REDUCING GREENHOUSE GAS EMMISSION - The Nigerian Approach

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Presentation Outline

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- Reducing Pressure on Fossil Fuel
- Carbon Storage
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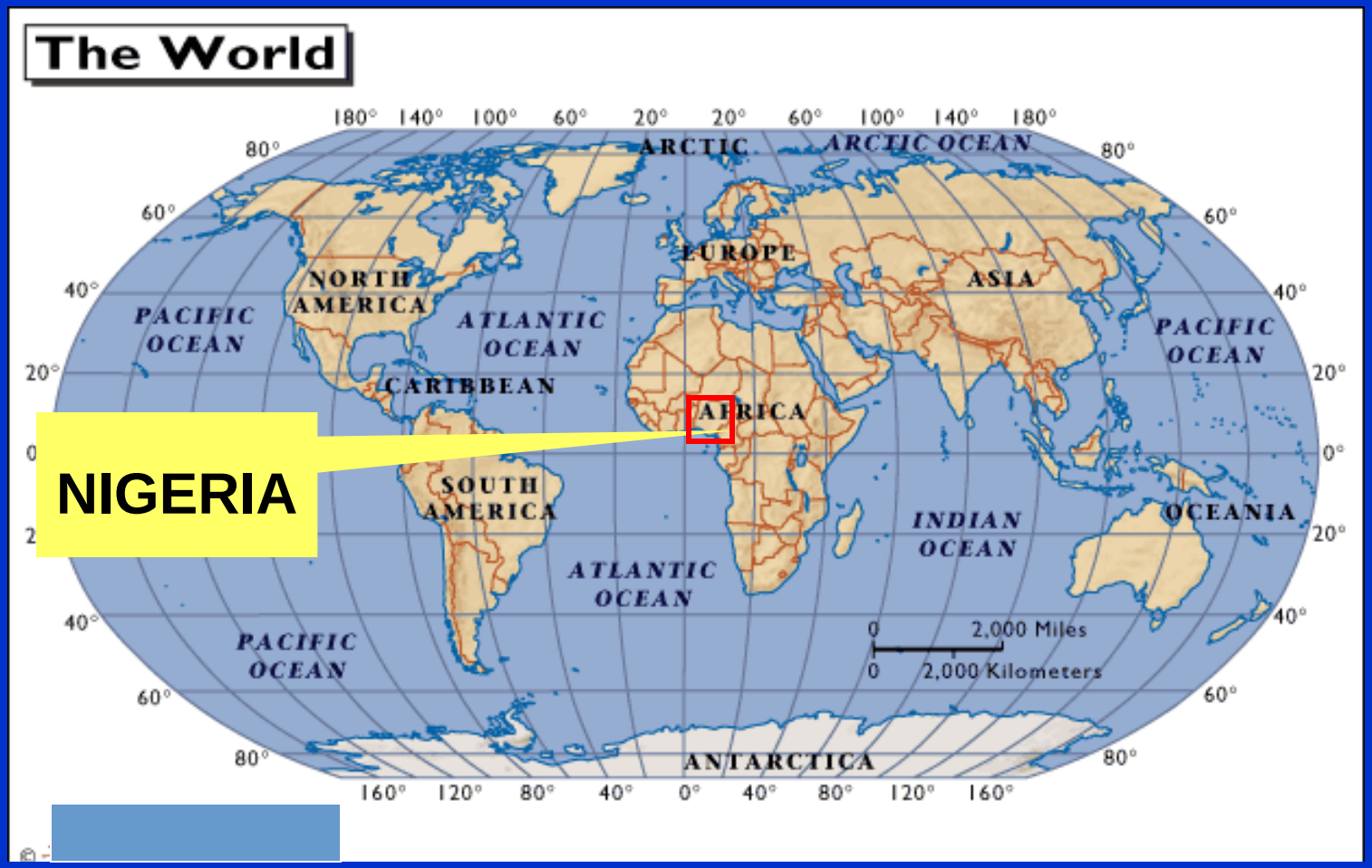
- Approach to Emission Reduction
- Conclusion

Nigeria



Nigeria is located in one of the most prolific hydrocarbon provinces of the world

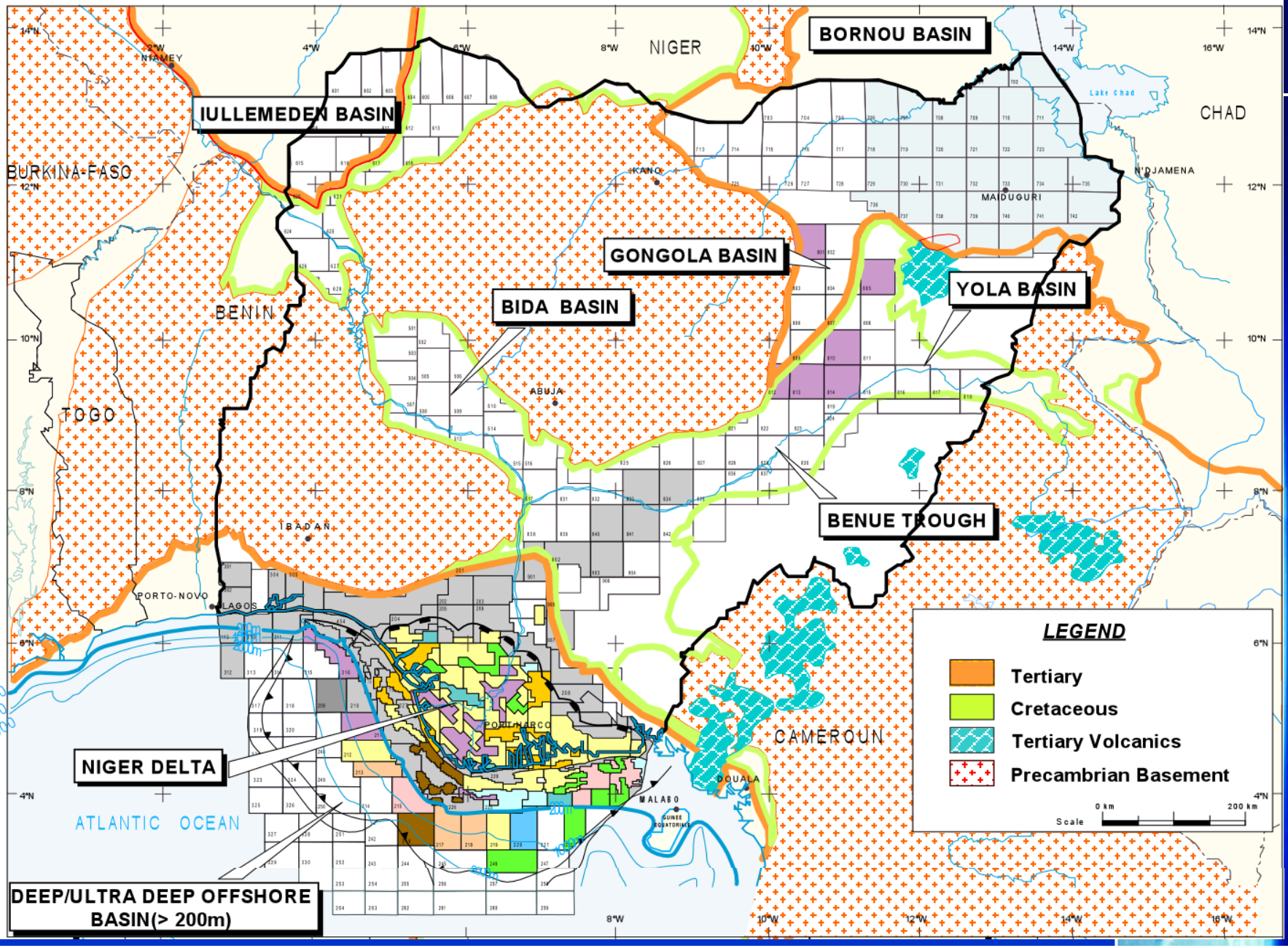
PREAMBLE

- **Reserves:**
  - Oil+Condensate (B- Bbls) 35.88
  - Total Gas (Tcf) 184.00
  - AG 98.00
  - NAG 86.00
  - Crude Oil Prod. Cap. (mmb/d) 3.35
  - Actual Oil Production (,,) 2.80
- Gas Prod. (mainly associated) Bcf/d 5.78

NATURAL GAS RESOURCE

- Nigeria ranks seventh in the world in gas reserves and no.1 in Africa
- All Natural Gas discoveries are incidental to exploration for crude oil
- High proportion of Natural Gas accumulation is concentrated in the Niger Delta
- Substantial volumes of Natural Gas discoveries made in the deep offshore area (27 Tcf about 15%)
- There are a few more basins that are gas bearing but remained largely unexplored.
- Scope for discovery is much higher if gas becomes the focus of exploration
- Nigeria has been described as more of a Gas Province than Oil

NIGERIA SEDIMENTARY BASINS AND LEASES

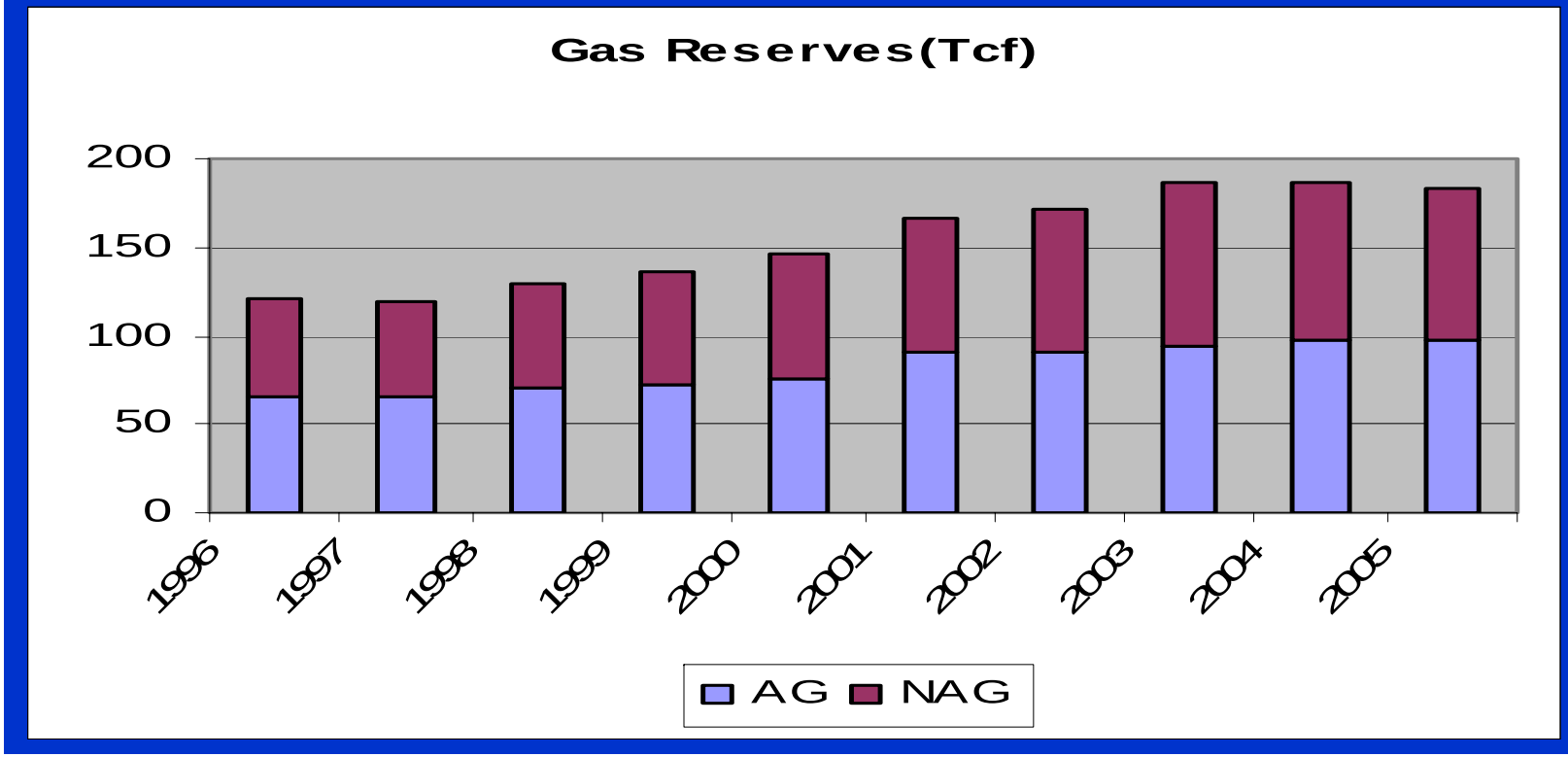


NATURAL GAS RESOURCE (Cont'd)

- Nigeria, Algeria, Egypt and Libya have more than 90% of the continents natural gas reserves and also produce more than 95% of the continents total production
- These countries have a developed (Algeria) and a rapidly developing (Nigeria, Egypt and Libya) Natural Gas Industry
- Many of the gas projects are export oriented supplying LNG to Europe, US and SE Asia
- These regions contribute substantially to GHG emission

NATURAL GAS SNAPSHOT
Gas Reserves

Yr 2005 (TCF)	AG	NAG	TOTAL
Ult. Recovery	144	89	234
Produced	46	4	50
Rem. Reserves	98	85	184



NATURAL GAS PRODUCTION

- Crude Oil Production started in Nigeria in 1958 at a very low rate of about 5,000 b/d
- Produced along with it, was associated gas but the quantity was considered insignificant
- Apart from a small proportion used to run some equipment and facilities , majority of the gas produced was flared.
- By the end of the 60's when crude oil production increased rapidly, natural gas was also produced in quantities sufficient to create concern to the Govt.
- In reaction, Govt. put in place legislation to regulate the handling of produced gas

LEGISLATION AIMED AT REDUCING GAS FLARING

- **1969 - Petroleum (Drilling and Production) Regulation**
  - **Licensee was expected to submit feasibility study, programme or proposal for gas utilisation not later than five years of the commencement of production**
  - **No adequate penalty for violation**
  - **Reason for non-compliance by operators**
- **1973 – Petroleum (Amendment) Act**
  - **Government may take the gas at the flare at no cost**
  - **Absence of infrastructure to develop and utilise the produced gas**

LEGISLATION AIMED AT REDUCING GAS FLARING

- **1979 – Associated Gas Re-injection Act**
  - **Requires producing companies to submit proposals for utilising produced associated gas**
  - **Companies were expected to stop routine flaring of gas by January, 1984**
  - **The acreage may be forfeited for violation**
  - **Empowers the Hon. Minister of Petroleum Resources to grant permission to flare**
  - **Implementation not possible due to inadequate financing as gas gathering is capital intensive**
- **1983 – Associated Gas Re-injection Amendment Act**
  - **Specific penalty introduced for the first time**
  - **Though penalty exists, it was not sufficient to serve as a deterrent**

INCENTIVES TO PROMOTE GAS UTILISATION

- In realisation of the fact that the "stick" was not a sufficient deterrent, Government decided to dangle the carrot. Thus a number of incentives were introduced
- The current Gas Incentives are covered under the following Agreement and Acts:
  - Associated Gas Framework Agreement (AGFA) 1992
  - Financial (Miscellaneous Taxation Provision) Act 1998
  - Financial (Miscellaneous Taxation Provision) Act 1999
  - Nigerian Liquefied Natural Gas (NLNG) Act 1990
- Essentially the incentives provide for:
  - Tax free period of 3-5 years and for NLNG 10 years
  - Reduced tax rate (CITA to apply)
  - Investment tax credit/allowance
  - Allowing for the quick recovery of investment

The incentives cover projects such as LNG, G-T-L, IPPs etc,

Aspirations for the Gas Sector

- Enhance the development of the domestic gas market and facilitate the growth of the power and industrial sectors
- Provide an enabling environment for the entry of new investors and increased private sector participation in the gas sector
- Address environmental issues and end gas flaring
- Capture economic value of gas through domestic and export projects
- Generate as much revenue from gas as oil within the decade
- Diversify from an oil industry to an integrated oil and gas industry

Natural Gas Study

JUMP STARTING NATURAL GAS DEVELOPMENT

- **1999/2000:**

  Government initiated a study which identified the following options to fast track gas development:

  - **Concentrate on gas export drive mainly LNG in view of its growing International demand**
  - **Stimulate Domestic demand through the development of the Power sector**
  - **Revive Dormant Gas Utilisation Centres**

- **2002:**

  Another Study – Natural Gas Strategy Study - was carried out in collaboration with the World Bank as another step towards promoting gas utilisation

NATURAL GAS STRATEGY STUDY

- The study was carried out in two phases:
  - Diagnostic which identified the problems
  - Options for reforms

- Consultations held with all stakeholders and identified impediments to gas development to include:
  - Financing – large investment required
  - Pricing - Prices inadequate to ensure cost recovery
  - Absence of Institutional Framework: no clearly defined roles for the different Government Agencies
  - Legal and Regulatory Framework – No specific legislation on gas
  - Fiscal Regime - Fiscal regime favourable to Upstream companies but a reduced Govt. Take
- Deliverables:
  - Draft National Policy for Gas
  - Draft Downstream Gas Act
  - Draft Fiscal Regime for Gas

GAS PROJECTS

DOMESTIC

17 POWER PROJECTS
CEMENT
FERTILISER
ALSCON
IRON AND STEEL
INDUSTRIAL
LPG

EXPORT

NLNG Trains 1-5

NLNG Trains 6 and 7

Brass LNG

OK LNG

XOM LNG

WAGP

TSGP

EGP 2

EGP3 -GTL

Gas Utilisation Projects - Domestic

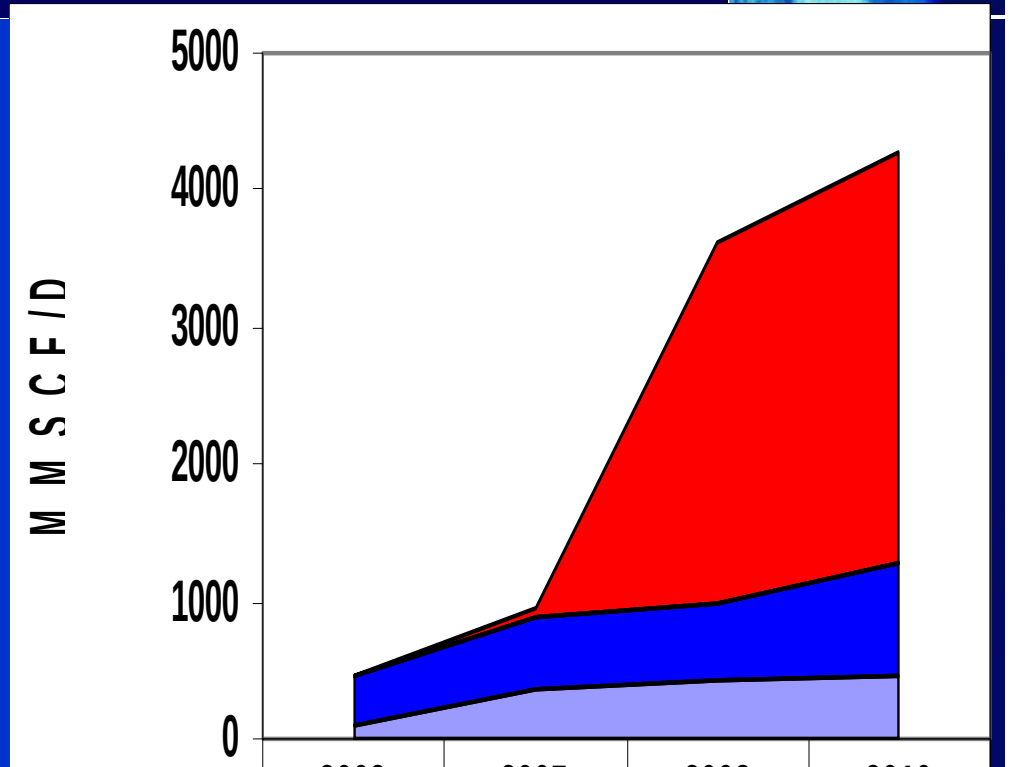
Existing Power Plants:
Afam, Egbin, Sapele, Ughelli and Okpai
Industrial:
Agbara, Greater Lagos Area,
ALSCON, NAFCON and Steel Plants

Proposed Power Plants – 17 in all and are categorised as:

JV Power Projects – 5
Govt. Power Expansion Programmes - 5
Niger Delta Power Plants – 7

Total Capacity of Proposed Power Plants – Over 8,000 MW
Daily Gas Requirement Over 2.7 Bcf

Meeting this level of gas supply requirements present a great deal of challenge:
- Financial and Infrastructural



	2002	2005	2008	2010
17 new IPPs		70	2619	2999
Power Plants	363	531	569	834
Industries	98	360	430	455

DOMESTIC GAS UTILISATION - INDUSTRIAL

- Current effort being made to expand existing gas infrastructure to enable it cope with anticipated increase in domestic gas requirements:
  - Another pipeline extension from Ajaokuta to Obajana Cement Factory
  - New set of pipelines to be constructed for the new power plants
- Dormant gas utilisation projects are being revived:
  - Steel Plants
  - Aluminum plant
  - Fertilizer plant
- Revival of the LPG market and make them available and affordable as a step towards discouraging the use of firewood thus slowing down the process of desertification
- A number of LPG plants are at different stages of project execution

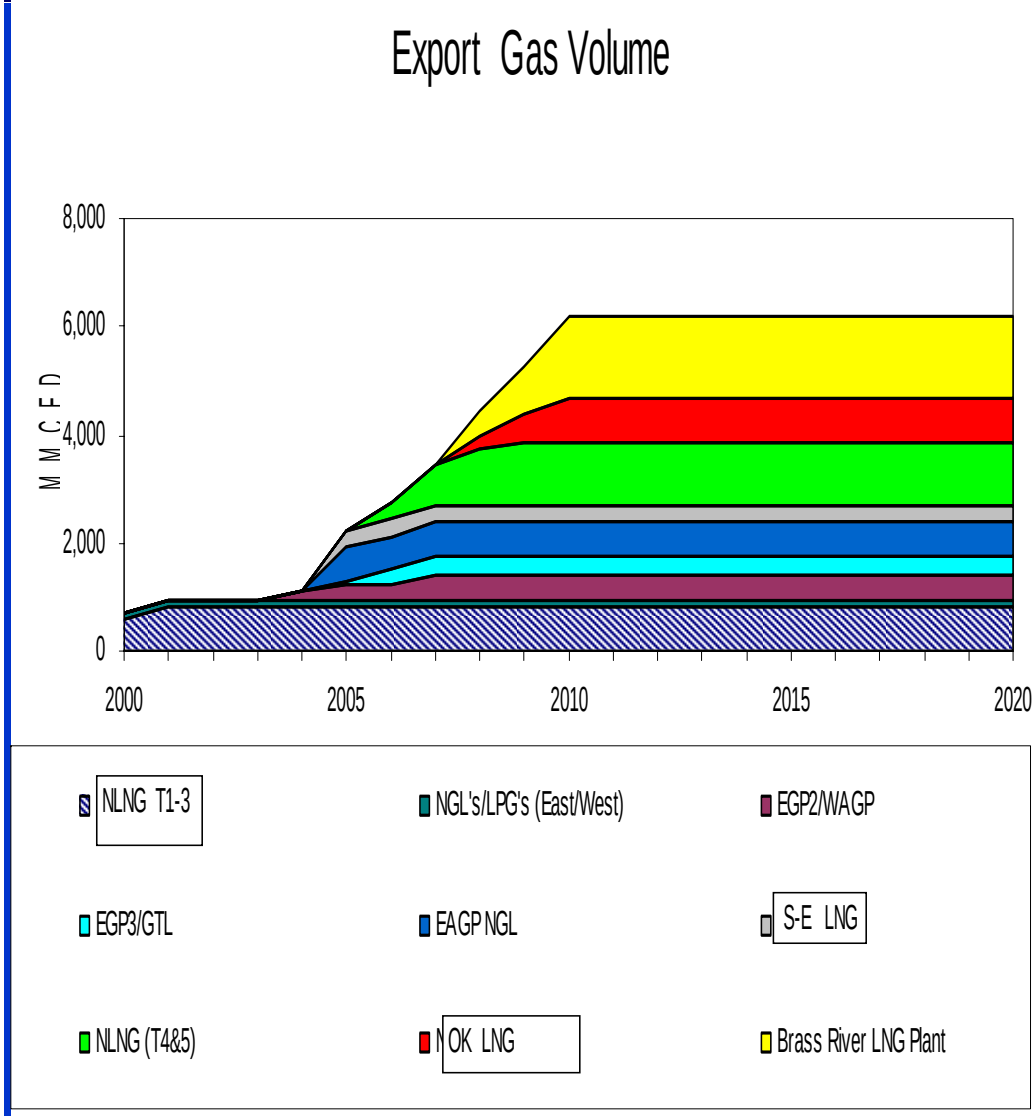
DOMESTIC GAS UTILISATION - INDUSTRIAL

- Existing and Proposed Gas Distribution Zones under franchise with Nigerian Gas Company
  - Agbara Industrial Area – Shell Nigeria Gas (SNG)
  - Greater Lagos Area – Gaslink Nigeria Limited (Gaslink)
  - Ikorodu Industrial Area – Falcon Nigeria Limited
  - Epe – Lekki Area – Gasland Nigeria Limited
- Apart from the promotion of gas utilisation, encouraged manufacturing outfits to switch over from less efficient fuels such as LPFO and diesel to cleaner, more efficient and cheaper natural gas
- The SNG and Gaslink projects were conceived to achieve this purpose
- Govt. is also looking at the use of Compressed Natural Gas (CNG) for automobiles as an alternative to the use of gasoline and diesel

Gas Utilisation Projects - Export

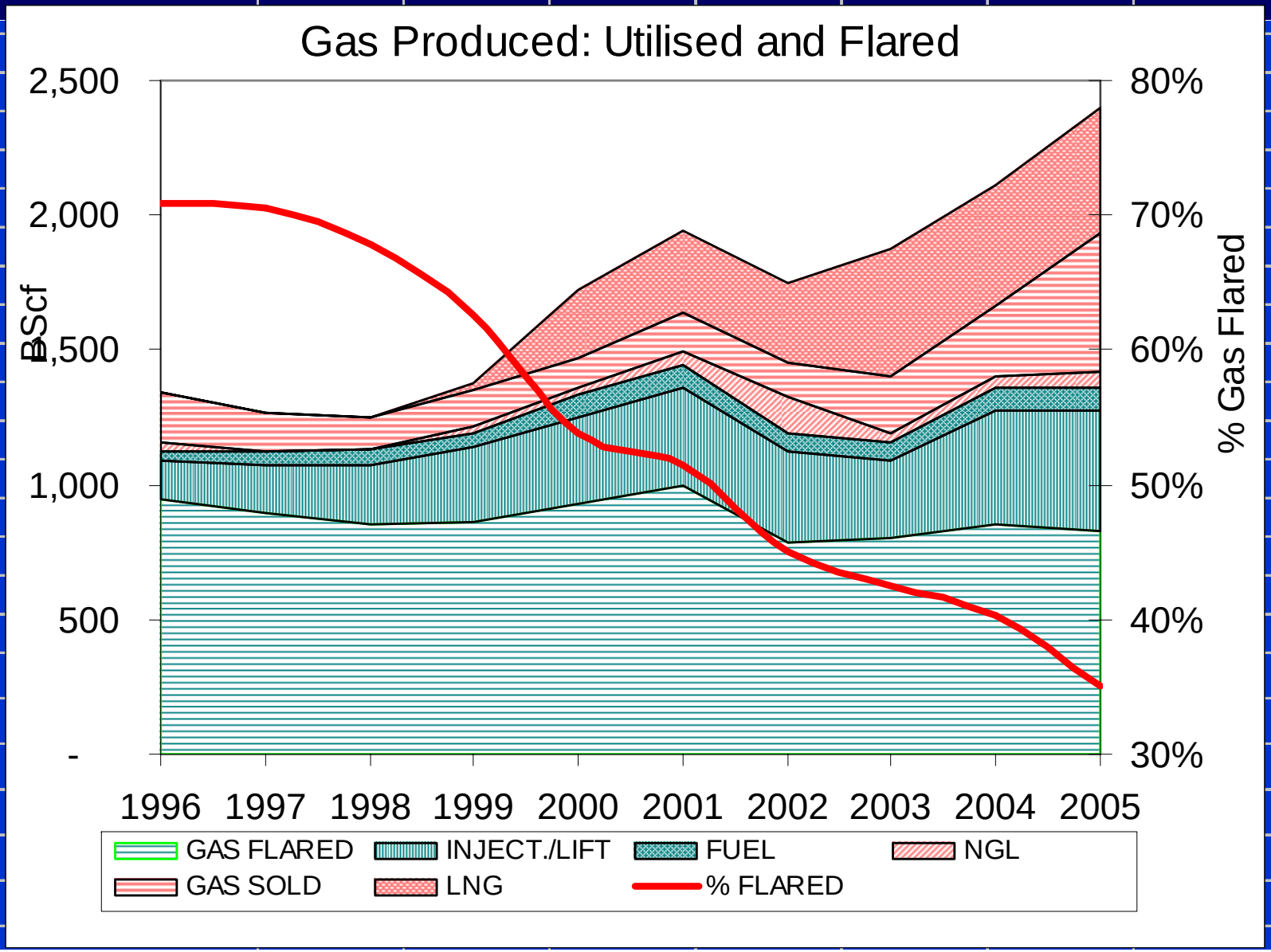
Summary of Gas Usage in Export Projects (mmcfd)

PROJECT	2002	2005	2008	2010	2015	2020
Current						
NLNG (T_{1-3})	845	1,329	1,329	845	845	845
NGL's/LPG's	105	105	105	105	105	105
Subtotal	**950**	**1,434**	**1,434**	**950**	**950**	**950**
Ongoing Projects						
NLNG (T4&5)		484	1,052	1,202	1,202	1,202
EGP_2/WAGP			450	450	450	450
EGP_3/GTL			350	350	350	350
EAGP NGL			630	630	630	630
Subtotal		**484**	**2,482**	**2,632**	**2,632**	**2,632**
New Potential						
Brass LNG Plant			450	1,500	1,500	1,500
OK LNG			300	1,500	1,500	1,500
XOM-LNG			300	830	830	830
Subtotal			**1,050**	**3,830**	**3,830**	**3,830**
TOTAL	**950**	**1,918**	**4,966**	**7,412**	**7,412**	**7,412**

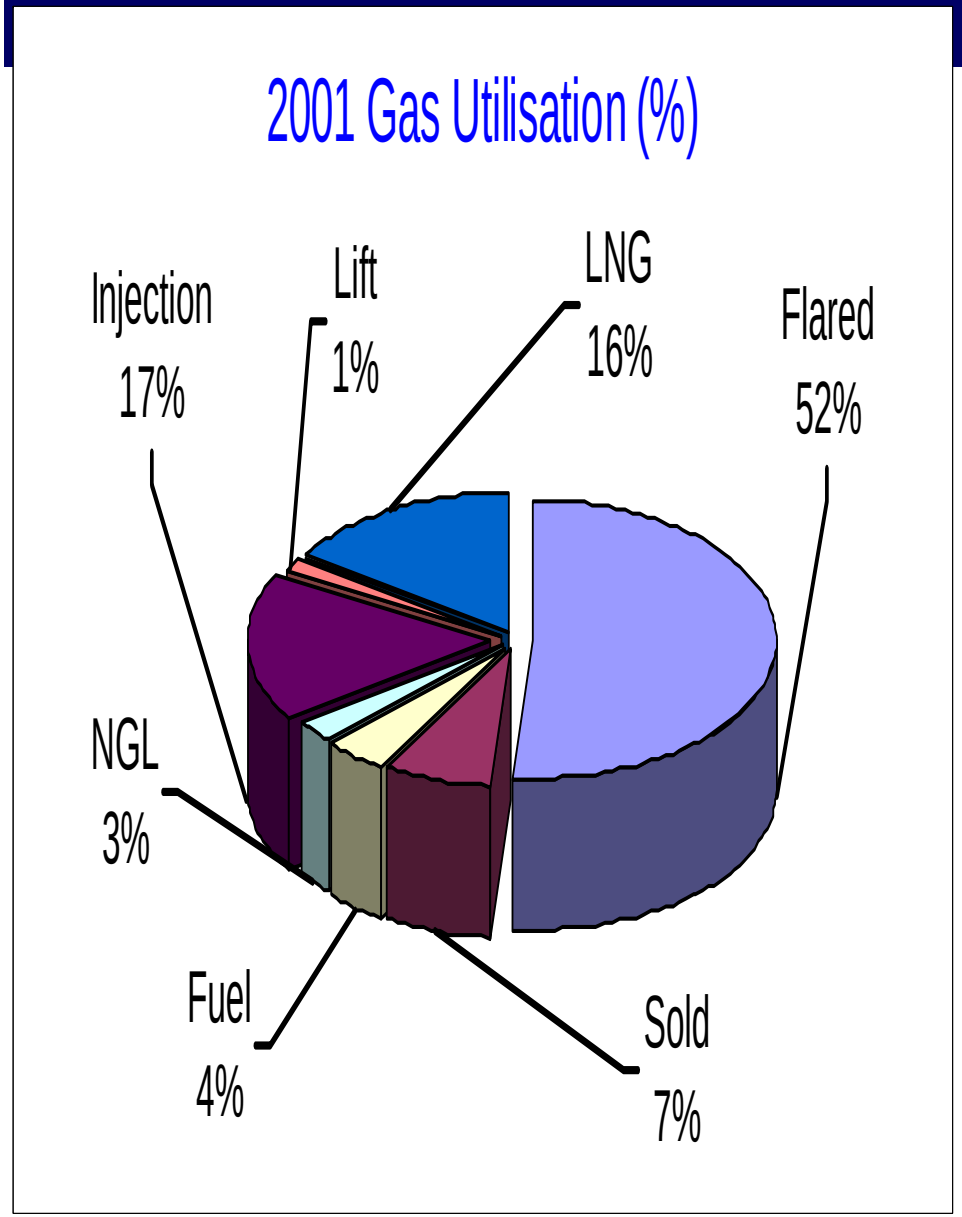


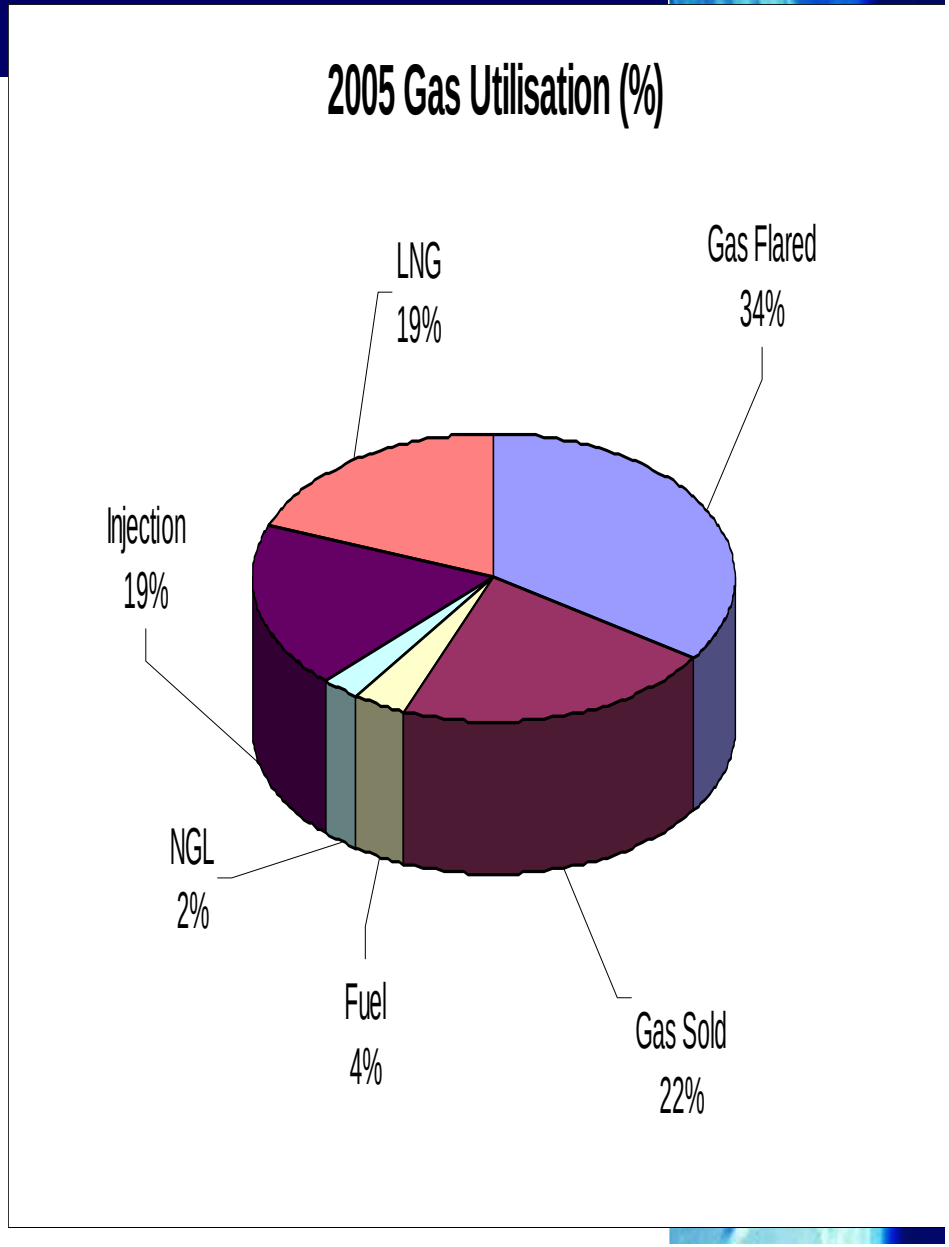
Pictorial View of the NLNG Plant at Bonny Island

GAS PRODUCED, UTILISED AND % FLARED



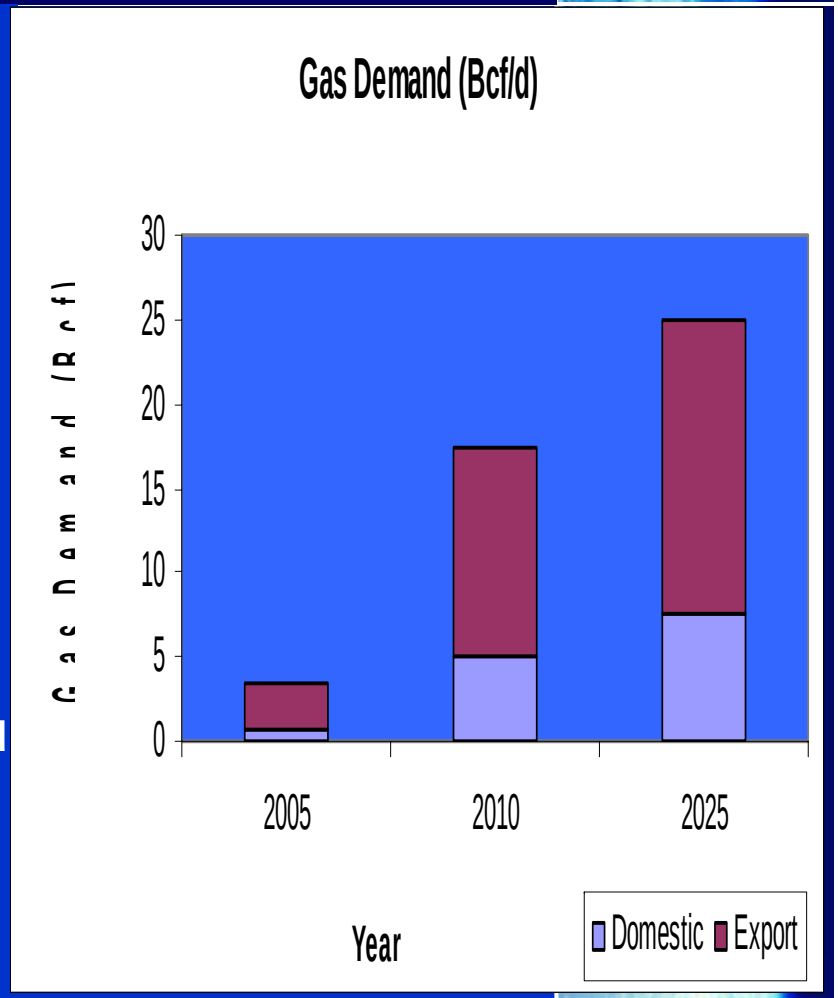
GAS UTILISATION SNAPSHOT





GAS DEMAND SCENARIO

- Many export oriented projects are going on simultaneously while others are under serious consideration
- Consequently, demand for gas expected to rise sharply
- Driven mainly by Government's desire to monetise gas and attain self sufficiency in Power Generation for which a target of additional 10,000 MW by 2007 has been set
- Current Daily Production = 5.78 Bcf
- As many other gas utilisation projects are currently under consideration, peak demand could be well above 10 Bcf/d in 2008
- As crude oil production increases to 4.00 Mmb/d as planned, AG production could rise to over 8 Bcf/d
- This would be inadequate to meet anticipated gas demand and the Incidence of gas flaring in Nigeria would have disappeared



This is likely to be the situation from Year 2009 as more gas projects come on stream

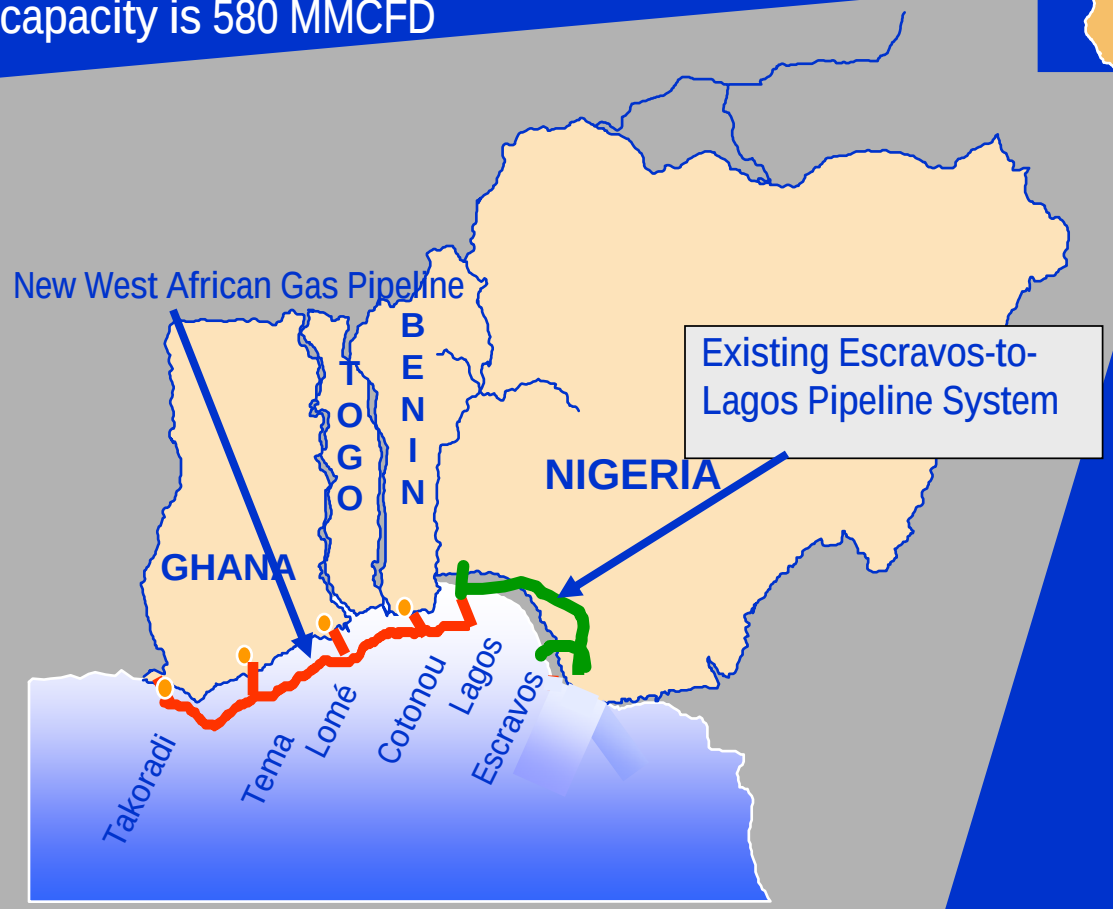
SUB REGIONAL COOPERATION

- Working assiduously to ensure the realisation of some key regional gas utilisation projects :
  - WAGP – Expected to come on stream in 2007 conveying gas from Nigeria to neighbouring countries of Benin , Togo and Ghana
  - Gas requirement is about 350 – 400 mmscf/d
  - Apart from creating avenue for effective gas utilisation also allows for use cleaner fuel - natural gas for power generation in these countries
  - Thus reducing pressure on other less efficient sources.

WEST AFRICAN GAS PROJECT

Pipeline originates from ELPS near Lagos and traverses land as well as offshore from Lagos Beach to Takoradi

Pipeline capacity is 580 MMCFD

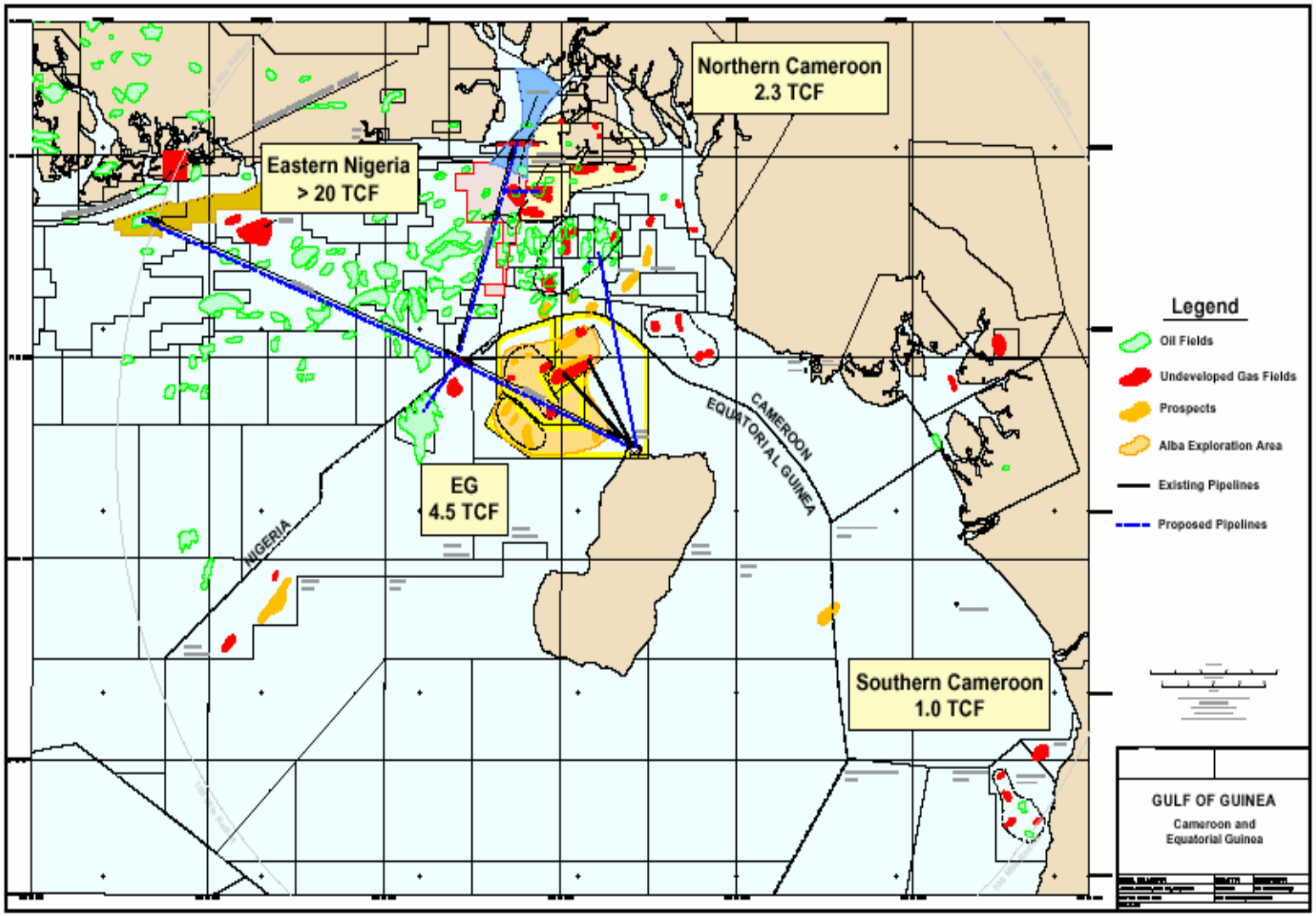


SUB REGIONAL COOPERATION (Cont'd)

- TRANS SAHARAN GAS PIPELINE:
  - Another effort at regional cooperation between Algeria and Nigeria
  - Currently at the feasibility study stage
  - Being conceived to convey natural gas from Nigeria to Europe through Algeria
- EQUATORIAL GUINEA:
  - Plan to supply 600 mmscf/day of gas to Train 2 of the Bioko LNG plant by 2009

PROPOSED TRANS NIGERIA ALGERIA GAS PIPELINE

Proposed Gas Supply to Equatorial Guinea



RENEWABLE ENERGY DRIVE

- **Reducing pressure on fossil fuel**
  - **Mambilla Hydroelectric Project with capacity of over 2,000MW**
  - **Gasohol "Green Petrol" or "Green Gasoline" – a programme being driven by Govt. to blend alcohol (10%) with Petrol**

- **Other options under consideration by Govt. include**
  - **Nuclear Power**
  - **Solar and**
  - **Wind**

Environmentally Friendly Fuel

- Govt.'s initiative on development of renewable energy through the introduction of biomass ethanol programme by producing fuel grade ethanol which would be blended with gasoline
- Transportation sector globally is responsible for about 25% of CO_2 emissions. A situation which could worsen with exploding urban population
- Imperatives for a more environmentally friendly fuel for automobiles and other forms of transportation
- Gasohol has a higher octane value
- The product of the combustion of this fuel is expected to reduce the volume of CO_2 released to the atmosphere

Environmentally Friendly Fuel (Cont'd)

- Ethanol will be produced from sugar cane and cassava which are widely grown in Nigeria
- This has the advantage of bringing more land under cultivation
- It creates employment for a wide variety of people
- Puts more disposable income into the hands of the farming community
- Puts less demand on gasoline
- EGP3 –G-T-L:
- To produce about 40,000 barrels per day of synthetic crude; capacity could be increased to about 120,000 b/d for export
- Other products are Diesel, Naphta and LPG
- Commitment not only to Gas Flaring reduction, but promoting the use of cleaner and more environmentally friendly fuel.

CARBON STORAGE – GAS INJECTION

- Since the late 1970's Nigeria has been engaged in gas injection:
  - To maintain reservoir pressure - the 1st being in Akri-Oguta field
- In response to Government legislation, a number of gas injection and recycling projects were instituted:
  - Obiafu – Obrikom
  - Kwale - Okpai
  - Asabo - Ekpe etc.
- About 1.5 bcf/d of gas are currently being re-injected

Potential CDM projects

- Of all the 6 projects under consideration by GGFR to benefit from CDM. Two are from Nigeria (Other countries are Russia, Indonesia, Angola and Cameroon)
- KWALE-OKPAI IPP: Utilises associated gas from five fields for power generation. Capacity --- 480MW using 140 mmscf/d
- AFAM IPP - 650 MW also using 190 mmscf/day
- Other Projects that may be considered include:
  - Obiafu-Obrikom Gas Injection Project: Involving the reinjection of between 270 – 350 mmscf/d. Has the potential to delay the release of the equivalence of 2.46 million tonnes of CO_2/year to the atmosphere
  - Renewable Energy Program of Govt. in which alcohol is blended with gasoline

APPROACH TO EMISSIONS REDUCTION

In taking up the challenge on GHG reduction, Nigeria has adopted the following approach:

- Put in place appropriate legislation to discourage gas flaring
- Introduced incentives to promote gas utilisation
- Govt. is directly involved in numerous gas projects

- Increased plants efficiency by promoting switching from a less efficient to a more efficient energy source e.g. LPFO and diesel to natural gas
- Promote the use of renewable energy sources in the long term
- Reforestation and control of desert encroachment

CONCLUSION

- Nigeria is endowed with Natural Gas
- Nigeria produces a lot of Natural Gas (in association with crude oil) an appreciable amount of which is flared
- The country has been proactively involved in controlling GHG emission through the provision of appropriate legislation and incentives long before the Rio Summit of 1992
- Since 1999, there has been a sharp reduction in gas flaring from about 70% to 35% in 2005 mostly through a policy shift from imposing penalty to providing incentives

CONCLUSION (Cont'd)

- Government is vigorously pursuing its aspiration of eliminating routine gas flaring by Year 2008 and this to a large extent is achievable
- Promoting the use of natural gas for power generation
- Set target for the elimination of gas
- Diversification of energy source as an alternative to dependence on fossil fuel
- Though not a developed country and not directly targeted as a consequence of the Rio Summit, Nigeria is fully committed to sustainable development and has demonstrated that it would not shift her responsibility to the coming generation

THANK YOU FOR YOUR KIND ATTENTION