CHALLENGES OF LIQUID PETROLEUM GAS PENETRATION IN KENYA

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ABSTRACT

The study sought to establish the challenges of liquefied petroleum gas penetration in Kenya. Access to modern forms of energy provides great benefits to development through the provision of reliable, convenient and efficient lighting, telecommunication services, transport, heating, clean water, cooking, healthcare and mechanical power. The main objective of this research study was to establish the challenges of LPG penetration in Kenya. Specifically, the study sought to establish the effects of price, availability of product, infrastructure and safety on LPG penetration in Kenya. This study was carried out through a descriptive research method.The study population consisted of the 21 companies licensed in Kenya to sell LPG Gas and the sample size for this study was 178 respondents. The study used a questionnaire to collect primary data. The pilot testing was conducted using the questionnaire on 10 management staff and the data was then be coded and checked for any errors and omissions. Frequency tables, percentages and means was used to present the findings. Responses in the questionnaires was tabulated, coded and processed by use of a computer Statistical Package for Social Science (SPSS) programme to analyze the data.

Keywords; Liquefied Petroleum Gas, Price stability, Discovery, Inflation and Hydrocarbon

INTRODUCTION

The study seeks to establish the challenges of liquefied petroleum gas penetration in Kenya. Access to modern forms of energy provides great benefits to development through the provision of reliable, convenient and efficient lighting, telecommunication services, transport, heating, clean water, cooking, healthcare and mechanical power. The international community has long been aware of the close correlation between income levels and access to modern energy. It has been observed that countries with a large proportion of the population living on an income of less than $2 a day tend to have low electrification rates and a high reliance on traditional biomass. The International Energy Agency (IEA) also notes that increases in incomes lead to a faster rise in access to electricity than access to other fuels. This is largely because governments give higher priority to electrification, though access to both electricity and clean cooking facilities is essential to success in eradicating the worst effects of poverty and putting poor communities on the path to development (WECD / IEA, 2010).

The United Nations' Sustainable Energy for All Initiative which was launched in 2011 sets as one of its three objectives universal access to modern energy services that is electricity and clean cooking and heating systems by 2030. About three billion people rely on solid biomass or coal for cooking and heating, and smoke from such fuel use is estimated to cause four deaths every minute. The (IEA) estimates that more than 40 percent of households newly gaining access to modern household energy by 2030 in the universal-access scenario will do so by switching to LPG, and Kenya is not exempt from this scenario as is evident in the increased consumption of LPG in the country(Barnett, 1999).

The main sources of energy in Kenya are biomass, fossil fuels, electricity and other renewable energy sources. In 2012, biomass energy accounted for about 70% of all energy consumed while petroleum and electricity accounted for only 21% and 9%, respectively. Petroleum is the most important source of commercial energy in Kenya and petroleum fuels are imported in form of crude oil for domestic processing and also as refined products, and mainly used in the transport sector, industrial sector and the commercial sector. Trends in the sale of petroleum fuels indicate that retail pump outlets and road transport constitute the single largest customers of petroleum fuels followed by aviation and power generation. Kerosene as a cooking and lighting fuel is equally important especially for the rural and urban poor households and sometimes used as a substitute for wood fuel (Gilberto, 2004).

Liquefied Petroleum Gas
The history of LPG can be traced back to the beginning of the 20th Century. In the early production of gasoline, one problem faced was that gasoline quickly evaporated when in storage (Barnett, 1999). Energy is essential for economic and social development yet for all the invaluable benefits that energy access brings, its consumption can have a negative effect on the environment, particularly with regard to climate change. However not all kinds of energy have the same impact on the climate. It is there for important that consumers are informed and able to choose clean energy sources (Barnes & Halpern, 2000). A study, conducted in accordance with the Intergovernmental Panel on Climate Change (IPCC) methodologies, demonstrated that

compared to many other energy sources, Liquified Petroleum Gas (LP Gas) can help minimize greenhouse gas (GHG) emissions and therefore mitigate climate change in many applications and regions around the world today (Sokona, 2003).

Petroleum Sector Overview

Kenya solely relies on oil imports to satisfy its oil energy needs. According to Kojima *et al.* (2010), Kenya has an Open Tender System, whereby crude or petroleum products are purchased by a single company for the entire market on the basis of a public tender and shared among all marketing companies in proportion to their share of the market. Questions have been raised about the cost-effectiveness of this system. The Government of Kenya (GoK) (2003) in its Vision 2030 recognizes that Kenya's energy costs are higher than those of her competitors and that Kenya must, therefore, generate more energy at a lower cost and increase efficiency in energy consumption. The Kenya Government is, therefore, encouraging foreign specified oil products in December 2010.

Interest in oil exploration thus there is a modest upstream oil industry, currently limited to exploration in various parts of Kenya. There has been a confirmation that Kenya has struck oil in Turkana area but the commercial viability of these discoveries is yet to be determined. Petroleum is Kenya's major source of commercial energy and has, over the years, accounted for about 80% of the country's commercial energy requirements (Wanjiku, 2011).

Statement of the Problem

The consumption of Liquefied Petroleum Gas in Kenya is estimated at a per capita of 1Kg compared to 10 Kgs in Senegal (Williams, 2006). This low usage is in spite of government effort to make it more affordable by removing VAT and the introduction of the common cylinder valve that is aimed at enhancing access to the product. Consumption of LPG in Kenya could be linked to the cost of the product and its accessibility at domestic level. Currently, the cost of LPG in other developing countries for instance Brazil is at 0.85 USD/KG, Senegal is at 0.60 USD/KG, South Africa is at 2.04 USD/KG and Tanzania is at 2.14 USD/KG while Kenya retails at 2.38 USD/KG (U.N, 2010). The statistics indicate that Kenya retails LPG at the highest price as compared to other developing countries in the world. The high cost of LPG could be hindering the uptake of the product at the domestic level in Kenya. There is need to find out whether cost of LPG among other factors have been a challenge to its penetration in Kenya.

Of the various modern sources of energy, great emphasis has been laid on electric energy and this is evident on the massive investment in the on-going rural electrification program in the country. Investment will also need to focus on other modern energy sources, including LPG, to help alleviate the widespread energy poverty in the country. Given the light emphasis on LPG energy, the role of LPG in addressing energy poverty in Kenya is vague. The measures that can be taken to enable more households to shift away from solid fuels to LPG are also unclear. There is little published work on the factors hindering LPG uptake, particularly in the context of developing countries in the dynamic African region and specifically in Kenya. This study intends to bridge this gap in knowledge. To address this gap in knowledge and address the time variance there is indeed a need for a study on the same. This has prompted this study on the challenges of liquefied petroleum gas penetration in Kenya.

Objectives of the Study
The main objective of this study was to establish the challenges of liquefied petroleum gas penetration in Kenya.

Specific Objectives
The specific objectives were to:
 i) To establish whether price of product affects LPG penetration in Kenya
ii) To find out if availability of product affects LPG penetration in Kenya
iii) To determine whether infrastructure affects LPG penetration in Kenya
iv) To investigate whether safety issues affects LPG penetration in Kenya

Research Questions
The study sought to answer the following research questions:
 i) Does price of product affect LPG penetration in Kenya?
ii) Does availability of product affect LPG penetration in Kenya?
iii) Does infrastructure affect LPG penetration in Kenya?
iv) Do safety issues affect LPG penetration in Kenya?

LITERATURE REVIEW

Theoretical Review
This section presents the theoretical review of literature as reviewed by other authors and the conceptual framework for the study.

Conflict Resolution Theory

This theory anchors this research study because it recognizes the need for collaboration which is an indicator of the integrating style of conflict management. According to Deutsch (2002), the norms of supportive behaviour in conflict resolution are similar to those of respect, responsibility, honesty, empowerment and caring behaviour towards friends or fellow group members.

This theory notes that good cooperative relations facilitate constructive management of inevitable conflicts. The norms in this theory are: placing the disagreements in perspective by identifying common ground and common interests, addressing only the issues when there are disagreements and refrain from making personal attacks. Also, in disagreements, seek to understand the others views from their perspective and build on the ideas of the other fully, acknowledging their value. Emphasize on the positive on the other party and the possibilities of constructive resolution of the conflict, take responsibility for the harmful consequences (intended or unintended) of what you do and say and seek to undo the harm and make sincere apology (Lorenz, 1966).

Game Theory

Game theory emphasizes on the fact that the two groups involved in a conflict have interdependent interests and their fates are tied together. It recognizes that the cooperative as well as competitive interests may be intertwined in conflict. The theory is well explained by Schellings (1960) phrase: the mixed-motive nature of conflict. The cooperative aspect

emphasizes on bargaining and negotiation where the conflicting parties arrive at a mutually satisfactory agreement that improves the outcome of each party.

Cooperation and Competition Theory

This theory was initially developed by Deutsch (2010) and elaborated by Johnson (1989). This theory has two basic ideas. The first is the interdependence among goals of the people involved in a conflict. The other is the type of action taken by the two people involved. He identifies two types of goal independence. The first is positive and the other negative. The positive is where the probability of a person's goal attainment is positively correlated with the amount of another attaining his goal. The negative is where the goal is linked in such a way that the amount of the goal attainment is negatively correlated with the amount of the others goal attainment. This means, if you are positively linked with another person, then you sink or swim together. Therefore, if the other sinks, you swim and if the other swims, you sink. In this theory, there are two basic types of action by a person. These are effective actions which improve a person's chance of attaining a goal and bungling actions, which worsens a person's chance of obtaining a goal.

This theory anchors this study because when conflicting parties co-operate to resolve an issue, they examine their differences and settle on a solution by integrating their opinions leading to outcomes of mutual benefits. Co-operation also brings in compromising where each party contributes a little to reach a compromise solution. Competing which leads to negative effects can be likened with the dominating style of conflict management where one uses his or her power to get what he or she wants, the dominating party has no consideration for his or her opponent.

Theory of Equity

Another approach that explains how people get committed hence enhancing the entire organizational performance is the Theory of Equity by J. Stacey Adam (2001) that explains that people make comparisons between themselves in terms of what they invest in their work and what outcome they receive from it in order to be fully dedicated and committed to the performance of their jobs. The theory stats that when people perceive an unequal situation, which may be to act positively to improve their performance or act negatively, for example, working slowly. However such thinking is best applied to extrinsic rewards such as pay, promotions and fringe benefits.

Conceptual Framework

In this framework, there are certain factors that influence challenges of liquefied petroleum gas penetration in Kenya. These factors include but are not limited to price of LPG, availability of LPG, infrastructure and safety issues. Government policy is the intervening variable.
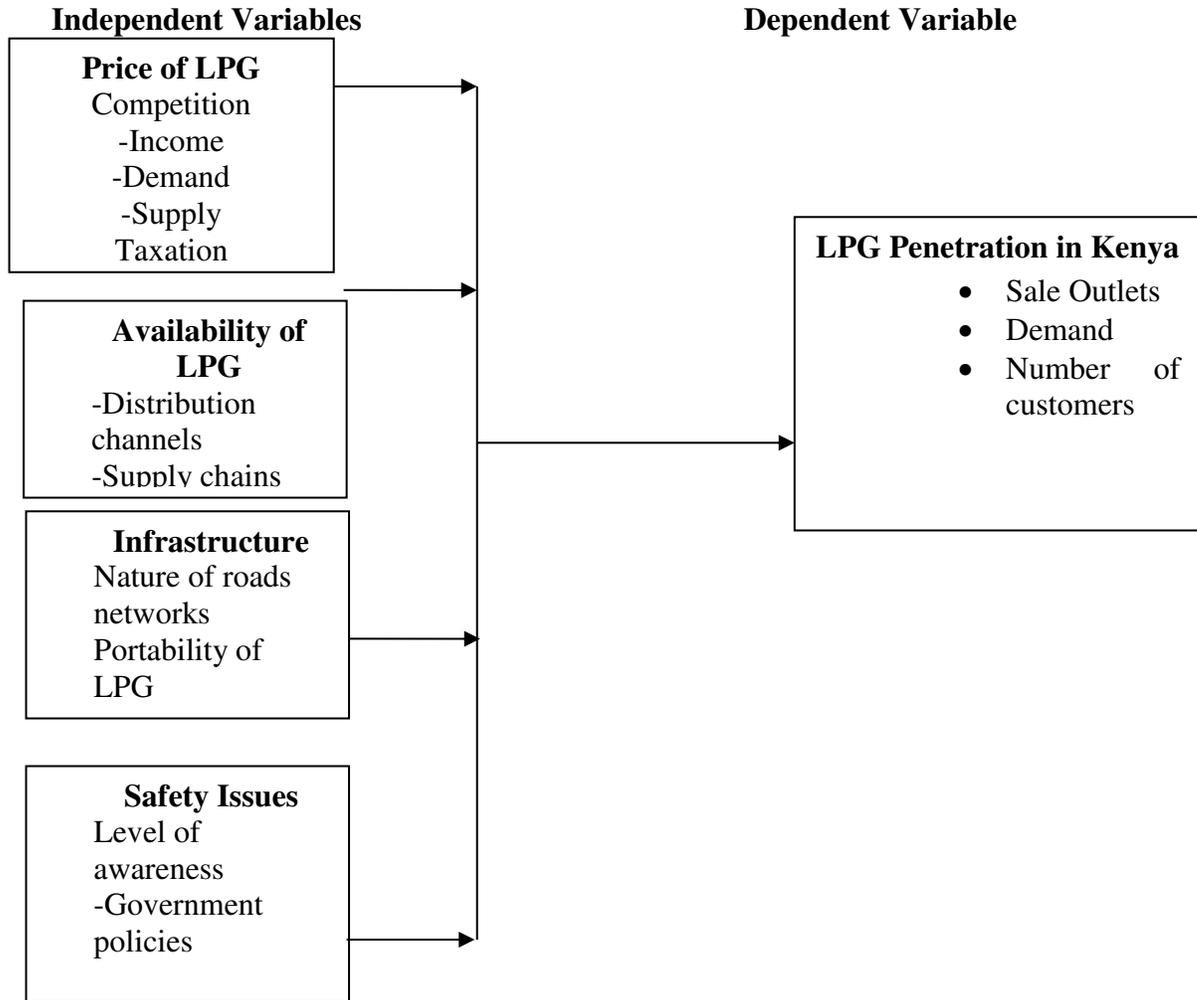
Independent Variables   **Dependent Variable**

| Price of LPG |
| Competition |
| -Income |
| -Demand |
| -Supply |
| Taxation |

| LPG Penetration in Kenya |
| • Sale Outlets |
| • Demand |
| • Number of customers |

| Availability of LPG |
| -Distribution channels |
| -Supply chains |

| Infrastructure |
| Nature of roads networks |
| Portability of LPG |

| Safety Issues |
| Level of awareness |
| -Government policies |

Figure 2 .1: Conceptual Framework
Source: Researcher (2016)

Price

Labys (2006) observes that higher oil prices can lead to higher inflation, lower corporate profits, higher unemployment and reduced national economic growth. Higher price volatility can lead to a reduction in investment, leading in turn to a long term reduction in supply, higher prices, and even reduced macroeconomic activity. Regnier (2007) found that oil and energy price volatility increased following the 1973 oil crisis. This increase has been accompanied by an increase in price volatility for all commodities. In the late 1970s, however, price volatility for most products returned to pre-1973 levels, while oil price volatility continued to increase.

Supporting this position, Plourde and Watkins (1998) found that crude oil price volatility during the 1985-1994 period was higher than price volatility for other by about 95%. Fattouh (2011) found that little attention has been devoted to the process of price discovery in the oil markets and the drivers of oil prices in the short run remain under-researched. According to the UNCTAD (2005), most developing country governments face heavy exposure to oil price volatility, either on the export or the import side – and sometimes, both. Kenya is no exception, being a net importer of oil products.

Gilberto (2004) reveals that Brazil practiced a cross-subsidy scheme for several decades in order to make LPG affordable to households in all parts of the country. As LPG prices were deregulated and collective subsidies to all customers were eliminated, the federal government started implementing a policy to assist low-income families to purchase the gas through a voucher valued at US$ 2.38 per month per family. Taxes and distribution margins constitute up to 60 percent of LPG retail price (TaTEDO, 2001).

Use of LPG has also been constrained by the initial cost of acquiring equipment such as the cookers and gas cylinders. On their own, such equipment is not inordinately expensive but the modest use is due to the heavy taxation on the equipment itself. For instance, as at April 2000, about 30 percent of the total cost of the simplest equipment was comprised of direct taxation by the government. Impliedly, if the government could moderate the tax, then the immediate result would be that more Kenyans would be able to afford the equipment and eschew the use of wood fuel or charcoal (Owino, 2000).

The world price of LPG increases with the approach of the Northern Hemisphere winter and decrease to some extent during the Northern Hemisphere autumn and summer. However, it is noteworthy that there appears to be a trend over the longer term for gradually rising LPG prices. This partially reflects the steadily increasing world demand for LPG, particularly in Asia. In countries such as China and India, demand for LPG has increased significantly in recent years. Also, in Australia, LPG consumption has increased from less than 100ML in 1975 to approximately 4,037ML in *2006-07* (DRET, 2007).

Availability

Antonette and Narasimha (2004) indicated that ensuring reliable supply and accessibility of LPG was a challenge in many developing countries. The two stated that a country needed not only additional LPG production capacity, in the face of increased demand from the domestic sectors, but also the development of adequate transportation (pipelines and rail-tank-wagons), and storage installations. There has to be a reliable distribution system running to local distributors even in rural areas, to prevent refilling inconveniences that seem to counteract the advantages of using LPG (Antonette and Narasimha, 2004).

In addition, suggestions have been given that the LPG sector of the petroleum industry is devoid of competition because each of the companies compels consumers to purchase a separate valve for the gas cylinders. Due to the different valves (regulators), the cylinders are not compatible with one another. It is argued that this state of affairs means that the companies avoid competing with one another by creating the impression that their products are different. As a result, the consumers are unable to compare prices between the competing companies and the cross over is

expensive because it requires that the consumer purchase a new set of equipment that has been argued above as fairly expensive (Owino, 2000).

Nigeria, with a population of about 140 million, consumes just 80,000 tonnes 100,000 tonnes of LPG (Adeshina, 2009). Research has shown that if an average family consumes 12.5kg of LPG a month, Nigeria is capable of consuming over 5.62m tons of LPG a year (Adeshina, 2009).The unrest in the oil rich Niger Delta region; stable and predictable market; and the high cost associated with gas importation were the reasons highlighted for the inadequate supply of LPG to satisfy high demand in Nigeria (Adeshina, 2009). In most countries with LPG supply industry, the supply chain from the import terminal or refinery through to cylinder plants is highly refined and efficient. Each step in the supply chain is made to be fully necessary and streamlined to reduce overhead cost.

Many genuine importers and dealers are out of business because of their inability to secure the use of these facilities; many incurred demurrage, which they later passed on to buyers. He further highlighted that these constrains have played villain to the noble task of making cooking gas available and affordable to a critical mass of Nigerians(Effiong, 2009). A long term solution in this regard may involve investors and the government in the building of jetties; provision of vessels that are compatible to the available jetties for loading and discharging of LPG; and the building of more storage facilities. Building of more storage facilities will help reduce the number of vessel trips made and ensure zero-stock out at all times. Based on this situation also, a short term plan should involve the cordial use of the limited jetties and storage facilities as this will prevent the heavy weight (major dealers) in the industry from seizing control and dominating the market and overtime assert their dominance by arbitrarily determining the price of the product (Antonette and Narasimha, 2004).

Infrastructure

Infrastructure here broadly refers to not only physical facilities of transmission and distribution networks, but also necessary equipment and services for power companies. Assurances of reliable capacity expansions of infrastructure at every stage in the power industry value chain are crucial to avoid bottlenecks in supply. Underdeveloped infrastructure has been described as one of the major impediments to the distribution of clean cooking fuel in sub-Sahara Africa (Schlag *et al.,* 2008). The lack of investment in modem energy infrastructure has also been described as what is retarding broader access to modem carriers (particularly to low-income groups in remote rural areas), keeping millions of people at low standards of living. Schlag *et al.* highlighted these problem are mainly felt in the rural areas where transport infrastructure (e.g. roads) are poorly developed and the lack of an extensive distribution network complicates efforts to offer modem alternatives to traditional fuel in sub-Sahara Africa (Schlag *et al*., 2008).

In Nigeria, inadequate facilities have consistently impeded evacuation when LPG was available at the refineries. Also, inland transportation infrastructure for LPG is underdeveloped (lack of access to existing infrastructure due to bad roads). The brutalization depots and some LPG plants have been left idle and are in various states of disrepair. Coastal shipping and road transport incur high costs due to lack of space for berthing in the only functional jetty in Lagos and lack of

access to existing infrastructure due to bad roads. These were the infrastructural problems described as major impediments to LPG distribution and utilization in Nigeria by Effiong (2009) in his report on "How to grow domestic LPG in Nigeria". Based on the report made by World Bank Energy Sector Management Assistance Program WBESMAP(2004) on LPG in Nigeria, there is an extensive distribution infrastructure capable of supplying a much enlarged market but these infrastructure needs rehabilitation. Also, the need to introduce other means like rail and pipelines for transporting LPG is vital for the sector to recover as the only means of inland distribution is practically through road transport.

Safety Issues

Creating industries or enterprises in most West African countries has been described as too long and arduous was the case put forward by Akuffo *et al.* in their write up on "Policy Recommendations for Energy SME Development in Africa". They highlighted that the procedures for energy entrepreneurs who sell LPG are relatively too long and daunting. Putting together the different legal papers and licenses (company registration, license for VAT, trading license, energy regulatory board certificate, authorization from service, approvals for telephone and water supply) is seen as time consuming and costly (Akuffo et aI, 2008). Although, the running of business is risky and requires careful safe guards and strict adherence to safety standards, it is also necessary that these processes be reduced to the barest minimum and also maintains standards. This can be made possible by reducing regulations, simplify bureaucratic processes, develop zoning and site plans that would serve as a guideline and direction to encourage potential energy investors. The local licensing authorities liaising with government agencies can work towards reducing the duration of obtaining permits, licensing and approval before starting an LPG business.

Safety is a legitimate concern for policy makers everywhere. Safety problems and the associated perceptions of have been described as likely barriers to the use of LPG (WLPGA, 2005:32). Safety standard is therefore an important area of responsibility for governments in partnership with LPG providers and end users. It is advisable that government should review/update existing safety standards and also adopt appropriate standards. Correct media, correct message and repetitive impact can help overcome negative perception of LPG. The introduction of safety as part of the school work for children and young adults has been described as one of the means of passing safety messages in areas of low literacy (WLPGA, 2005:32).

RESEARCH METHODOLOGY

Research Design

This study was carried out through a descriptive research design. Orodho (2003) defines a research design as the scheme, outline or plan that is used to generate answers to research problems. Creswell (2008) stated that the descriptive method of research is to gather information about the present existing condition. The emphasis was on describing rather than on judging or interpreting. The descriptive approach is quick and practical in terms of the financial aspect. Moreover, this method allowed a flexible approach, thus, when important new issues and questions arise during the duration of the study, further investigation was conducted.

Target Population

A population refers to an entire group of individuals, events or objects having a common observable characteristic (Mugenda &Mugenda, 2003). The study population consisted of the 21 companies licensed in Kenya to sell LPG Gas. They include: Total Kenya Ltd. (Total Gaz), Libya Oil (K). Ltd (Mpishi Gas), Shell Kenya Ltd. (Afrigas), B.O.C Gasses (K) Ltd (Handigas), National Oil Co. Kenya (Supagas), KenolKobi Ltd (K-Gas), Pan African Petroleum Ltd (Pan Gas), Hunkar Trading Co. Ltd (Hunkar Gas), Addax Kenya Ltd (Tri-gas & Oryx gas), Fossil Fuels Ltd (Pet Gas), Quality Gas Ltd (Q-gas), Hashi Energy Ltd (Hashi Gas), Tex Ltd (Tex Gas), Megtraco Ltd (Kapri gas), Green Energy Ltd (G-Gas), Midland Energy Ltd (Mid gas), Tuangaze Ltd (T-Energy), Oilcom (K) Ltd (Oilcom gas), Galana Oil (K) Ltd (Del gas), Hass Petroleum (K) Ltd (Hass gas) and Premier Gas Ltd (Pima Gas) (PIEA, 2013).

Sampling Technique

The study will use stratified random sampling technique in coming up with a sample from senior, middle and lower level managers in the LPG companies within Nairobi CBD. Mugenda and Mugenda (2003) advocated 10-40% of target population as representative. With this stratified random sampling, subjects was selected in such a way that the existing sub-groups in the target population are more or less represented in the sample, Mugenda and Mugenda (2003). The sample size for this study was 178 respondents.

Sample Size and Sampling Techniques

	Population	Sample Ratio	Sample Size
Total Kenya Ltd	113	40	45
Libya Oil (K)	75	40	30
VIVO	110	40	44
Kenol Kobil	62	40	25
Hashi Energy	84	40	34
Total	**444**	**40**	**178**

Data Collection

The study used a questionnaire to collect primary data. Questionnaires were appropriate for studies since they collected information that was not directly observable as they inquire about feelings, motivations, attitudes, accomplishments as well as experiences of individuals, Mellenbergh (2008). The questionnaire comprised of both open and close-ended questions.

Franker, (2006) stated that a questionnaire is useful in obtaining objective data because participants are not manipulated in any way by the researcher. Further, questionnaires will have the added advantage of being less costly and using less time as instruments of data collection.

The data instrument addressed the five research objectives while it was sub-divided into two sections. The first section of the questionnaire enquired on the general information about the respondents, while the next sections sought to answer the five objectives, that is, price, availability of product, infrastructure, relevant policies and regulations and safety issues. The researcher involved three research assistances to help in distribution of the questionnaires to the targeted respondents. The questionnaires was administered through drop and pick later method. The quantitative section of the instrument employed both nominal and a Likert type scale format to determine each of the variables. A 5 point Likert scale ranging from 1 to 5 were used as answers to statement like questions. The Likert - type format was selected as the format yields equal - interval data, a fact that allows the use of more powerful statistical to be used to test hypotheses (Kiess & Bloomquist, 2008).

Data Processing and Analysis
The data was then coded and checked for any errors and omissions (Kothari, 2007). Frequency tables, percentages and means were used to present the findings. Responses in the questionnaires was tabulated, coded and processed by use of a computer Statistical Package for Social Science (SPSS) programme to analyze the data. The responses from the open-ended questions were listed to obtain proportions appropriately; the response was then reported by descriptive narrative. Descriptive statistics such as mean and standard deviation was used. Inferential statistics were also used to test relationships between variables.

LPG Penetration in Kenya was regressed against four variables of price, availability, infrastructure and safety issues. The relationship among the variable are depicted below.

The equation for LPG Penetration in Kenya was expressed in the following equation:

$Ys = \beta_0 + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + \varepsilon$, Where,

Ys = LPG Penetration in Kenya

β_0 = constant (coefficient of intercept)
X_1 = price
X_2 = availability

X_3 = infrastructure

X_4 = safety issues

$B_1 \ldots B_4$ = regression coefficient of four variables.
Inferential statistics such non parametric test which include analysis of variance (ANOVA) was used to test the significance of the overall model at 95% level of significance. According to

Mugenda (2008) analysis of variance is used because it makes use of the F – test in terms of sums of squares residual.

FINDINGS

Price

The study found out that price had a positive influence on LPG penetration because P value = 0.002.These echoed findings by Labys (2006) who observed that higher oil prices can lead to higher inflation, lower corporate profits, higher unemployment and reduced national economic growth. Higher price volatility can lead to a reduction in investment, leading in turn to a long term reduction in supply, higher prices, and even reduced macroeconomic activity.

Availability

Additionally the study found out that availability of LGP had a positive influence on LPG penetration in Kenyan market because P value = 0.036.These finding are in line with Esteves and Pastor (2000), who found out that ensuring reliable supply and accessibility of LPG was a challenge in many developing countries. The growth in production of LPG will probably outstrip that of most other oil products, since natural gas processing is now the largest source of LPG -is increasing more rapidly than crude oil processing (WB & WLPGA, 2002).

Infrastructure

The study found out that infrastructure had a positive influence on LPG penetration in Kenyan market because P value = 0.001. These finding are in line with Esteves and Pastor (2000), who found out that inland transportation infrastructure for LPG is underdeveloped (lack of access to existing infrastructure due to bad roads). Assurances of reliable capacity expansions of infrastructure at every stage in the power industry value chain are crucial to avoid bottlenecks in supply

Safety Issues

From the findings, safety issues had a positive influence on LPG penetration in Kenyan market because P value = 0.003. This finding ware in line with a study by (Akuffo et aI, 2008) indicated that Safety problems and the associated perceptions of have been described as likely barriers to the use of LPG.

LPG penetration in Kenyan market

From the findings, reduced price, good infrastructure and availability had a positive influence on LPG penetration in Kenyan market because P value = 0.012. This finding ware in line with a study by Kathori (2006) indicated that there was a strong relationship between reduced price, good infrastructure and availability on LPG penetration in Kenyan market.

The study further carried out regression analysis to establish the statistical significance relationship between the independent variables notably, (X_1) price, (X_2) availability, (X_3)

infrastructure and (X_4) safety issues and dependent variables (Y) LPG penetration in Kenyan market. According to Salkind (2003) regression analysis is a statistics process of estimating the relationship between variables. Regression analysis helps in generating equation that describes the statistics relationship between one or more predictor variables and the response variable. The regression analysis results were presented using regression model summary table, Analysis Of Variance (ANOVA) table and beta coefficients table. The model used for the regression analysis was expressed in the general form as given below:

$$Y= a + B_{1*}X_1 + B_{2*}X_2 + B_{3*}X_3 + B_{4*}X_{4\,+} + B_{5*}X_{5+}\,e$$

For this model, LPG penetration in Kenya used as the dependent variable (Y) and independent variables included (X_1) price, (X_2) availability, (X_3) infrastructure and (X_4) safety issues. The relationships between the dependent variable and independent variables, and the results of testing significance of the model were also respectively interpreted. In interpreting the results of multiple regression analysis, the three major elements considered were: the coefficient of multiple determinations, the standard error of estimate and the regression coefficients. R squared was used to check how well the model fitted the data. R squared is the proportion of variation in the dependent variable explained by the regression model. These elements and the results of multiple regression analysis were presented and interpreted accordingly in table 4. 7,table 4.8 and table 4.9

From the findings of the study it shows that the regression model coefficient of determination (R2) is 0.783and R is 0.855 at 0.05significance level. This is an indication that the four independent variables notably price, availability, infrastructure and safety issues were significant in contributing to LPG penetration in Kenyan market. The coefficient of determination indicates that 94.9% of the variation on) LPG penetration in Kenyan market determined by independent variables (X_1) price, (X_2) availability, (X_3) infrastructure and (X_4) safety issues. This implies that there exists a strong positive relationship between independent variables and procurement performance. The remaining 6.1% of the variation on LPG penetration in Kenyan market be explained by other variables not included in the model. This shows that the model has a good fit since the value is above 75%. This concurred with Graham (2002) that (R2) is always between 0 and 100%: 0% indicates that the model explains none of the variability of the response data around its mean and100% indicates that the model explains all the variability of the response data around its mean. In general, the higher the (R2) the better the model fits the data.

Regression Model Summary

Model	R	R Square
1	.855	.783

Predictors: (Constant), X1, X2, X3, X4

The study further used one way Analysis of Variance (ANOVA) in order to test the significance of the overall regression model. Green &Salkind (2003) posits that one way Analysis of Variance helps in determining the significant relationship between the research variables. Table

4.7 hence shows the regression and residual (or error) sums of squares. The variance of the residuals (or errors) is the value of the mean square which is 2.234. The predictors X1, X2, X3 and X4 represent the independent variables notably; (X_1) price, (X_2) availability, (X_3) infrastructure and (X_4) safety issues as the major factors determining LPG penetration in Kenyan market. Table 4.8 presents the results of ANOVA test which reveal that all the independent variables notably; have a significance influence on LPG penetration in Kenyan market. Since the P value is actual 0.00 which is less than 5% level of significance. Table 4.8 also indicates that the high value of F (81.209) with significant level of 0.00 is large enough to conclude that all the independent variables significantly determine procurement performance.

Analysis of Variance (ANOVA)

Model		Sum of Squares	Mean Square	F	P-Value.
1	Regression	8.118	2.234	81.209	.000
	Residual	1.000	.027		
	Total	9.118			

a. Predictors: (Constant), X1, X2, X3, X4
b. Dependent Variable: Y

The regression model below has established that taking all the independent variables into account notably; price, availability, infrastructure and safety constant at Zero influences LPG penetration in Kenyan market (0.446). The results presented also shows that taking all other independent variables at zero, a unit increase in price leads to a 0.086 increase in LPG penetration; a unit increase in availability leads to 0.024 increase in LPG penetration; a unit increase in infrastructure leads to 0.176 increase in LPG penetration and a unit increase in safety issue leads to 0.082 increase in LPG penetration. Inferences can therefore be made that price followed by availability, infrastructure and safety issues determines LPG penetration. These findings echoed findings by Oliveira and Martins (2011) who found out that LPG penetration in many developing nations is greatly determined by price level, availability, infrastructure and safety issues

Multiple Regression Analysis

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig (P-Value).
		B	Std. Error	Beta		
1	(Constant)	.446	.173		2.630	.012
	Price	.086	.021	.209	4.446	.002
	Availability	.024	.015	.084	2.119	.036
	Infrastructure	.176	.019	.452	9.252	.001
	Safety issues	.082	.017	.238	4.376	.003

a. Dependent Variable: **LPG** penetration

Source: Research, 2016

a. Predictors: (Constant), price level, availability, infrastructure and safety issues

b. Dependent Variable: LPG penetration.
From the regression findings, the substitution of the equation ($Y = \beta 0 + \beta 1 X 1 + \beta 2 X 2 + \beta 3 X 3 + \beta 4 X 4$) becomes:

$Y = .446 + .086 X_1 + .024 X2 + .176 X_3 + .082 X_4$

Where Y is the dependent variable (**LPG** penetration) X_1 is price variable, X_2 is availability, X_3 is infrastructure and X_4 is the safety issues.

According to the equation, taking all factors (price, availability, infrastructure and safety issues) constant at zero, LPG penetration was .446.
From the results, price as a component of LPG penetration contributes most to the LPG penetration, which has the greatest t value of 9.252, while availability contributes the least which has the smallest t value of 2.119.

Conclusions
The study concludes that price, availability, infrastructure and safety issues positively affected LPG penetration in Kenyan market.
The study also concludes that there was a good distribution which depicts a fair balance of gender. Since majority of the responses for this study relies on the perceptual measures of the respondents
The study further concludes that majority of respondents (40%) agreed to a little extent that availability of LPG affects its penetration in the market, 25% agreed to a moderate, 20% agreed to great extent while 15% did not agree with the statement
The most important factor was found to be price followed by availability as pointed out by most of the respondents. This was because good price oil products result to effectiveness and efficiency in LPG penetration in the Kenyan market.

The study concludes that Coastal shipping and road transport incur high costs due to lack of space for berthing and lack of access to existing infrastructure due to bad roads.

The study further concludes that respondents agreed to a very great extent (56%) that safety issues affected LPG penetration in the Kenyan market, 29% agreed to a great extent, 13% agreed to moderate extent while 2% agreed to a little extent that Safety issues affected LPG penetration in the Kenyan market.

Recommendations

This study established that price positively affects LPG penetration in the Kenyan market to a large extent. The study recommends that price control should be frequently reviewed so as to improve on the LPG penetration in the Kenyan market.

The study also recommends for safety measure in these distribution channels to a great extent

This will not only help maintain good supply standards but also will help achieve high levels of efficiency and effectiveness.

In addition, to avoid delays in supply and provision of services, the study recommends for improved infrastructure for easy transportation.

Further the study recommends for any stable economic and energy regulation environment, a rapid, transparent and fair decision-making processes are basic principles that have to be put in place so as to encouraged investors for development and capacity building

Recommendation for further study

This study looked at four independent variables (price, availability, infrastructure and safety issues) which according the study contributes to 90.7% of the variations in LPG penetration in the Kenyan market. The researcher recommends further research to investigate the other factors that affect LPG penetration in the Kenyan market. Equally, further research should be carried out in other sectors to ascertain whether these findings are universal.

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