"OIL AND GAS:- LIQUEFIED PEROLEUM GAS (LPG) BUSINESS AND ITS PROSPECTS IN NIGERIA".

PRESENTATION

BY

ENGR OSUALA

On behalf of

THE PLEROMA HAVEN CHAPTER,

"ADVANTAGE – SERIES 2"

INSTITUTE FOR GOVERNMENT RESEARCH & LEADERSHIP TECHNOLOGY
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LPG MARKETS: BUSINESS AND PROSPECTS

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INTRODUCTION

Nigeria with a population of 180 million people has a potentially huge LPG market estimated at between 700,000 – 1,500,000per year.

Challenged by policy, infrastructure and market developmental issues. It remains only a potential at less than 1,000,000tons per year.

This segment of the course highlights the

- Market opportunities
- Market challenges
- Developmental issues along the value chain.

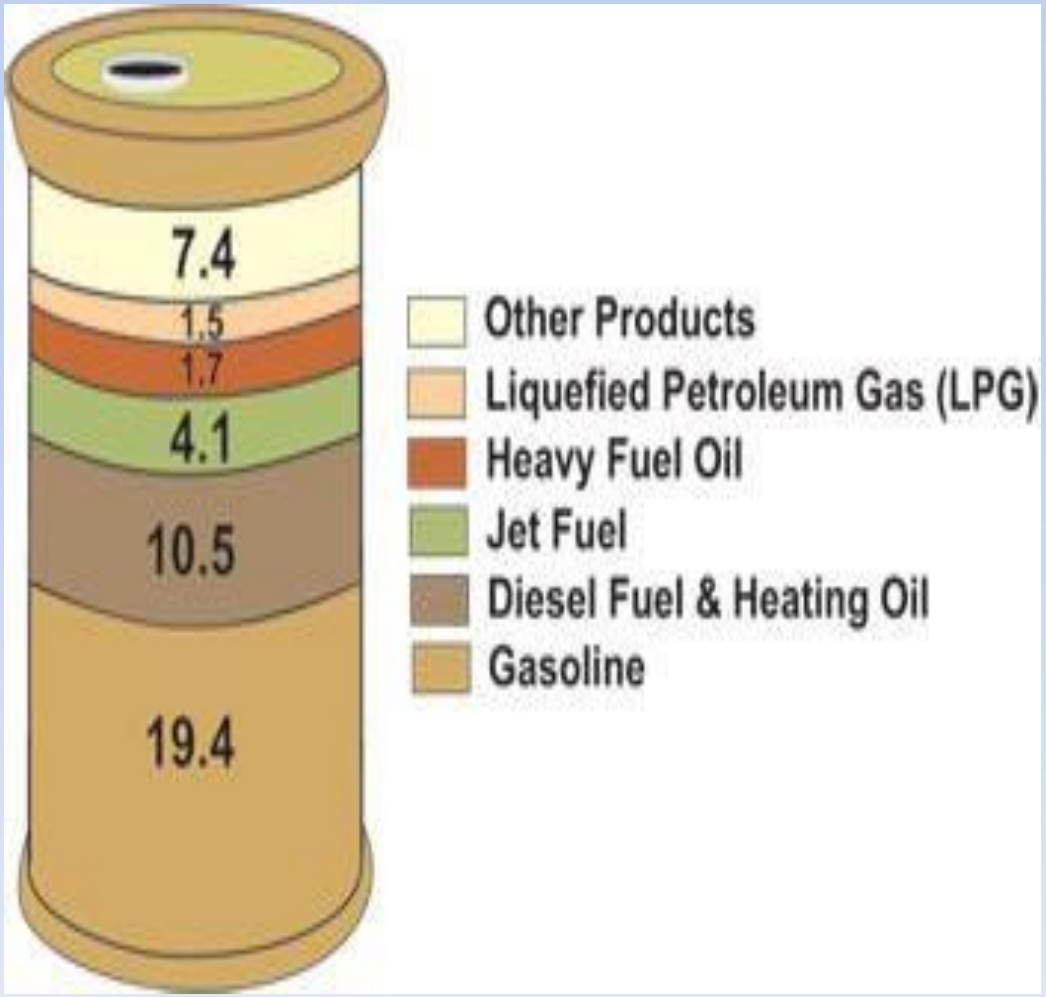
INTRODUCTION

It is expected at the end of it:

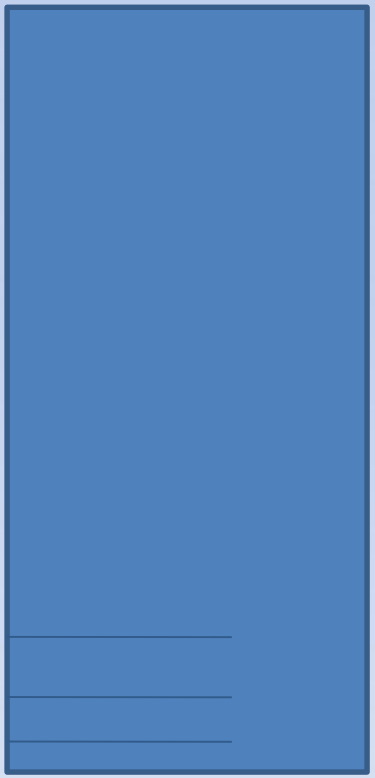
- Understand LPG as a product
- Its Sources and Structure
- Understand the LPG value chain the challenges and opportunities along the value chain
- Understand the impact of Policy and Price on Supplies
- Understand LPG business and the opportunities along the value chain

SOURCES OF LPG

- Crude process



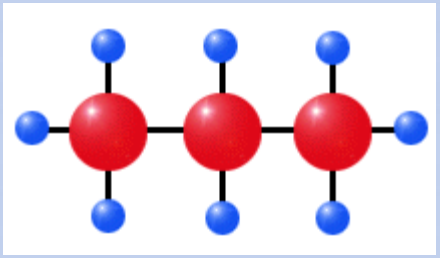
- NG process



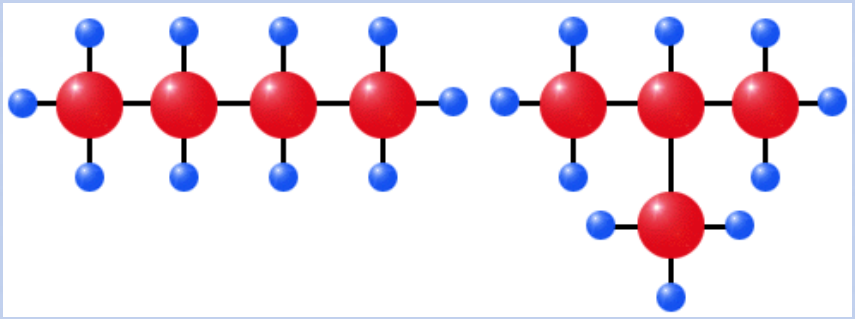
90% CH4
& C2H6

5% C3H8
3% C4H10
2% C5+

ORGANIC STRUCTURE OF LPG



Propane(C3H8)



Butane (C4H10)

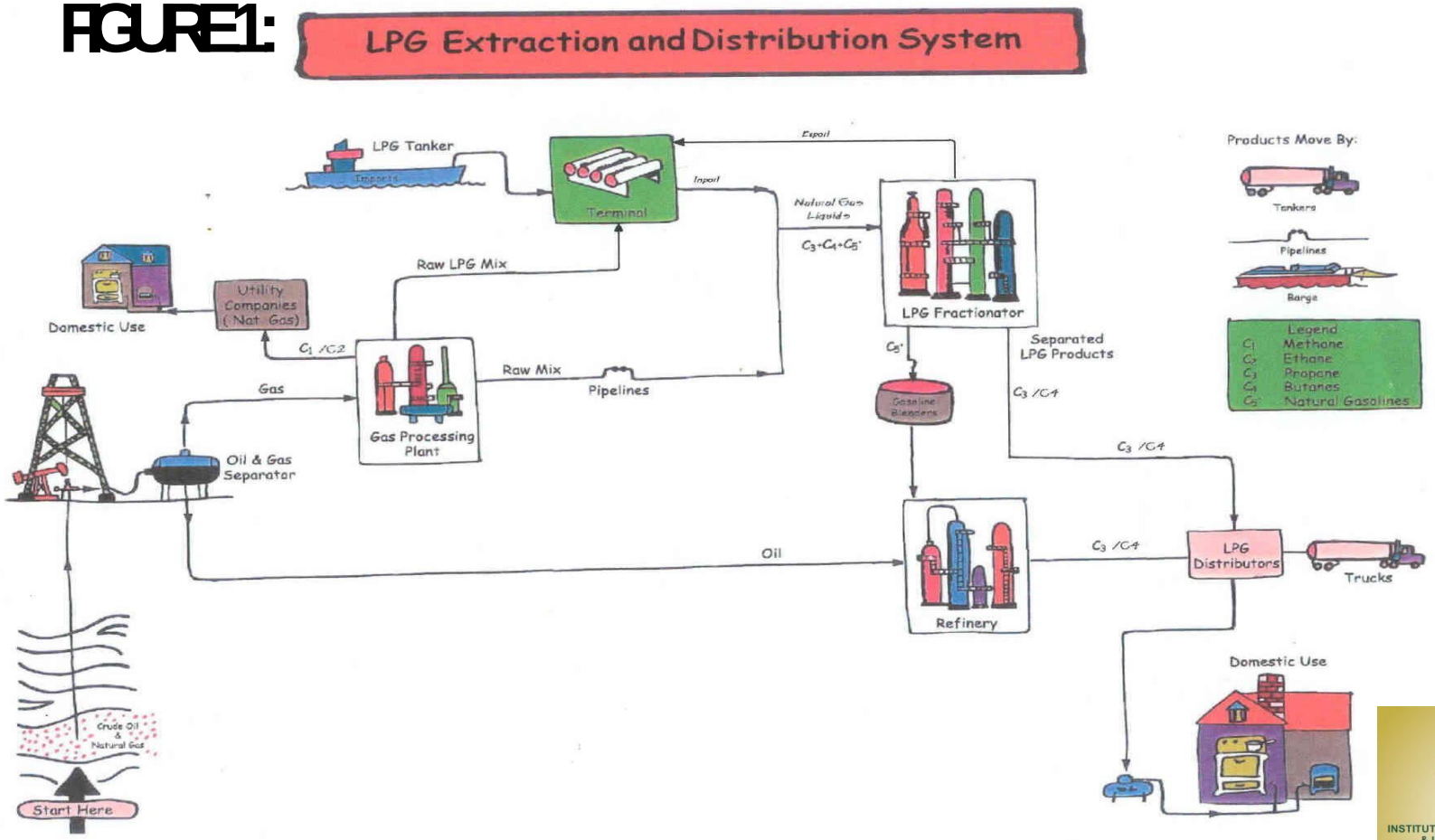
- LPG is a mixture of propane and butane

TYPICAL PROPERTIES OF COMMERCIAL LPG

	Commercial Butane	Commercial Propane
Relative density of liquid at 15 ƒC	0,57 to 0,58	0,50 to 0,51
Imperial gallons/ton at 15 ƒC	385 to 393	439 to 448
Litre/tonne at 15 ƒC	1 723 to 1 760	1 965 to 2 019
Relative density of gas compared with air at 15 ƒC and 1 013,25 mbar	1,90 to 2,10	1,40 to 1,55
Boiling point at atmospheric pressure ƒC approx.	-2	-45
Specific heat of liquid at 15 ƒC (kJ/kg ƒC)	2,386	2,512
Sulphur content per cent weight	Negligible to 0,02	Negligible to 0,02
Calorific Values: Gross:		
(MJ/m3) dry	121,8	93,1
(MJ/kg)	49,3	50,0
Air required for combustion (m3 to burn 1 m3 of gas)	30	24

LPG EXTRACTION AND DISTRIBUTION SYSTEM

FIGURE1:



APPLICATIONS

- **IN THE HOME:**
- **Space-heating**
- **Central heating**
- **Air-conditioning**
- **Hot-water supply**
  BarbequesCooking
- **Patio Heaters**

- **AT WORK**
- **Gas and chemicals**
- **Ferrous and non-ferrous metals**
- **Engineering equipment and ships**
- **Heavy clay and ceramics Glass**
- **Food and drink**
- **Mechanical handling equipment (FLTs)**
- **Textiles, leather and clothing**
- **Paper and print**

- **OTHR APPLIATIONS**
- **On building and civil engineering sites**
- **In agriculture and the rural economy**
- **For heating and cooking in caravans and boats**
- **As a fuel for internal combustion engines including those for generators/pumps**

NIGERIAN LPG MARKET

HISTORY OF LPG CONSUMTION IN NIGERIA

Nigeria produced 12% of LPG consumed in the Sub-Saharan Africa but accounted for the consumption of only 1% in the West Africa region

In the late 80s and 90s, LPG consumption in Nigeria grew rapidly from 34,000 metric tonnes to 129,000 tonnes.

Subsequent years, LPG consumption declined by an average rate of 13% per annum reaching a trough of 43,000 metric tons in 2001.

Nigeria with a population of over 150 million consumed only 120,000MT of LPG in 2010 compared to Senegal, with a population of 10.2 million that consumes an average of 134,000 metric tons of LPG annually

This implies that Nigeria has the potential to consume over 2,000,000MT annually if adequate infrastructure and incentives (e.g. **subsidy on LPG equipments**) are put in place all through the LPG Value Chain

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LPG CONSUMPTION IN NIGERIA

The Consumption of Liquefied Petroleum Gas (Cooking Gas) reached 500,000 Metric Tonnes in 2016, according to Dapo Adesina, Chairman of the Nigeria Liquefied Natural Gas Association.

It was the first year in which the Nigerian Liquefied Natural Gas (NLNG), which has been the main supplier of the Fuel since 2004, broke even on the Project.

The Company(NLNG) provided 350,000 Metric Tonnes, or 70% of the Consumption, in 2016. Other suppliers included NNPC refineries, but the consumption is far short of the World Bank estimated potentials for the country which, as far back as 2004, was 3.2 Millions Tonnes Per Annum.

The NLNG Intervention, which started with 70,000 Metric Tonnes Per year allocation, thus guaranteed some security of Supply, which led to increase demand from what was clearly a low base.

By 2012, the Company had increased its allocation to 150,000 Metric Tonnes.It increased to 250,000 Metric Tonnes in 2013 due to growing demand.

LPG MARKET IN NIGERIA

- PAST HIGHEST 120,000Mt
- CURRENT 400,000-500,000Mt
- \+ POTENTIAL 1,500,000Mt

We come to learn the following:

Household use about 12.5 kg per month

1 in 2 Household keep an average of one cylinder as a back up

Distributors keep about 14 days stock in shops.

This constitute the cylinder capacity and Culture of the operators.

This implies:

700,000 of 12.5kg cylinders at END USER LEVEL
300,000 of 12.5Kg Cylinders at DISTRIBUTORS LEVEL
1,000,000 TOTAL

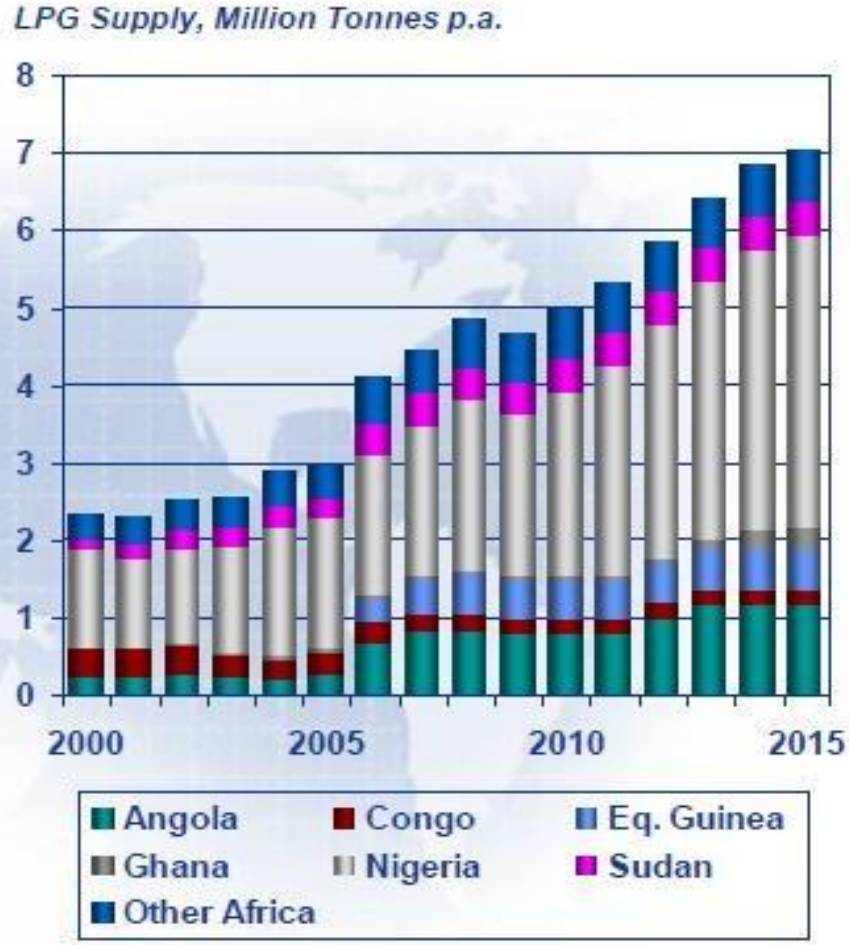
To grow from 400,000Mt per annum to 1,500,000 Mt we need about 12,000,000 units of cylinders.

Though the usage of lpg has increased about 36% in few years, but More than 80% of the house hold still uses kerosine and firewood

HIGHEST LPG PRODUCERS IN SUB-SAHARA AFRICA BY COUNTRY

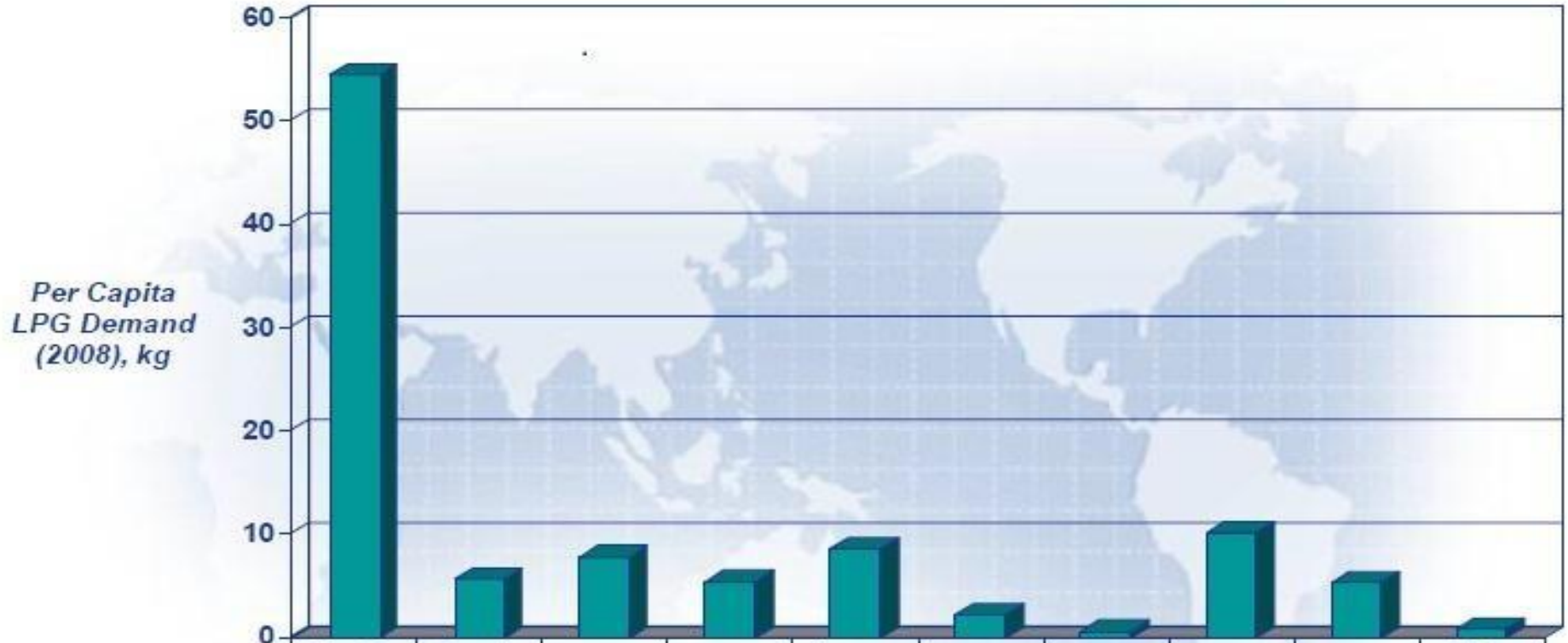
Sub-Sahara LPG Supply Is Dominated By West Africa . . . . .

- West African LPG supply is 87% of the region's total – this share is expected to rise to more than 90% in 2015
  - Nigeria and Angola are the main producers (79% in 2009) although most is exported
- Equatorial Guinea became an LPG producer with start-up of the Bioko Island LNG plant in 2006/2007
- New production is expected in the region from 2012/2013
  - Ghana - onshore processing of deep water offshore Jubilee associated gas
  - Angola – start-up of the Angola LNG project



LPG CONSUMPTION I N SUB-SAHARAN AFRICA

Per Capita Demand Is Low In Most Sub-Sahara African Countries . . . . .



	North Africa	South Africa	Angola	Ghana	Ivory Coast	Kenya	Nigeria	Senegal	Sudan	Other Africa
Per Capita Demand	54.5	5.7	7.8	5.4	8.6	2.2	1.1	10.1	5.3	0.8

LPG MARKET

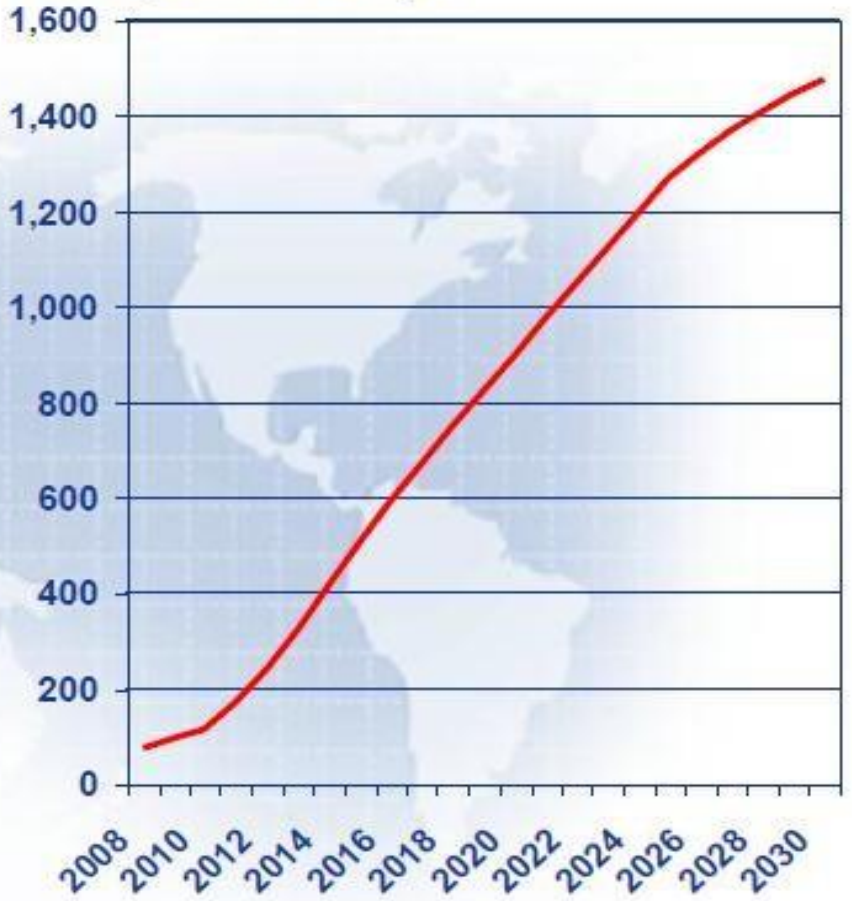
- Government's aspiration is to bring national consumption to that of Angola fellow oil producing neighbour per capital average of 7.8kg/person.
- With a population of about 180million this translates to:
  - Minimum Production requirement of 1,500,000 Mt per annum

LPG MARKET

. . . . But Demand Growth Could Be Rapid . . . . .

- Nigeria's LPG market faces (or has faced) many barriers that include:
  - Unstable LPG supply
  - Kerosene subsidies
  - Low income households
  - Consumer concerns over product use and safety
- Removal of these barriers could result in significant demand growth
  - 2030 demand = 1.5 million tonnes or 6.8 kg per capita consumption
  - ~20% market penetration
- In order to realise this potential considerable incremental investment would be required in the LPG value chain
  - ~ 12 million cylinders
  - ~ 9 million consuming appliances
  - More than 1,000 road tankers

Forecast Nigerian LPG Demand Potential, Million Tonnes p.a.



GAS VALUE CHAIN

AGENCIES

NNPC/PPPR
AAAA

Customs &
Exercise

VAT
NAVY
NPA
DPR

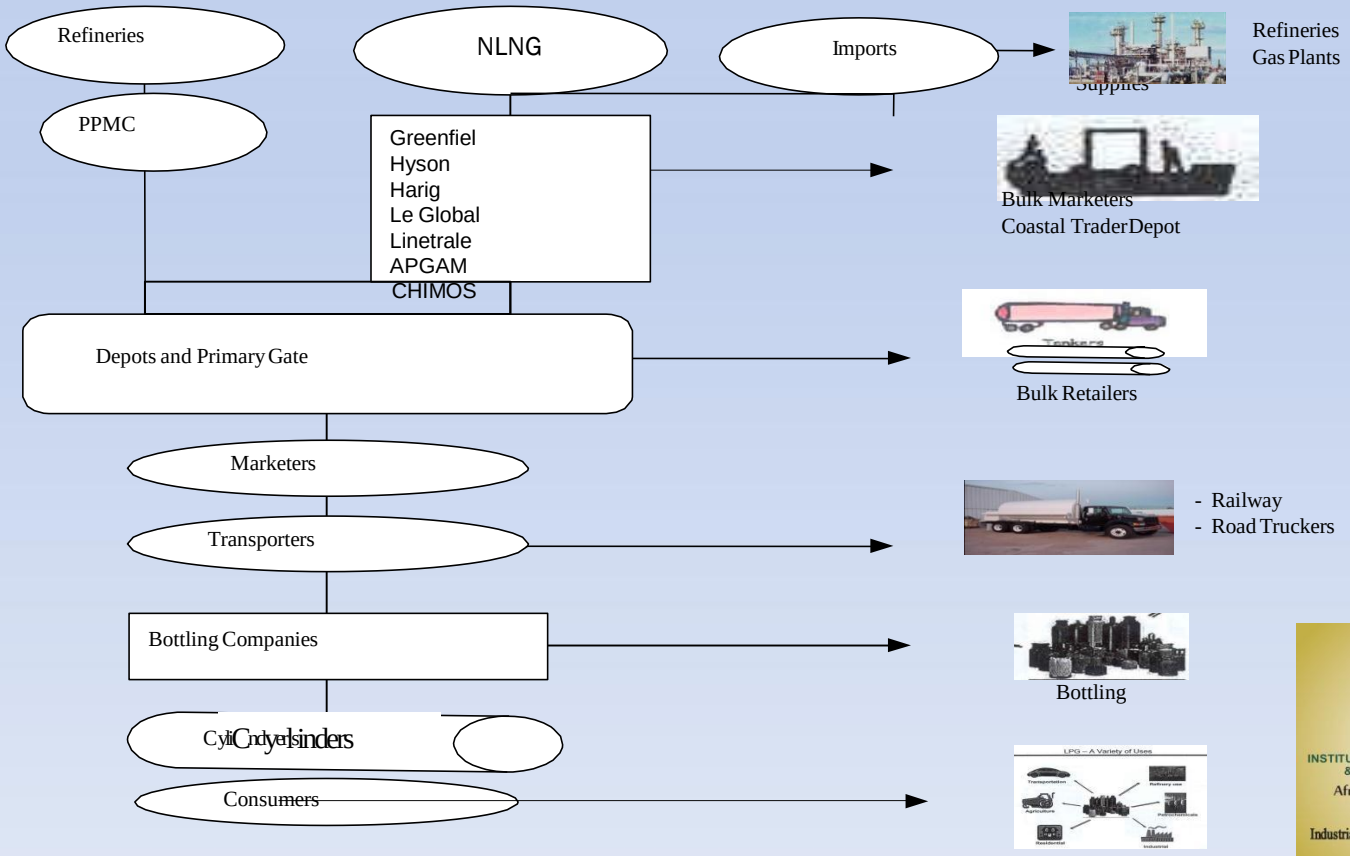
NUPENG

TOTAL, AP,
OANDO, NIDOGAS

NUPENG

NUPENG

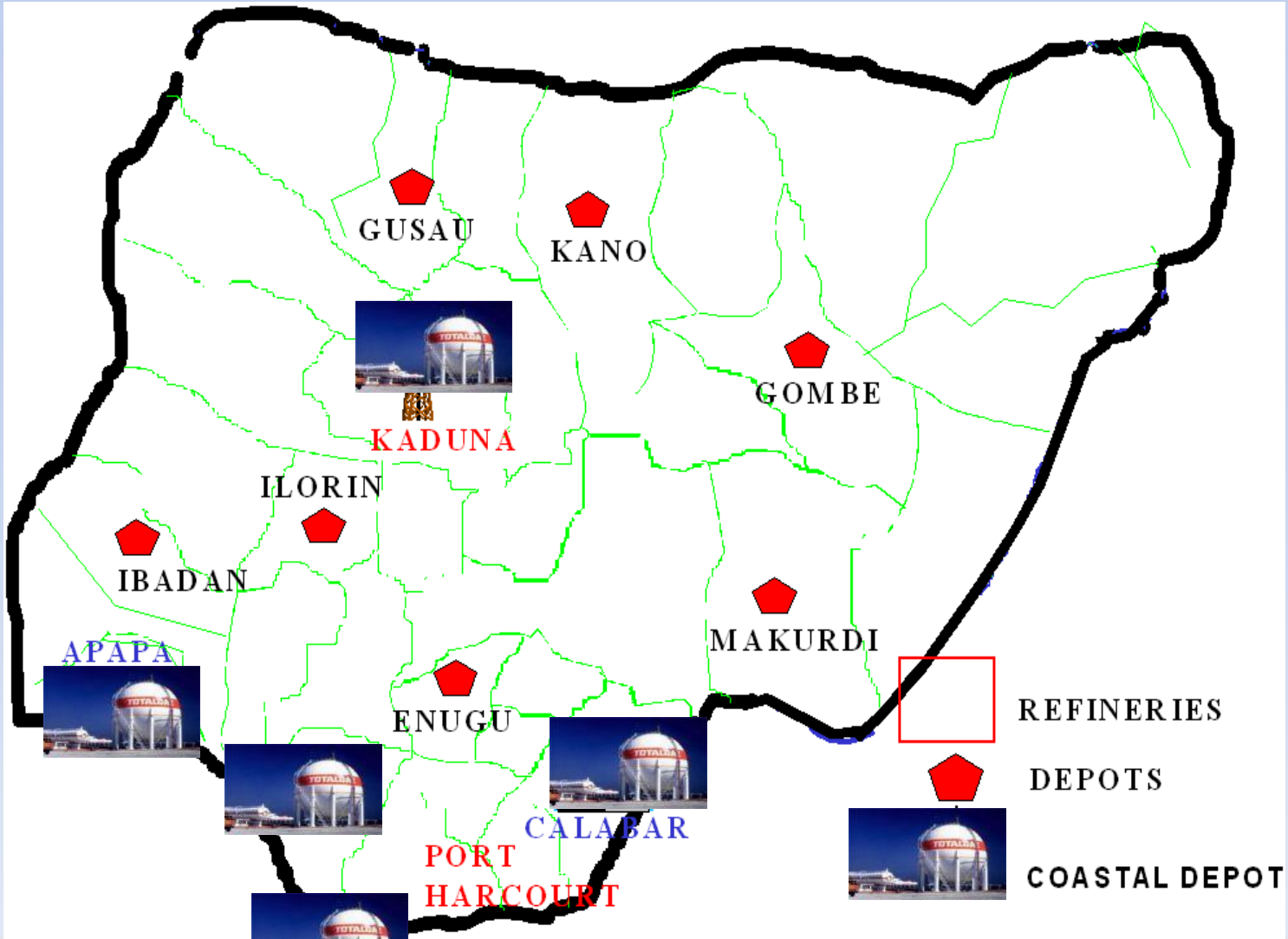
NUPENG



MARKET DEVELOPMENT ISSUES

- Butanization Policy
- Refinery Based Supply Strategy
- Coastal Depots Lagos ,PH ,WARRI & Calabar as receptacles
- Secondary Depots-inland to bring gas closer to tertiary storage/bottling plants

PRIMARY DEPOTS



REFINERY BASED SUPPLY POLICY

PHRC
New Port Harcourt Refinery – 150,000bpd, commissioned in 1989- more complex refinery with 8 processing units:
Crude Distillation Unit(CDU) – 150,00bpsd
Vacuum Distillation Unit(VDU) – 53,560bpsd
Naphtha Hydro treating Unit(NHU) – 33,000bpsd
Catalytic Reforming Unit(CRU) – 33,000bpsd
Kerosene Hydro treating Unit(KHU)- 14,500bpsd
Fluid Catalytic Cracking Unit(FCCU) – 40,000bpsd
Dimersol Unit (DIMU) –4,459bpsd
HF Alkylation Unit ––7,200bpsd

WRPC
Warri Refinery and Petrochemical
Warri Refinery commissioned in 1978 Fuels Plant
installed capacity 125,000bpsd
Petrochemical Plant commissioned in 1988
Polypropylene Plant–installed capacity ––35,000 tons of polymer per year
Carbon Black Plant installed capacity 18,000 metric tons of various grade of carbon black per annum
Utilities and Offsite Facilities:

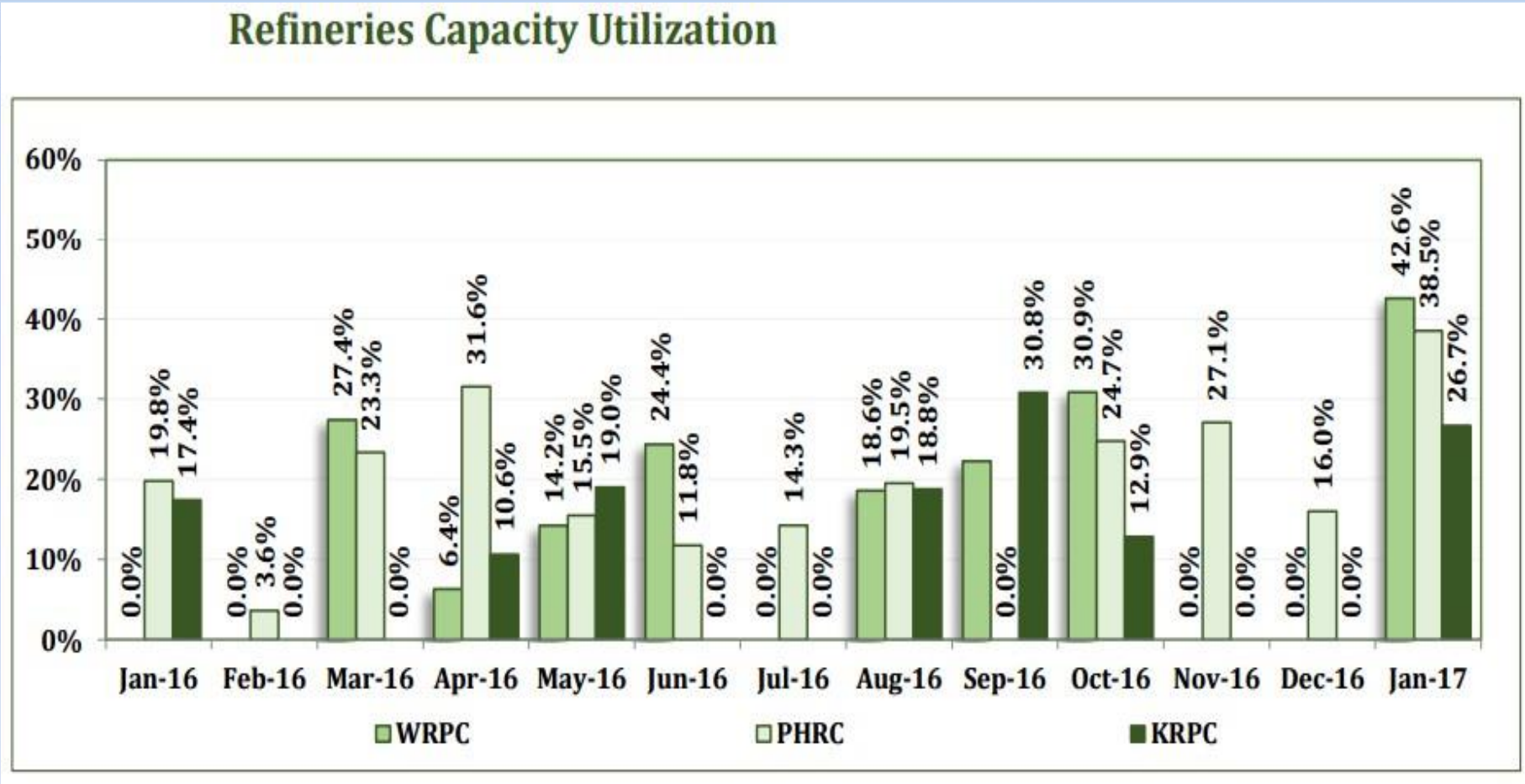
KRPC

Refinery and Petrochemical Kaduna Company Limited Commissioned sequentially between 1980 and 1988, with installed capacity for refining 110,000 bpsd

Fuels Plant—capable of processing 60,000bpsd
Lubes Plant --designed to process 50,000bpd of heavy crude oil imported from Kuwait or Venezuela, or Saudi Arabia Light Crude into lubes base oils, waxes and asphalts.

Petrochemicals Plant (Linear Alkyl Benzene Plant)
Utilities Production Plants
Offsite Plants

TOTAL REFINERY PRODUCTION 2016 T0 2017



Refineries Production

REFINERY CAPACITY

Total Refinery Capacity: 445,000 bpsd

- **Daily Refinery Design Production, MT:**
- **–PMS: 17,170**
- **–AGO: 14,317**
- **–DPK: 8,429**
- **–LPFO/HPFO: 9,898**
- **–LPG: 2,007**

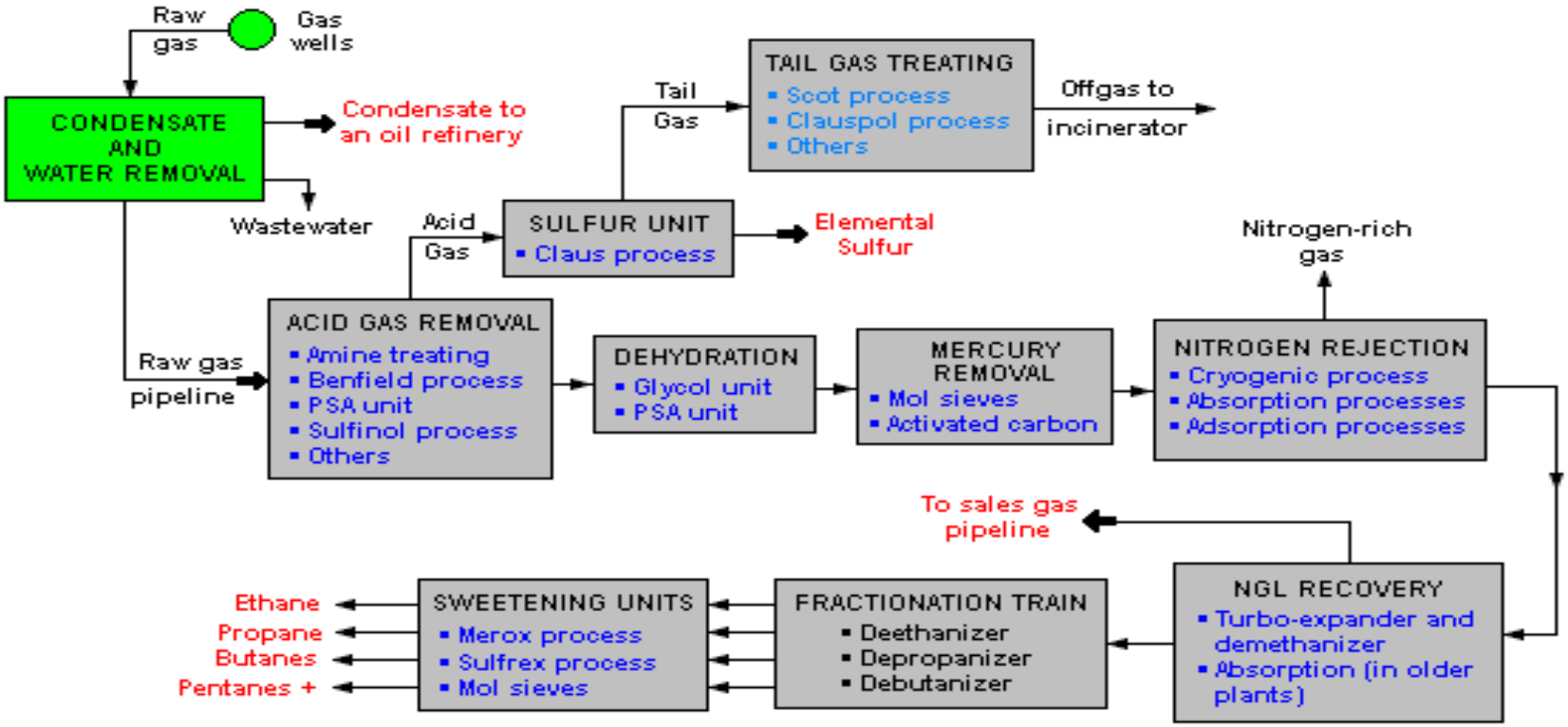
LPG SUPPLY FROM REFINERIES

- The current installed capacity of the refineries is about 2007Mt per day or 700,000Mt/ Annum
- This is adequate for the national aspiration
- However due to operational issues PPMC is unable to meet the domestic demand.
- The Refineries has delivered to the domestic market about 5500mt from January to April this year

REFINERY BASED SUPPLY POLICY IMPACT

- Unreliable Supply
- Market Decline

LPG SUPPLY FROM NATURAL GAS



LEGEND:

- Located at gas wells — Located in gas processing plant
- Red Indicates final sales products — Blue Indicates optional unit processes available
- Condensate is also called natural gasoline or casinghead gasoline
- Pentanes + are pentanes plus heavier hydrocarbons and also called natural gasoline
- Acid gases are hydrogen sulfide and carbon dioxide
- Sweetening processes remove mercaptans from the NGL products
- PSA is Pressure Swing Adsorption
- NGL is Natural Gas Liquids

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NATURAL GAS STRIPPING PLANT

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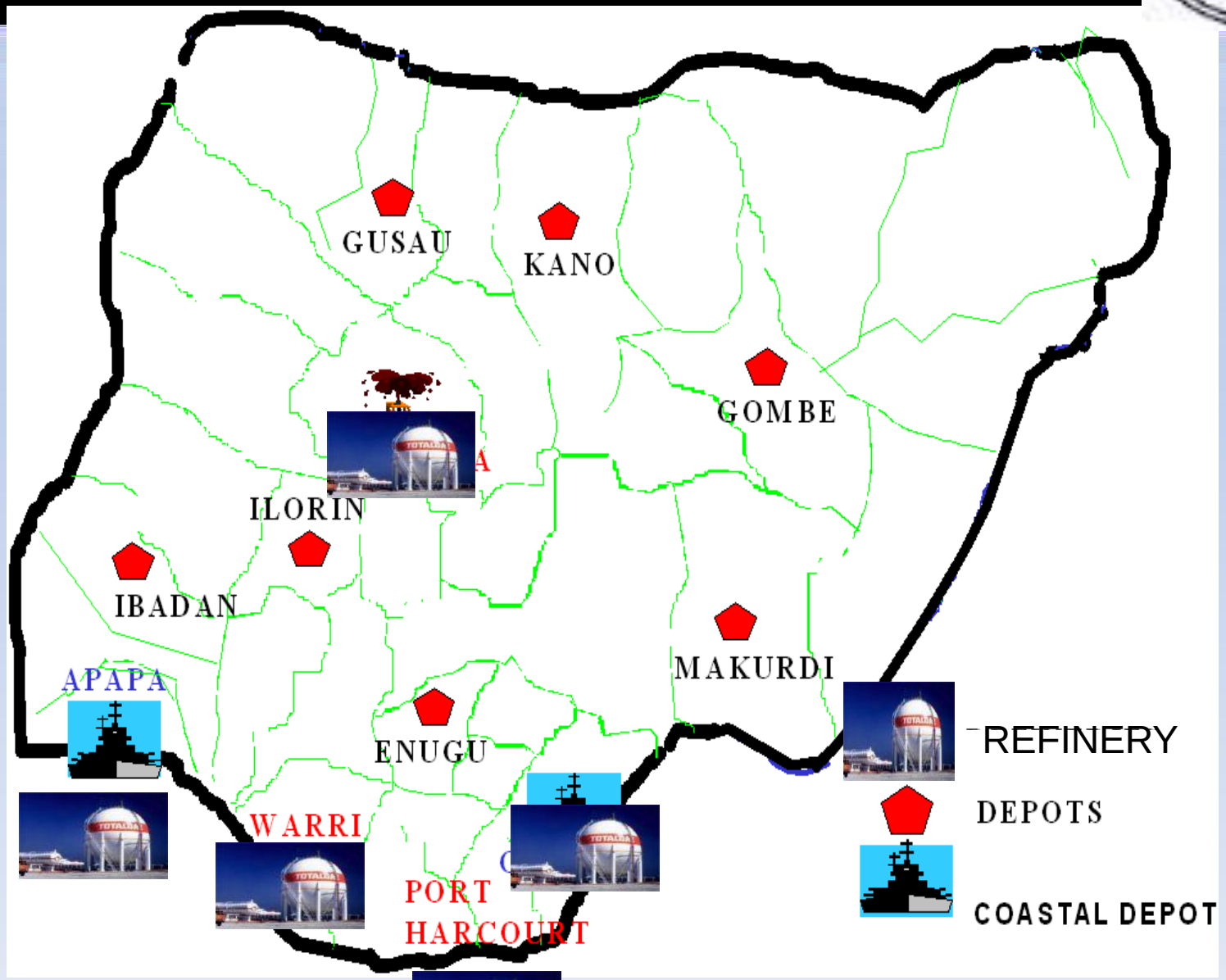
GAS PROCESSING PLANTS

PLANT	MILLION	SITUATION
ExxonMobil Oso	2.8 million	Export Oriented
NLNG	1 million	Export Oriented
CHEVRON ESCRAVOS	1 million	Export Oriented
GLOBAL GAS & REFINING LTD	100,000 tpa	Private
FUTURE PLAN		
BRASS LNG	0.4 mtpa	ETD 2009
OK LNG	0.4 mtpa	ETD 2011
IZOMBE	66,000 tpa	
IBENO		

PRODUCTION FROM GAS PLANTS

- LPG production from the Gas Processing plants were design to meet export markets with exception of Global Gas project.
  - ExxonMobil made 350,000 Mt available but due to logistic constrains only few cargos were actualized.
  - NLNG made 350,000 Mt available via Verge Saga 1n 2016 the highest so far in a year

PRIMARY DEPOTS



COASTAL DEPOTS

Depot	Capacity	Location	Jetty Access	Situation
PPMC	4000 Mt	Lagos	NOJ	Public Ownership
PPMC	1000 Mt	Calabar	PPMC	Public ownership/ Draft issues
TOTAL	800 Mt	Lagos	NOJ	Common Jetty issues
OANDO	500 Mt	Lagos	NOJ	Common Jetty issues
FORTE	600 Mt	Lagos	NOJ	Common Jetty issues
NIPCO	5000 Mt	Lagos	NOJ	Common Jetty issues
NAVAGAS	6000 Mt	Lagos	PRIVATE	
DOZZY MATRIX SHORE LINK	5000mt 5000Mt	CALABAR WARRI PH		NEW Under construction NEW

SECONDARY DEPOTS

Depot	Capacity	Situation
Kano	1000 Mt	Public Ownership
Ibadan	1000 Mt	Public Ownership
Enugu	1000 Mt	Public Ownership
Gombe	1000 Mt	Public Ownership
Yola	1000 Mt	Public Ownership
Markurdi	1000 Mt	Public Ownership
Ilorin	1000 Mt	Public Ownership
Total	7,000 Mt	

DEPOT SITUATION

- There has been significant growth in coastal depot capacity between 2007 & 2017 but the jetty access is still an issue in the supply chain especially in lagos.
- The inland depots are still not being used.
- No Pipeline Connection
- No Rail Connection

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ON-GOING GAS DEPOT PROJECT

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ON-GOING GAS DEPOT PROJECT

BOTTLING PLANTS

- There are up to 580 Bottling Plants of LPG in Nigeria spread into 6 geo political zones of the Nation according to Nalpgam

ZONE	No of Plants	Average Storage Capacity	Average consumption
South West	173		30%
South/South	99		17%
South East	110		19%
North/West	76		13%
North Central	87		15%
North East	35		6%
Total	580		100%

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LPG RE-FILLING PLANT

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LPG PUMP CONSTRUCTION

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BOTTLING PLANTS

- The primary customers of the Bulk Sellers are the Bottling Plants.
  - Storage capacity of about 16,160 Mt
  - Average of 800 Filling Heads
  - Capacity to fill over 128,000 Cylinders of 12.5 kg per day or 1500 Mt per day which gives 547,500 mt

- This implies inadequate capacity to meet the national aspiration of about 1,500,000Mt per annum.

TRANSPORTERS

- It is estimated that about 150 Trucks are available in the country for LPG transportation.
- This can be translated into 3000Mt holding capacity with about 36 hours turn round we believe this gives about 1800 Mt per day transportation capacity.
- Most are dedicated to plants therefore not available for third party usage or are not road worthy.

TRANSPORTERS

- This activity falls into the expertise of Logistics Management.
  - It is my opinion that the policy that compels the bottling plants to have to own trucks is stretching the competence of the operators.
  - The road infrastructure is weak
  - The Training system of the manpower (drivers & Managers) is weak
  - The Drivers are unionized (NUPENG) the strongest union in the country.
- This situation makes the service look INADEQUATE but in reality turn round on the trucking capacity is low.

CYLINDER REQUIREMENTS

We have seen a number of presentations on this issue, we elect to take a pragmatic approach in analyzing the situation on the basis of our experience

We come to learn the following:

- Household use about 12.5 kg per month
- 1 in 2 Household keep an average of one cylinder as a back up
- Distributors keep about 14 days stock in shops.

- This constitute the cylinder capacity and Culture of the operators.
- This implies:
  - 700,000 of 12.5kg cylinders at END USER LEVEL
  - 300,000 of 12.5Kg Cylinders at DISTRIBUTORS LEVEL
  - 1,000,000 TOTAL
- To grow from 400,000Mt per annum to 1,500,000 Mt we need about 12,000,000 units of cylinders.

CYLINDERS MANUFACTURE

- . Presently, there few cylinder manufacturing plants in Nigeria MIDAS (100,000PA),NGCC(1,000,000 PA) have shut down, except for NGCC that is still operating skeletal services
- There is cylinder manufacturing facility coming up in Lekki yet to start production this year.
  - Cylinder requirement 12M (Equiv. of many yrs Production)

There is indeed a gap between the capacity available and the national aspiration

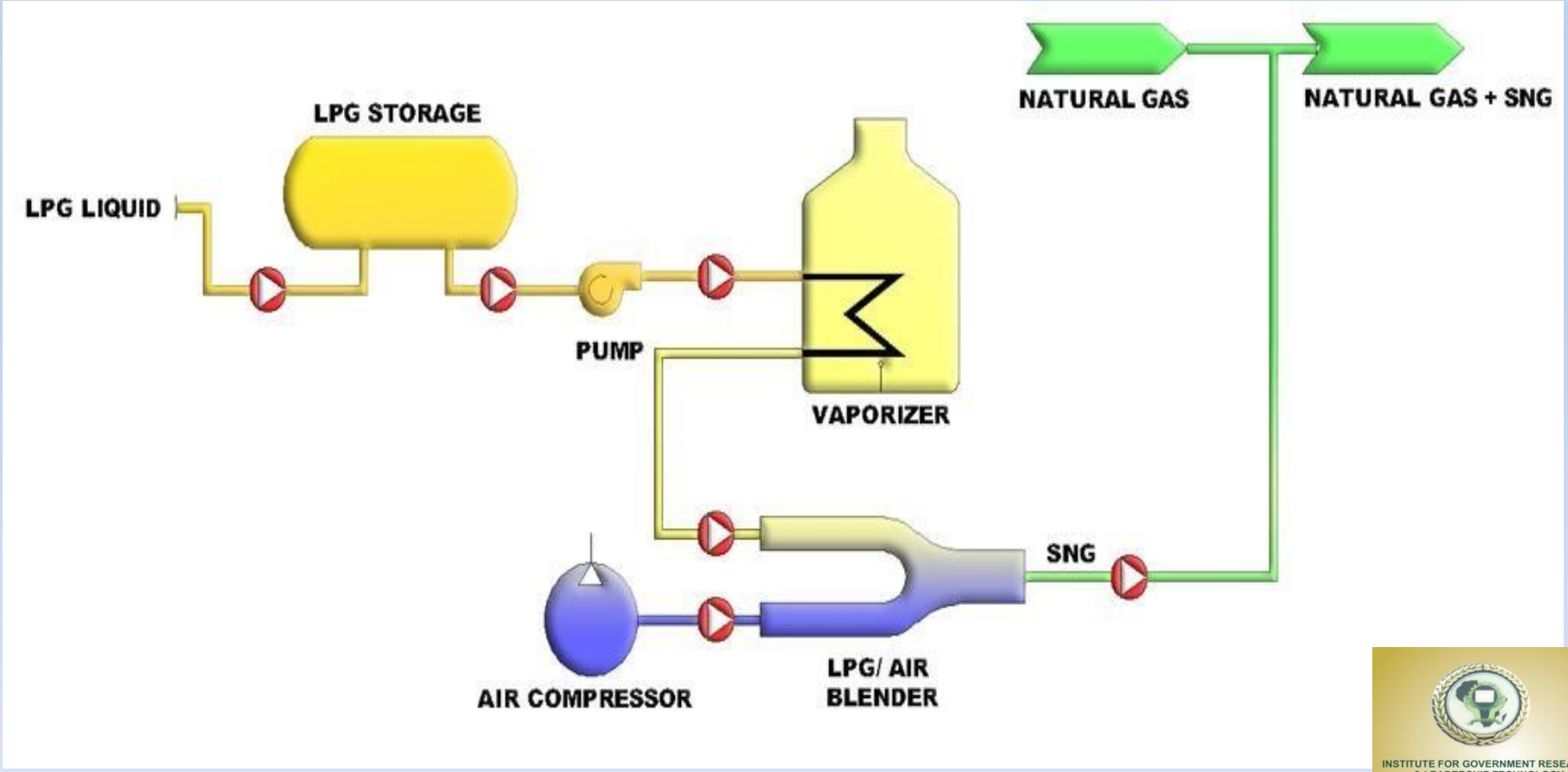
CONSUMERS

- The Consumer is the last and most important customer in the value chain.
- LPG has no captive market and can be substituted by any other fuel in a number of application at home, work and industry.

NIGERIAN TYPICAL APPLICATION

- The Customers can be grouped and classified into applications and users:
  - Domestic
  - Commercial
  - Industrial
- Nigerian typically use LPG in the following areas:
  - Cooking
  - As Propellants
  - Agriculture
  - Glass & Ceramic industries
- Potential markets:
  - Auto Gas
  - SNG

SNG SYSTEM



GAP IDENTIFICATION

	Production	Logistics production to primary depot	Primary Depot	Onshore transportation	Bottling Plants	Cylinders	Customers
Capacity	2.5 mtpa	Saga	(45,000 Mt)	200 trucks	580	2 M	500,000 Mt
aspiration	4.5 mtpa	Nil	(77,000 Mt)	300 trucks	1000	14 M	1,500,000 Mt
Surplus (gap)	2.0 mtpa	Saga*	(32,100 Mt)	100 trucks	420	(12 M)	(1,000,000) Mt

OPPORTUNITIES

OPPORTUNITIES	
Production	While acknowledging the excess production capacity within the country, we need to be mindful of the contractual obligations of the various projects at the same time solve the operational challenges of the refineries other wise we should consider the supply and aspiration gap as opportunity for investment in the production sector
Logistics (Production to Primary depots)	Verge Saga was sponsored by NLNG to facilitate the supply of 350,000Mt per annum to the Nigerian market at a cost of about $25,000 per day this implies a minimum cost of at least $60 per ton which is almost at par with shipment cost on import. This portion of the chain is currently being subsidized by NLNG or Govt.
Primary Depots	If we are to achieve our national objective there is indeed a gap of about 32,000 Mt depot capacity that is needed.
Onshore transport system	We noted the trucking capacity of LPG and see adequacy of the system to meet national aspiration
Bottling Plants	We noted also the Current Capacity under utilization in this area and believe it will be enough for the national aspiration.
Cylinder Capacity	There is indeed a gap of 12million cylinders before the national aspiration of 1,500,000 Mt can be achieved
Customers	The customer base is apparently making demand of between 500,000 and 700, 000 mt currently , however we noted that other users (Automobile, etc) have not keyed in to this product.

CHALLENGES

- Looking at the Value Chain after identifying the gaps we see the following Challenges assuming we are to push for the national aspiration.

CHALLENGES	
Production	The challenges at the refineries are operational while that of the offshore facilities are contractual and logistic
Logistics (Production to Primary depots)	The cost of running a mother vessel is not sustainable unless turn round utilization of the vessel can be improved , however contractual obligations of the facilities need also to be attended to.
Primary Depots	With improve depot capacity the major challenge of the depots will be through put and indeed the jetty utilization is major issue.
Onshore transport system	The major challenge in transportation in Nigeria is and remains road infrastructure, logistics management.
Bottling Plants	The challenge here is capacity Utilization.
Cylinder Capacity	The Challenge here are the manufacturing capacity , regulatory requirement if it is to be imported, then cylinder branding and management.
Customers	The real challenges here are the pricing policy of LPG and its substitute products. Other issue are bordered around safety concerns of the customer.

CRITICAL SUCCESS FACTORS

- Good financing
- Legal and Regulatory Framework
- Strong government commitment
- Clarity of Gas policy
- Commercial Framework
- Availability and Sustainability
- Gas pricing and infrastructural tariff
- Human Capital development

LPG SALES AND PURCHASE AGREEMENT

The following are the main purposes of an LPG Sales and Purchase Agreement

- A binding agreement to ensure a destination for the product
- To give comfort to the banks to carry out due diligence for Gas Nomination and Logistics support
- To have a commercial and legal scope that is enforceable.
- To ascertain duration of the agreement and the rights of parties.
- A requirement by the government and the regulatory bodies in the Country.

LPG SALES AND PURCHASE AGREEMENT

The following are the features of an LPG Sales and Purchase Agreement

- Recital of Parties to the agreement
- Duration of contract
- Annual Take Or Pay Quantity
- Nomination procedure
- Product Specification
- Custody Transfer Point
- Payment Terms
- Responsibilities of parties
- Title and Risk
- Termination clause
- Force majeure
- Applicable laws of the Country

ECONOMIC - LPG DEPOT

ASSUMPTIONS

- Capex (Capital Expenditure)- N800m
- Tax Regime - CITA
- Life Span - 20years
- Term Loan - 5 years
- Debt/Equity Ratio – 50/50
- Interest rate - 25%

RESULT

- IRR (Internal rate of Return) = 10-20 %
- PBP (Pay Back Period) = 5- 7years

ECONOMIC - LPG BOTTLING PLANT

ASSUMPTIONS

- Capex (Capital Expenditure)- N40m
- Tax Regime - CITA
- Life Span - 20years
- Term Loan - 5 years
- Debt/Equity Ratio – 50/50
- Interest rate - 25%

RESULT

- IRR (Internal rate of Return) = 15 – 23 %
- PBP (Pay Back Period) = 5- 7years

ECONOMIC - LPG TRUCKING PLANT

ASSUMPTIONS

- Capex - N32m
- Tax Regime - CITA
- Life Span - 10years
- Term Loan - 4 years
- Debt/Equity Ratio - 50/50
- Interest rate - 25%

RESULT

- IRR = 20% and above
- PBP = 3- 5years

ECONOMIC - LPG DISTRIBUTION

ASSUMPTIONS

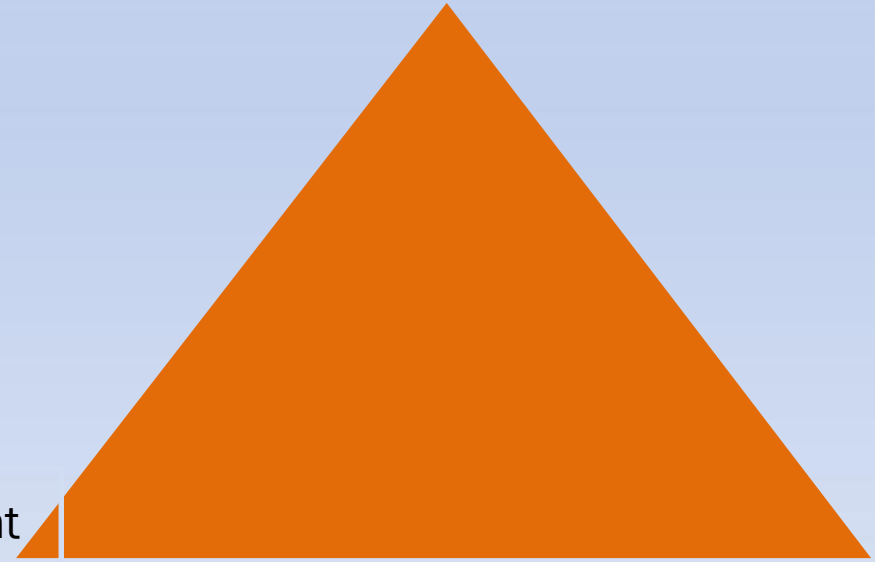
- Capex - N2.2m
- Tax Regime - CITA
- Life Span - 15years
- Term Loan - 4 years
- Debt/Equity Ratio - 50/50
- Interest rate - 25%

RESULT

- IRR = 20% and above
- PBP = 4-6years

CRITERIA FOR ENERGY CHOICE

Competing Energy Sources:
Wood
Kerosene
LPFO
AGO
PMS
Electricity



CONCLUSION

- For any effective Strategy there is need to identify the key success factors of the Objective (In this case improving LPG Utilization to 1,500,000Mt) and key to that are:
  - Customer Demand
  - Infrastructural Development
  - System Management.

CONCLUSION

- Customer Demand:
- Balancing the National Policy on pricing of the various competing energy sources will be the key driver to use choice and investment Choice.
- Environmental Aspiration and regulation of the country plays a role
- Then the customer desire and intent

CONCLUSIONS

- Infrastructural Gap have been Identified in the analysis namely:
  - Operational Management of the Refineries
  - Off shore to On shore facility
  - Road Infrastructure

CONCLUSION

SYSTEM MANAGEMENT:

THANK YOU

FOR MORE ENQUIRES,

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