

# **OVERVIEW OF THE EFFECTIVE PETROLEUM PRODUCTS TRANSPORTATION AND DISTRIBUTION SYSTEMS IN NIGERIA**

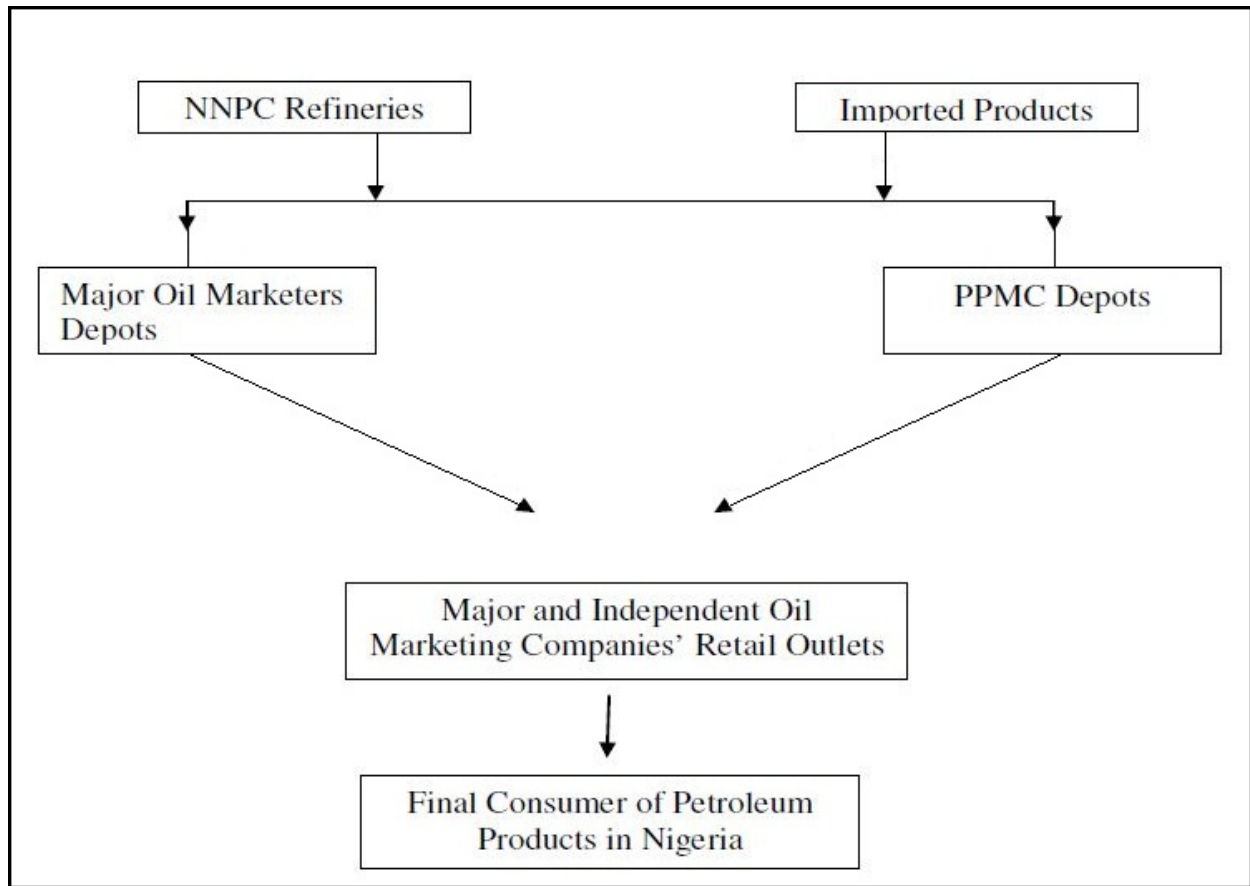
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## **1. INTRODUCTION**

Overview of petroleum products transportation and distribution system in Nigeria is presented. Petroleum products are the different types of fuels processed from crude petroleum which are used for power generation. They are extracted from crude petroleum in processing units by thermal cracking in the refineries. Nigeria through Nigerian National Petroleum Corporation (NNPC) has four functional refineries with total refining capacity of 445000bbl/d of crude oil (NNPC, 2015). These are transported and distributed with the aid of pipelines from processing plants to the loading depot, and by Tankers from the refinery and depot to the filling stations.

The most commonly used here among the fuels are; Premium Motor Spirit (PMS), Automotive Gas Oil (AGO or Diesel), Household Kerosene (HHK), Aviation Turbine Kerosene (ATK or jet-A1), Liquefied petroleum Gas (LPG).

Petroleum products distribution is concerned with the movement of refined petroleum from the refinery to the final consumers across various locations of delivery in the country. In the Nigeria situation, the Pipelines and Products Marketing Company (PPMC) is responsible for the wholesale supply, distribution and marketing of petroleum products in Nigeria.



**Figure 1: The physical flow of products: the retail route used by major and independent companies in Nigeria. Source: NNPC/PPMC Bulletin, 2010.**

Therefore for the distribution and transportation to be effectively carried out, there must be safety in the loading, transportation, delivery, storage and sales stages for the products in the filling station. That means, our watch word should be “safety”. But we need to look at the above measures individually since there are relatively a number of hazards associated with each of them at any stage of the distribution system.

This paper is therefore geared towards achieving effective ways of handling these products right from the loading terminal to the discharge station during the era of scarcity. Loading terminal could be the refinery, depot and/or Jetty in the case of importation.

## **2. SCARCITY**

This is the condition of insufficiency in which case the product is not enough with respect to the number of users. As a result, supply becomes very low and with constraints. Scarcity could be natural or artificial depending on the cause. During this period, either that the plants are not producing in full capacity or that the plants are shut down and the alternative now becomes importation through sea. There is no doubt, during this scarcity situation, the dealers and the users go to any length to make sure they get the products, while the government keeps sleepless nights to make sure they bring the situation back to normalcy. It is true that the above expression is the traditional thing that is supposed to happen, but the fact remains that the parties involved see the situation as an avenue to get quicker, thereby making the masses suffer by paying huge sums to have the products.

As a result, the handling of the product becomes unsafe since the business of distribution has been taken over by untrained persons. Basically, an average Nigerian wants to get rich quick overnight, hence selling of products has turned to be a money spinner in the era of scarcity. As a result, it becomes the booming business of the day once you can face the rigors involved, which include but not limited to touting in one way and cash flow, the other way. You will agree that during this period, very many wrong people jump into the business and so no safety measures are imbibed, quality control of the product is neglected and also the price has no control. This is due to the fact that the only thing that interests every man who is on the business is how much money he makes from the “golden liquid” at the end of the day.

Pipeline and products marketing company (PPMC) is the government agency that is in charge of selling these products to the licensed marketers whether processed here or imported. The marketers load the products from the refinery, depot or from the jetty in the case of importation, and then transport and distribute the products to the stations where the masses can now buy them. This happens in an ideal situation, but what

actually happens during scarcity is rather ridiculous, which is associated with numerous hazards.

During scarcity, right from the refinery, depot and/or jetty, the funny situations commence whereby the scarce product is sold to a typical Nigerian businessman who doesn't even know the difference between one type of fuel and the other. This is to the detriment of the licensed marketers, who must have been waiting with their tankers to reach their turn to load, simply because he adds money on the approved liter price. Once this happens, the pandemonium has started, since the man lifts the product only to transport and dump at the wrong place without any safety measures. At times the only alternative dumping place if he has no underground tanks is an abandoned filling station whose tanks have not been calibrated for a long time, thereby creating the hazard of leakages and possible fire outbreaks. Whether it is licensed dealer that lifts the products at a price different from the approved price, and even though he dumps at a perfectly functioning filling station, the price at which he sells to the buyers will still be higher than the approved price.

### **3. CALIBRATION**

This is gauging the storage tanks and the lifting tankers based on the original construction specification to ascertain the actual quantity of product pumped into them and/or to know when they are due for replacement or re-enforcement due to wear and tear. Calibration is also used to rectify confirmation of the original graduation of the tanks and to mark out the scale of the tanks or any measuring instrument so that the content can be measured.

We are going to look at the transportation and distribution of these products together with the dangers associated with them from the point of loading to the discharge station. Taking PMS as an example, we consider the right facilities and people involved for the achievement of efficiency and effectiveness during the period of scarcity. Also we look at the possible sources of error and ways of preventing and correcting their occurrences as regards to the effective transportation and distribution of the product.

#### **4. QUALITY CONTROL AND ASSURANCE**

According to Agbola (1987), one of the tasks performed by the Petroleum Inspectorate is monitoring of Quality of Products in the oil Industry. This task spans the entire spectrum of the industry from Crude Production through the process plants down to storage depots Petrol Filling Stations. It is of great importance to maintain the quality of products throughout various phases of the distribution network from the Refinery to consumers. The Refineries manufacture Petroleum Products to specification standards approved by the Standard Organization of Nigeria. The Oil marketing companies also have established procedures for handling various grades of Petroleum Products to prevent contamination with other grades, water or sediments. The petroleum Inspectorate therefore monitors the operations of the Refineries to ensure that products manufactured meet specification standards and are accurately accounted for through joint participation in all stock taking exercise.

The petroleum Inspectorate also monitors shipment of these products by Sea, Rail, Road and network of Pipeline to bulk Storage Deposits. The activities of the oil marketing companies are monitored to ensure correct volume of products are sold at approve prices and that products sold meet specification standards.

#### **5. LOADING TERMINAL**

This is the point at which the processed product is lifted with tanker for discharge at the filling station. In the first place, the government ought to constitute a task force (if this is not already in place) to include trained security personnel, experienced products handlers, safety officers, and health officers to work from the loading terminal to the filling station. The task force shall inspect the tankers to give approval for their lifting of products by issuing them nomination certificate with which the dealers go to the loading terminal for lifting products. Prior to the issuing of the nomination certificate, the tankers must have undergone recent calibration. For the right product requested to be delivered, the task force shall test the product before loading and make sure that a bill of quantity and quality is issued to the dealer to avoid illegal price increase, adulteration, and

preventing dealers from lifting toxic product that is dangerous to health. They also make sure that the PPMC officials work with consumption statistics to enable them ascertain the quantity to be allocated to a particular direction based on the consumption rate. There are six petroleum exportation terminals in the country. Shell owns two, while Mobil, Chevron, Texaco, and Agip own one each. Shell also owns the Forcados Terminal, which is capable of storing 13 million barrels (2,100,000 m<sup>3</sup>) of crude oil in conjunction with the nearby Bonny Terminal. Mobil operates primarily out of the Qua Iboe Terminal in Akwa Ibom State, while Chevron owns the Escravos Terminal located in Delta State and has a storage capacity of 3.6 million barrels (570,000 m<sup>3</sup>). Agip operates the Brass Terminal in Brass, a town 113 km southwest of Port Harcourt and has a storage capacity of 3,558,000 barrels (565,700 m<sup>3</sup>). Texaco operates the Pennington Terminal (Nigeria Business Info, 2015). A terminal is pictured in Fig 2 below.



**Fig 2: An oil terminal (Wikimedia, 2015)**

## **6. TRANSPORTATION**



After loading, security personnel in the task force shall escort the tanker out of the loading terminal to some kilometers away from the point of lifting. This is to avoid the act of re-selling which is practiced by the dealers in collaboration with the touts. During the trip, the tanker stops at designated points for routine check/inspection by the field personnel (members of the task force), who are stationed at strategic positions to avoid diversion of the product. A schematic of an offshore oil shipping vessel is shown in Fig 3.



**Fig 3: Oil shipping vessel (Wikimedia, 2015)**

## **7. FILLING STATION**

This is the right place for the discharging of the product by the tanker into the underground tanks. The task force is to ensure that the product is sold to the users at the right time and at the approved price per liter. They are to make sure that the pump attendants do not collect bribes from some impatient buyers who would want to jump the queue. Selling of the product in jerry-cans shall be avoided, (except in 4-liter containers for use in generators), in order to check hoarding and road side marketeering. To ensure smoothness, each of the pumps at any particular point in time shall play host to the attendant, a single buyer, and a task force personnel. All customers must remain in their cars, although they could be allowed to stand beside the cars. This helps to check the congestion around the pump by desperate buyers and

touts that that always results to confusion and exchange of words and sometimes fighting. The product sample from the tanks with known quality and quantity is re-examined on a daily basis to ensure that the quality remains constant, since some dealers indulge in product adulteration during the night. Also a record of the sold quantity before the close of the business for the day must be compared with the certified remaining quantity in order to check the selling of products in drums at nights. This operation is carried out by members of the task force posted to the filling station, who also ensure that the dealer continues selling the product until it finishes to check the situation whereby there will be products in the tanks but the dealers go on to deceive motorists by hanging a big sign post stating “NO FUEL”. A picture of a filling station is as shown in Figure 4 below.



**Fig 4: A picture of a filling station (Unigas, 2015)**

## **8. SAFETY FACILITIES**

These are the built-in gadgets that help to ensure smooth & efficient selling operation. They include safety gadgets, security and health gadgets. It shall be the duty of the combined team of the task force and PPMC officials to carry out inspection of the newly constructed filling station and to give approval before any product is discharged into the tanks of the filling station. This will go a long way to ensure that the safety, health, security and communication facilities are functioning effectively. Telephone, portable fire



extinguishers and fire buckets as well as complete first aid kits are indispensable facilities in a filling station. For a station to get approval to store products, the pump meters and tanks shall be calibrated and proved at specified intervals of time. This helps to know when the pump meters start giving error and also to know when the tanks and pumps are due for replacement.

## **9. ENVIRONMENTAL ISSUES**

According to Williams (2012), transportation pipelines have been constructed for many decades and there is a great deal of information on how to mitigate their standard environmental effects, such as those on fish habitat associated with river crossings. For example, pipeline routes can be changed to avoid vulnerable areas; project design and construction can be specific to circumstances (such as trenchless river crossings); and habitat can be compensated for, if necessary. However, assessing the cumulative impacts of multiple aspects of a project that may occur in a single ecological unit (such as multiple crossings throughout a river basin) is more difficult. As a result, the necessary mitigation efforts are less well understood.

The environmental impact of shipping includes greenhouse gas emissions, acoustic, and oil pollution. The International Maritime Organization (IMO) estimates that Carbon dioxide emissions from shipping were equal to 2.7% of the global human-made emissions in 2007 and expects them to rise by as much as 2 to 3 times by 2050 if no action is taken (IMO, 2009). Ballast water discharges by ships can have a negative impact on the marine environment. Cruise ships, large tankers, and bulk cargo carriers use a huge amount of ballast water, which is often taken on in the coastal waters in one region after ships discharge wastewater or unload cargo, and discharged at the next port of call, wherever more cargo is loaded. Ballast water discharge typically contains a variety of biological materials, including plants, animals, viruses, and bacteria. These materials often include non-native, nuisance, invasive, exotic species that can cause extensive ecological and economic damage to aquatic ecosystems along with serious human health problems. Noise pollution caused by shipping and other human

enterprises has increased in recent history (The Hindu, 2010). The noise produced by ships can travel long distances, and marine species who may rely on sound for their orientation, communication, and feeding, can be harmed by this sound pollution (Simpson et al, 2010). Marine mammals, such a whales and manatees, risk being struck by ships, causing injury and death. For example, if a ship is traveling at a speed of only 15 knots, there is a 79 percent chance of a collision being lethal to a whale (Vanderlaan et al, 2007). One notable example of the impact of ship collisions is the endangered North Atlantic right whale, of which 400 or less remain. The greatest danger to the North Atlantic right whale is injury sustained from ship strikes. Between 1970 and 1999, 35.5 percent of recorded deaths were attributed to collisions (Ward-Geiger et al, 2005). During 1999 to 2003, incidents of mortality and serious injury attributed to ship strikes averaged one per year. In 2004 to 2006, that number increased to 2.6. Deaths from collisions has become an extinction threat (Reilly et al, 2008). Exhaust gases from ships are considered to be a significant source of air pollution, both for conventional pollutants and greenhouse gases.

## **10. ALTERNATIVE FUELS**

The alternative fuel shall be provided for each of the fuel types since all the fuels may not necessarily be scarce at the same time. This enables the users to switch over to the more available fuel even though it may be more expensive. This will reduce the rush to get the usual but scarce product. For example the compressed natural gas which has been confirmed to be an alternative to PMS and AGO for vehicles can be utilized. Furthermore, it is even cheaper.

## **11. PAYMENT**

This includes the payment for the product by the dealers before lifting from the loading terminal and also the payment for the served quantity by the vehicle owners at the filling the station. Both the dealers and the buyers are faced with the hazard of robbery attacks due to the fact the loading terminals, as well as the filling station are usually congested by hoodlums and touts who pretend to be there for business. As a result, it

becomes difficult to identify the genuine customers both at the depot and at the service stations.

All the parties involved must be ready to accept security payments like bank cheques, smart cards, credit cards, traveler's cheques and other computerized means of payment. This makes it easier and more convenient for the dealers and also the buyers and thereby preventing the act of carrying cash which attracts the robbers.

## **12. CONCLUSION**

Finally, the discussion is not complete without mentioning the human factor. The aforementioned measures are only possible when the human factor has been taken care of and in a strict manner.

Legal punishment must be given apart from dismissal, to any corrupt personnel from PPMC, Task force, tanker drivers, dealers and pump attendants who go contrary to the assigned duty.

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## **NOMENCLATURE**

AGO = Automotive Gas Oil

ATK = Aviation Turbine Kerosene

Bbl/d = barrel per day

HHK = Household Kerosene

LPG = Liquefied Petroleum Gas

m<sup>3</sup> = cubic metre



NNPC = Nigerian National Petroleum Corporation

PMS = Premium Motor Spirit

PPMC = Pipelines and Products Marketing Company