Therefore, the need to establish a local LPG Association is long overdue.

5.9.1 Recommendation

The LPG industry should be encouraged to from an Association. The Authority will play a facilitative role to ensure that the industry is properly guided. The industry, in forming an association, could borrow a leaf from the Liquefied Petroleum Gas Safety Association of South Africa (LPGSASA) which exist to represent the industry in all matters regarding the promotion of the safe use of LPG.

According to the LPGSASA Code of Conduct, a member is obliged to abide by the following practices and principles of the Association:

(a) Comply with the Occupation Health & Safety Act (No 85 of 1993) and all related and applicable Standards, Regulations and South African Bureau of Standards (SABS) Codes of Practice pertaining to the supply handling, delivery, installation of LPG equipment and appliances;

(b) Provide appropriate guidance and support to its distribution network to ensure high standards of safety and commercial business practice are maintained throughout the business chain.

(c) Ensure that all activities are carried out in a manner that minimises the impact on the environment and causes no harm to the public;

(d) Subscribe to and support the development and involvement of Black Economic Empowerment (BEE) in our industry according to the Liquid Fuels Charter;

(e) Contribute to the public understanding of LPG;

(f) Assure high standards of safety, quality and reliability are maintained in all products and services offered to the market;

(g) Maintain the highest degree of personal integrity, credibility and business ethics at all times;

(h) Maintain membership status in good standing at all times; and

(i) Should a company or individual decide not to retain their membership, they are obliged to cease using the logo/s and remove all logos from their stationery, vehicles and any advertising paraphernalia.

5.10 Training and development

The Authority has limited skills and experience to regulate the highly specialised and complicated LPG market. It is important for BERA to have continuous training and development programs for its employees in the petroleum and gas department. Besides the fact that the Authority will be introducing new regulations to an unregulated market, the business environment keeps changing, and hence it is critical to keep learning and pick up new skills to improve the effectiveness of the organisation and its employees so as to support immediate changes and longer-term goals.

5.10.1 Recommendation

The Authority should develop a robust training and development program to capacitate its officers dealing with LPG to effectively regulate the sector. Such a program should be blended to include the following;

(a) Training courses on tariff setting which covers price regulation, building revenue requirements, tariff structure and design, and end-user price regulation and monitoring; and technical regulation covering amongst others; supply and logistics, gas installations, and quality assessment and management;
(b) Education tour of major local LPG facilities, such as depots, to appreciate processes in those facilities;
(c) Subject to travel restrictions, tour of selected international oil markets to appreciate the sources and routes of supply of LPG; and
(d) Benchmarking with leading countries in the region on LPG regulation

5.11 Cross border movement of LPG cylinders

There are no systems put in place to regulate the movement of gas cylinders across the border into neighbouring countries. This has resulted in increased theft and smuggling of cylinders into neighbouring countries. This issue, if not addressed, will continue to affect the ability of local LPG companies to trade and this will ultimately compromise security of supply of the gas.

5.11.1 Recommendations

(a) Allow cross-border movement of LPG cylinders only for companies and individuals with a valid BERA licence and provided they are the owners of such cylinders
(b) Collaborate with BURS and the Botswana Police Service to enforce compliance on cross-border movement of LPG cylinders.

6 Implementation Matrix

Implementation of recommendations at Chapter 5 will be as per the matrix below. Short term objectives are planned for implementation within 6 months of approval of the matrix. Similarly, medium- and long-term objectives are planned for 6 to 12 months and 12 to 24 months, respectively. Each activity is assigned a driver who will spearhead implementation of such.

No.	Activity	Short term	Medium term	Long term	Objective Driver
		0-6 months	6-12 months	12-24 months	
5.1.1	Identify and map alternative sources and routes of supply of LPG into Botswana.				BERA
	Explore opportunities in the gas market, including developing the necessary competencies to trade in LPG.				BOL
5.2.1	Review the licensing requirements to facilitate investments into the development of the gas infrastructure in the country				BERA
	Consider implementing commitments under Bulk Petroleum Infrastructure and Product Supply Agreement to include trading in LPG and accompanying measures to promote citizen participation in the gas market.				BOL
5.3.1	Undertake rapid identification and assessment of factors impeding entry into the local gas market.				CCA
	Review the Draft Botswana Oil and Gas Sector Strategy of 2013 to provide policy direction on the development of the local gas market.				DoE
	LPG regulations should be approved as a matter of urgency and implemented accordingly to ensure efficient regulation of the sector.				MMGE/BERA
5.4.1	Reorganise the LPG industry to attain efficiencies and value for money. The existing 3-tier model should be revised to a 2-tier model comprising LPG suppliers and retailers.				BERA
	Prohibit the filling of gas cylinders of any size and type at a retail facility.				BERA
	Prohibit the sale of gas to individual consumers by wholesalers.				BERA
	The retailing space is reserved for citizens in line with trade regulations.				BERA
	Prohibit cross filling of competitor cylinders.				BERA/LPG Association
5.5.1	Undertake further research and benchmarking on LPG pricing to address the following: (a) Determine reference markets and international benchmarks for the calculation of Free-on-Board (FOB) price for LPG; (b) Determine prudently incurred costs along the LPG value chain;				BERA

	(c) Develop pricing rules to act as a guideline to the industry; and (d) Finalise appropriate pricing framework for LPG.				
5.6.1	Adopt the South African National Standard on LPG quality specifications.				BERA
	Expand existing petroleum testing laboratories capabilities to include testing for the quality of gas.				BERA
5.7.1	Install an apt measuring scale and weigh a cylinder that is sold to a consumer at a retail facility as a way of verifying the amount of gas in that cylinder				Retailers
	Undertake rigorous awareness campaign to help educate the public on safe handling and use of gas.				BERA
5.8.1	Establishment of industry trust fund to facilitate cylinder swapping in instances where one company suspends operations or close shop.				BERA/LPG Association
	Standardise the cylinder deposit fee and this should be capped at P405.				BERA
5.9.1	Facilitate formation of the Liquefied Petroleum Gas Association of Botswana.				BERA
5.10.1	Develop a robust training and development program to capacitate the BERA staff dealing with LPG to effectively regulate the sector.				BERA
5.11.1	Allow cross-border movement of LPG cylinders only for companies and individuals with a valid BERA licence and provided they are the owners of such cylinders.				BURS/BERA
	Collaborate with BURS and the Botswana Police Service to enforce compliance on cross-border movement of LPG cylinders.				BERA

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Appendices

Appendix A: Questionnaire for LPG retailers

SECTION A: IDENTIFICATION AND COMPANY DETAILS

The information in this form has been provided by:	
Name	
Position	
Phone number	
Email address	
Date	

Company information	
Name of Company/business	
Physical Address	
Postal Address	
Year of incorporation	

Question 1: How long have you been in the LPG business? *(Please tick)*					
0-5 years		6-10 years		More than 10 years	

Question 2: Which of the following brands are you selling?	
(i) Easi Gas - Silver	
(ii) Afrox Gas - Grey	
(iii)Quick Gas - Blue	
(iv)Simsa Gas - Green	
(v) Tswana Gas - Yellow	
(vi)Air Liquide – Orange/Green	
(vii) Other (specify)	

Question 3: Where do you get/source your LPG?	
Wholesalers	
Others (please specify)	

Question 4: Do you have an agreement with your supplier?			
No		Yes	

Question 5: Which cylinder sizes do you mostly sell? Also indicate the number if possible		
Cylinder size	Please tick in this column	Number
9kg		
14kg		
19kg		
48kg		

Question 6: At what price do you buy and sell your Gas?		
Cylinder size	**Buying Price (Pula)**	**Selling price (Pula)**
9kg		
14kg		
19kg		
48kg		

Question 7: State your total sales for the past 5 months?	
Months	Sales (Pula)
January 2020	
February 2020	
March 2020	
April 2020	
May 2020	

Question 8: How often do you purchase your stock?							
Daily		Weekly		Monthly		Annually	

Question 9: Are you satisfied with your LPG supplier?			
No		Yes	

Question 10: Please give an explanation to the answer provided at Question 9.

_____

_____

_____

_____

Question 11: Are you delivering Gas to your customers?			
No		Yes	

Question 12: If you answered yes at Question 11, how much is the delivery cost?_____

Question 13: How do you receive LPG from your Supplier? Also indicate associated cost	
Supplier delivers to my business premises	
We collect for ourselves	
Other (*please specify*)	

Question 14: How much do you sell an empty cylinder? _____

Question 15: Which pricing method are you using?	
Cost Plus Method	

Demand based pricing	
Competition based pricing	
Other (*please specify*)	

Question 16: Based on the method you chose at Question 15, please demonstrate below on how you arrive at your final selling price. (*Please show all the factors you include in your overall selling price***)**	
Cost parameter/element	**Cost price (Pula)**
1. Buying price from supplier	
2.	
3.	
4.	
5.	
6.	

Appendix B: Questionnaire for LPG Wholesalers and Distributors

SECTION A: IDENTIFICATION AND COMPANY DETAILS

The information in this form has been provided by:	
Name	
Position	
Phone number	
Email address	
Date	

Company information	
Name of Company/business	
Physical Address	
Postal Address	
Year of incorporation	

Question 1: Type of Business (*You may tick more than one*)					
Wholesaler		Distributor		Retailer	

Question 2: Current Status							
Sole proprietorship		Partnership		Corporation		Other (*specify*)	

Question 3: If applicable, list the name of your parent company and any subsidiary	
Parent company	
Subsidiary	

Question 4: Are you a member/affiliate of any local, regional or international body?

No		Yes (*please state name*)		

SECTION B: COMPANY OPERATIONS – COMMERCIAL AND FINANCIAL INFORMATION

Question 5: Which year did you start selling LPG? _____

Question 6: Where do you buy your LPG?	
Locally (specify)	
Regionally (Specify)	
Internationally (Specify)	

Question 7: State the quantities and average buying price of LPG ordered/procured over a 10-year period as follows:		
Year	**Quantity (kg)**	**Average Buying Price (Pula/kg)**
2010		
2011		
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		

Question 8: How often do you purchase your stock?					
Daily		Weekly		Monthly	
After 2 months		Half a year		Yearly	

Question 7: State the quantities and average price of LPG sold over a 10-year period as follows:		
Year	**Quantities sold (kg)**	**Average selling Price (Pula/kg)**
2010		
2011		
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		

Question 8: Which pricing method are you using?	
Cost Plus Method	
Demand based pricing	
Competition based pricing	
Other (*please specify*)	

Question 9: What factors do you consider when changing prices?	
Inflation	
Changing prices from the refinery/depot	
Other (*please specify*)	

Question 10: Based on the method you chose at Question 8, please demonstrate below on how you arrive at your final selling price. (*Please show all the factors you include in your overall selling price***)**

Cost parameter/element	Cost price (Pula/kg)
2. Gate price/buying price from supplier	
2.	
3.	
4.	
5.	
6.	

SECTION C: COMPANY OPERATIONS – TECHNICAL INFORMATION

Question 11: Do you have storage facilities for LPG? Yes _____ No_____

Question 12: If you answered "Yes" to Question 11, please indicate the type, location and capacity of each storage facility		
Storage type	**Location**	**Capacity** (*for cylinders, specify size*)
e.g. Depot	Gaborone	1000 tons

Question 13: Do you have your own transport? Yes_____ No _____

Question 14: If you answered "yes" to Question 13, do you deliver to your customers?

Yes_____ No_____

Appendix C: LPG Prices per cylinder size per district

Districts		16a. 9KG	16b. 14KG	16c. 19KG	16d. 48KG
Kweneng	Mean	192.8929	290.0711	382.6492	953.6480
	N	14	9	13	10
	Std. Deviation	12.37709	9.68481	12.64013	48.39342
	Sum	2700.50	2610.64	4974.44	9536.48
	Minimum	160.00	270.00	360.00	850.00
	Maximum	210.00	300.00	400.00	1000.00
	Range	50.00	30.00	40.00	150.00
	Variance	153.192	93.796	159.773	2341.923
Kgalagadi	Mean	213.9036	318.7955	441.8893	1072.1000
	N	14	11	14	12
	Std. Deviation	24.23160	22.21951	45.49137	91.62000
	Sum	2994.65	3506.75	6186.45	12865.20
	Minimum	173.85	273.85	363.75	889.65
	Maximum	267.00	350.00	563.00	1200.00
	Range	93.15	76.15	199.25	310.35
	Variance	587.171	493.707	2069.464	8394.224
Ghanzi	Mean	223.7500	333.7500	442.5000	1107.5000
	N	4	4	4	4
	Std. Deviation	39.02456	35.91077	37.96929	128.16006
	Sum	895.00	1335.00	1770.00	4430.00
	Minimum	195.00	295.00	395.00	960.00
	Maximum	280.00	380.00	480.00	1250.00
	Range	85.00	85.00	85.00	290.00
	Variance	1522.917	1289.583	1441.667	16425.000
North West	Mean	253.0125	365.7458	472.4192	1139.9962
	N	12	12	13	13
	Std. Deviation	20.60565	30.03063	39.18606	122.24940

	Sum	3036.15	4388.95	6141.45	14819.95
	Minimum	220.00	330.00	430.00	955.00
	Maximum	288.15	445.95	585.95	1400.00
	Range	68.15	115.95	155.95	445.00
	Variance	424.593	901.839	1535.547	14944.917
Chobe	Mean	262.0000	384.0000	491.0000	1179.0000
	N	5	5	5	5
	Std. Deviation	66.38901	65.51717	33.24154	41.59327
	Sum	1310.00	1920.00	2455.00	5895.00
	Minimum	205.00	325.00	470.00	1105.00
	Maximum	370.00	495.00	550.00	1200.00
	Range	165.00	170.00	80.00	95.00
	Variance	4407.500	4292.500	1105.000	1730.000
North East	Mean	204.4160	305.8560	404.3760	997.4500
	N	25	25	25	24
	Std. Deviation	21.11539	20.06162	23.33562	80.35773
	Sum	5110.40	7646.40	10109.40	23938.80
	Minimum	170.00	280.00	360.00	880.00
	Maximum	250.00	350.00	450.00	1200.00
	Range	80.00	70.00	90.00	320.00
	Variance	445.860	402.468	544.551	6457.364
Central	Mean	196.7131	297.7061	390.8202	947.5476
	N	42	41	42	41
	Std. Deviation	17.85220	22.90484	27.39570	48.16655
	Sum	8261.95	12205.95	16414.45	38849.45
	Minimum	162.00	249.00	329.00	848.00
	Maximum	250.00	350.00	450.00	1056.00
	Range	88.00	101.00	121.00	208.00
	Variance	318.701	524.632	750.524	2320.016
Kgatleng	Mean	185.6250	281.2500	364.3750	893.1250
	N	8	8	8	8

	Std. Deviation	9.03861	11.57275	11.78301	54.04611
	Sum	1485.00	2250.00	2915.00	7145.00
	Minimum	170.00	270.00	350.00	790.00
	Maximum	200.00	300.00	385.00	965.00
	Range	30.00	30.00	35.00	175.00
	Variance	81.696	133.929	138.839	2920.982
South East	Mean	188.0000	288.4545	381.4091	948.4773
	N	22	22	22	22
	Std. Deviation	14.30618	16.79492	26.74155	80.92273
	Sum	4136.00	6346.00	8391.00	20866.50
	Minimum	170.00	266.00	350.00	850.00
	Maximum	235.00	350.00	485.00	1199.50
	Range	65.00	84.00	135.00	349.50
	Variance	204.667	282.069	715.110	6548.488
Southern	Mean	190.0497	290.1856	393.5644	975.9426
	N	34	34	34	34
	Std. Deviation	17.20560	34.63804	34.69660	98.11621
	Sum	6461.69	9866.31	13381.19	33182.05
	Minimum	167.94	204.00	350.00	850.00
	Maximum	264.95	409.95	549.00	1399.75
	Range	97.01	205.95	199.00	549.75
	Variance	296.033	1199.794	1203.854	9626.791
Total	Mean	202.1741	304.5380	404.1021	991.4938
	N	180	171	180	173
	Std. Deviation	28.14486	35.71095	42.34678	104.57267
	Sum	36391.34	52076.00	72738.38	171528.43
	Minimum	160.00	204.00	329.00	790.00
	Maximum	370.00	495.00	585.95	1400.00
	Range	210.00	291.00	256.95	610.00
	Variance	792.133	1275.272	1793.250	10935.442