

The Advent of Modular Refineries in Nigeria

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Abstract

The advent of modular refineries is not something new to the world even in Nigeria, as modular refinery operations in Nigeria can be traceable to the period before the Nigeria Civil war. However, modular refineries in Nigeria become more evident from the period of the civil war, as this period in Nigeria witnessed the refining of crude oil in Eastern Nigeria with specific reference to Igboland, the region of the country that was under serious bombardment from the Nigerian Army yet she was able to continue with the crude oil refining process and make adequate fuel available for the movement of her armory. After this period, modular refineries or activities can further be said to decline because the country at that time was focused on realignment, reconciliation and rehabilitation drive. Then came the Niger-delta militant uprising & again the concept of modular refineries were resurrected again and this time it was not born out of the necessity for wining the Nigeria civil war but it was born out of a perceived marginalization that Niger Delta people felt that they were not getting from the federal government. Though several attempt has made by the government, invariably it has become obvious that the modular refinery conceptions have come to stay in as far as the Nigerian oil and gas sector is concerned. This study attempt to look at the general business of modular refining in Nigeria and its concerns, with a view to examine and ex-ray possible solutions for the Nigeria population in relation to oil crisis.

Keywords: Modular Refinery, Govt Policies, Oil Crisis.

Introduction

Nigeria has been one of the world's leading importers of refined petroleum products for over two decades now. This unenviable position has earned the nation a very bad image among the Organization of Petroleum Exporting Countries, Alike (2015). It is very clear that the absence of functional refineries has multiple negative effects on the nation's economy. It is a big strain on foreign reserves in particular and the economy in general. In spite of the four petroleum refineries owned and operated by the Nigerian Federal government in Kaduna, Warri and Port Harcourt, (two in Port Harcourt (PHRC), and one each in Kaduna (KRPC) and Warri (WRPC)), the nation surprisingly still depends on importation of close to 90% of her requirement of petroleum products Atojoko (2015). The refineries have a combined installed capacity of 445,000 bpd with combined installed capacity of the two refineries of PHRC having the highest of 210,000 bpsd Huffington (2015).

Over the last four decades, Nigeria has consistently struggled to keep its refineries functioning optimally. How Nigeria can get out of the problem of importing refined products and become an exporting country of refined petroleum products expected of a big crude oil producer through the establishment of private refineries is the theme of this write-up. It is crystal clear that involving the private sector participation in the petroleum refining aspect of the important energy sector of the nation's economy will essentially solve the current problems of available and refined crude oil products for domestic consumption and perhaps for export, Igwe (2015). The present scenario whereby one of the world's leading exporter of crude oil is importing premium motor spirit (petrol) is unacceptable. Obviously, the development of private refineries will be the solution to this monster-headed problem. Undoubtedly, operating functional refineries in the country would not

only increase the supply of the following refined petroleum products: Automotive Gas Oil (AGO), Base oil, Bitumen, High Pour Flow Oil (HPFO), Liquidified Petroleum Gas (LPG), Polypropylene, and Premium Motor Spirit (PMS) to the domestic marketers but would also guarantee supplies to neighboring Economic Community of West African States (ECOWAS). It will create employment for the teeming unemployed youths and bring to an end a fast-encroaching poverty and hunger, Izeze (2015). It is when somebody is employed, he will be able to patronize the banks, supermarkets, buy a car, send children to school among others to halt the chain of poverty line. Additionally, the huge financial cost to the nation in terms of freight charges, storage and demurrage incurred on late delivery of petroleum products cannot be overemphasized Lukman (2010). The design, construction and commissioning of functional private refineries in different locations of Nigeria would bring to an end the petroleum subsidy fund (PSF), price equalization, bridging cost and other subsidies paid by the government to help oil marketers to import, store and distribute petrol under a regulated economic system NNPC (2014).

THE HISTORY OF MODULAR REFINERIES IN NIGERIA

The concept modular refinery is not a practice that is relatively new. Although they were earlier used in the early forties, this concept later re-surfaced in the seventies when there were needs to solve problems associated with the conventional refinery, Ogedengbe (2009). A modular refinery is a conventional refinery constructed in a fragmented way or simply a big refinery in miniature form. Globally this concept is applied successfully when crude oil and a ready market are available but low refining capacity is recorded. Further research shows that it can also be used when there is a need to reduce the transportation cost associated with the movement of crude oil from the field to refineries located in remote areas

OPEC (2012). It also gives the option of setting up a refinery which can easily be hidden or taken down if the need arises. He was the first to develop a one skid (12 feet wide, 45 feet long and 11 feet high) portable crude topping unit for the production of straight run gasoline, diesel oil and heavy fuel residue. His intent was to put the plant into operation a day after arriving to its new location without the need of crane, concrete foundation or external power supply. The plant then had the ability to provide sufficient heat in an economic manner. He constructed an adjusting mechanism to overcome height limitation during transportation mode. Jack stands were also constructed at the bottom of the skids to help in moving the skids from one place to another. The idea of a modular topping unit on one skid with a jack stands was later phased out since cranes were currently available at most sites. There was also no need to crowd equipment on one skid; multiple skids were employed to provide for more room. These modules which come in different sizes and capacities can be horizontal, vertical, single level or multi-level depending on the available plot space. They are always designed, fabricated and tested in a controlled shop environment before being transported to the project site for installation. They are either installed independently to create a small remote refinery or linked together in a cascading format to create a larger refining operation, PPRA (2010). Over the years, they have become an effective solution for building refinery or gas processing facilities in remote places or offshore platforms where there is access to crude oil but low refining capacity.

According to Cenam Energy Partners (2014) a modular refinery is a refinery whose parts or equipment are constructed in modules designed to be easily transported quickly and easily anywhere in the world and comes in a variety of sizes with capacities that range from 500 to 30,000 barrels per day. They are thus considered to be mini refineries. Modular topping plants or Crude Distillation

Units (CDUs) are the simplest and economical way to extract valuable fuels from crude oil. A topping plant can be up and running within fourteen months of contract execution, giving host communities access to valuable fuels for vehicles, power generation, water treatment, and opportunities for jobs.

Differences Between Conventional and Modular Refineries

Comparing factors	Modular Refinery	Conventional Refinery
Production capacity	4,000 to 50,000 bpd	Above 120,000 bpd
Construction period	12 to 18 months	2-5 years
Operational flexibility	Flexible to meet demand changes	Complex
Production expectation	Unleaded Gasoline, Diesel, Kerosene and Fuel Oil	Unleaded Gasoline, Diesel, Kerosene, and Fuel Oil, Lubricating oil, waxes and asphalt (Caters for all range of products)
Construction process	Parts or equipment are constructed in modules designed to be transported quickly and easily anywhere in the world	Constructed on site
Operational efficiency	Good	Better
Land size	Limited refinery project	Maximum land take

	land space	
Cost of installation	Low installation cost	High cost of installation
Return on Investment	Quicker investment recovery	Longer period

THE IMPORTANCE OF MODULAR REFINERIES IN NIGERIA

In Nigeria, setting up modular refineries at strategic locations within the country will help in the following areas:

- Supporting the low performance of the existing refinery. A modular refinery will help to rapidly meet local demand with relatively low capital cost
- Eradicate the shortage of petroleum products across the country
- Drastically help to minimize our reliance on imported petroleum products
- Totally remove the need for subsidy
- Encourage private investors since start-up capital is low compared to a conventional refinery
- Remove the factor of vandalization as pipelines will not be laid across a wide area
- Ensure optimal use of our resource which has a multiplier effect on the economy

THE ECONOMIC IMPORTANCE OF MODULAR REFINERIES IN NIGERIA

Modular refinery which is ideal for stranded production fields and remote locations could be sited in the riverine areas where accessibility to the petroleum products at present seems to be very difficult due to logistics, Ubah (2010). This will

opportune the dwellers in such areas to purchase the products at cheaper price than what is obtainable there at present. Since modular refinery can be put together within a short time span of about 15 to 20 months for modular refinery of 20,000bpsd, it will be easy to establish as many as possible through different investors within short period of time at different locations. This will remove the need for expensive transportation of crude oil through pipeline covering long distance which may be susceptible to vandalization as it has been experienced severally in the country. Furthermore, establishment of many modular refineries in Nigeria will bring about rapid production of feedstocks for downstream petrochemical plants Hogan (1974). Its key advantage lies in its size, cost differential and flexibility. It is constructed in a controlled environment and properly tested before being shipped out. It is relatively easier to fabricate and erect. Also, when an area becomes unsuitable for business, it can be disassembled and reassembled in a more suitable environment. For areas with non-cohesive geopolitics like Nigeria, modular plants can be scattered throughout the country to each serve the needs of the various regions of the country. The maintenance cost is low; considering that it processes 2,000 to 15000 BPD of mainly light sweet crude, routine turn around maintenance and on-stream inspections would require less personnel and down time. Modular plants are easier to secure because of the reduced surface area and perimeter; issues of internal monitoring of equipment and external acts of sabotage can be better policed given the smaller area of operation, and in a situation where one plant suffers an incident, the other smaller plants scattered all over the country can still be operational. The impact on the environment is nothing compared to a large-scale refinery, Brown (2003). Environmental pollution and regulation can best be controlled with small scale plants in countries that may not have the industrial ethics to manage the huge amount of pollution prevalent with large-scale refining. While a full conversion

plant can cost anywhere from 2 to 9 billion dollars, the same amount can be used to spread the risk potential and build various modular plants all over the country to cater to the needs of each geopolitical zone, Mamudu (2016). Finally, while it may take several years to build a large refinery, modular plants can be put to service in a matter of months, and only cost about 250 million dollars.

Several other economic importance of modular refineries to Nigeria are:

- Rapid production of primary fuels (for consumption) and raw materials or feed (for the petrochemical industries)
- Greater process flexibility (Refining units may operate independently or likewise be interconnected in combination as determined by the processing needs).
- Limited refinery project land space
- Low or minimal installation cost (using skid-mounted during construction)
- Quicker investment recovery vii. Two operators can restart the plant from a cold start and have the plant in full operation in a matter of hours.
- Completely automated and once an operator sets all the controlling points, all product temperatures and flows can be controlled automatically.
- Only a flat support area or concrete slab without anchor bolts is required to support the plant.
- Fuel supply can be natural gas, naphtha, diesel, fuel oil or a combination of these fuels.

THE MAJOR BENEFICIARIES OF MODULAR REFINERIES IN NIGERIA

Recent attempts made in driving the growth of refineries through private investment notwithstanding, Nigeria still has a long way to go in establishing

refineries that are capable of producing at full potentials. Quite commendably, there have been some efforts in recent years to upgrade existing refineries. One commendable step taken in the right direction is the issuance of twenty-five (25) refining licenses (conventional and modular) to indigenous companies. These initiatives, if executed rigorously, will drive growth and reforms within the sector in the medium to long term, Duncan (1991). By estimation, the combined capacity of the 25 candidate refineries stands at approximately 1.6 million bpd. Three (3) of the licensed companies are billed to construct conventional stick-build plants with capacity estimated at over 850,000 bpd, while 22 licenses are to construct modular units estimated at about 700,000 bpd in combined capacity.

Modular Refineries are ideally suited for remote locations and are viable for investments by Public-Private Partnership (PPP) as a source of rapid production of primary fuel products and raw materials for Petrochemical Downstream Industries. Hence the locality is at easy with the availability of the product at their reach, Ikenna (2016).

Establishing a crude oil refinery requires approval from the Department of Petroleum Resources (DPR) in Nigeria. Investors may need to apply for oil block allocation or partner with government at different level on a PPP basis to guarantee investment and feedstock for the production plant hence both parties also benefit from the business.

Conclusion:

As it is a well known fact that Nigeria is major player in the energy sector of the world from her membership in the OPEC association, but this major player position is not adequately felt within its shores, as citizens from time to time are thrown into a struggle for petroleum products despite the persistent increase of fuel prices by the Nigerian government, almost on a yearly basis. This trend which has beguiled Nigeria must be corrected through a more elaborate systematic approach by the government, its agencies and her collective citizenry through some of the recommendations highlighted below.

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