Nigeria
Associated Gas Utilization Study

Perrine Toledano and Belinda Archibong

Thanks to Albert Bressand and Thomas Mitro for their thorough peer-review
Nigeria has an extensive regulatory and fiscal framework surrounding flaring and Associated Petroleum Gas (APG) use, as well as networks of domestic and international pipelines (such as the West African Gas Pipeline).

This has spurred a few APG use projects in the country including the landmark NLNG project using APG for LNG production for export.

However, deficient maintenance of non-integrated gas pipelines and unattractive gas and power pricing act as disincentives for APG use and investment in the domestic economy, particularly the power sector.

Deficient governance of the oil sector marked by the lack of an independent regulator and a history of payment defaults on the part of the NNPC and the power utility, combined with some unstructured regulation like the recent directive by the MPR urging oil companies to give flared gas to 3rd party investors for APG utilization projects has sparked much controversy among oil majors operating in the country.
The statistics of APG flaring in Nigeria:
How bad is it?

Overview stats on APG flaring

On the companies involved

Over the last decade

And their flaring trend over time

Nigeria accounts for just over 2% of global oil production and about 10% of gas flared globally in 2011.

Economic cost of flaring has been assessed at about $72bn from 1970-2006 = about $2.5bn/year in revenue losses.
(source: Nigeria Gas Association)
The statistics of APG flaring in Nigeria: How bad is it?

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Source: Department of Petroleum Resources (DPR) Nigeria, 2011

- Of the 2400 bscf of gas produced in 2011, 1800 bscf or about 75% was APG. About 28% of this APG was flared in a decreasing trend from 2006 continuing today.

- As of 2008, Nigeria was exporting about 3 bcf/d of gas in LNG form, while flaring about 2.5 bcf/d and providing only 0.5 bcf/d to the domestic power sector which accounted for about 70% of domestic gas consumption.
The statistics of APG flaring in Nigeria: Who is involved?

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Amount of Gas flared (bcm) in Nigeria in 2009 by company

- ExxonMobil: 4.1 bcm
- Chevron: 3.4 bcm
- ENI (NAOC): 2.1 bcm
- Shell (SPDC): 2.1 bcm
- Addax-Sinopec: 1.6 bcm
- Total: 1.0 bcm
- Others: 0.5 bcm

Total: 11.1 bcm


- ExxonMobil is the top gas flarer in the country as of 2009.
The statistics of APG flaring in Nigeria: Who is involved?

Over the last decade

And their flaring trend over time

Shell has been the top flarer on a cumulative basis over almost a decade, followed closely by Exxon, ENI and Chevron.

Overview stats on APG flaring

On the companies involved

2000-2008 % share of gas flared by Company in Nigeria

Source: Oni, 2011, Madueme, 2010
Shell has seen the most dramatic decrease in gas flared over the past decade spurred presumably by a combination of attractive fiscal incentives and public opprobrium concerning their actions in the Niger Delta region of the country.

<table>
<thead>
<tr>
<th>Year</th>
<th>Shell (SPDC)</th>
<th>ExxonMobil</th>
<th>Chevron</th>
<th>Total</th>
<th>Eni (NAOC)</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-2002</td>
<td>8.5</td>
<td>2.5</td>
<td>3.0</td>
<td>14.0</td>
<td>1.5</td>
<td>0.5</td>
</tr>
<tr>
<td>2003-2005</td>
<td>7.5</td>
<td>2.0</td>
<td>3.0</td>
<td>12.5</td>
<td>1.0</td>
<td>0.5</td>
</tr>
<tr>
<td>2006</td>
<td>6.5</td>
<td>1.5</td>
<td>2.5</td>
<td>10.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>2007</td>
<td>5.5</td>
<td>1.0</td>
<td>2.0</td>
<td>8.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>2008</td>
<td>4.5</td>
<td>0.5</td>
<td>1.5</td>
<td>6.0</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>2009</td>
<td>3.5</td>
<td>0.5</td>
<td>1.0</td>
<td>4.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Source: GE, 2011
The statistics of APG flaring in Nigeria: Who is involved?

Overview stats on APG flaring

On the companies involved

Over the last decade

And their flaring trend over time

Of the major IOCs, Chevron has flared the greatest share of its total gas produced for the last decade, with flared gas making up as much as 64% of total gas produced as of 2008; in comparison Shell has flared 12% of total gas produced as of 2008.

Source: Madueme, 2010
### What is the legal and fiscal framework in place to stop flaring and incentivize APG use?

<table>
<thead>
<tr>
<th>Government institutions involved in regulation of oil production/flaring</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Federal Ministry of Petroleum Resources (MPR)</strong></td>
<td>Headed by the Minister. In charge of formulating oil and gas policies and regulating Exploration &amp; Production (E&amp;P) activities by granting flaring allowances and monitoring E&amp;P activities. Controls the NNPC and DPR</td>
</tr>
<tr>
<td><strong>Department of Petroleum Resources (DPR)</strong></td>
<td>Originally the first legal agency created to regulate the petroleum sector in Nigeria; is currently the enforcement arm of the MPR</td>
</tr>
<tr>
<td><strong>Nigerian National Petroleum Corporation (NNPC)</strong></td>
<td>Government oil corporation, exerts Nigeria’s interests in the petroleum industry. The Nigerian Gas Company (NGC) is one of about 11 subsidiaries of the NNPC and is responsible for the development of an efficient gas industry. NNPC has generally 60% state equity share in the projects that it has trouble honoring</td>
</tr>
<tr>
<td><strong>Federal Ministry of Environment (FMENV)</strong></td>
<td>Federal ministry responsible for protection and improvement of water, air, land, forest and wildlife in Nigeria (note: except oil and gas)</td>
</tr>
<tr>
<td><strong>The National Environmental Standards and Regulations Enforcement Agency (NESREA)</strong></td>
<td>Subsidiary of FMENV, created to enforce environmental laws, policies and regulations in Nigeria. Acts as the regulatory arm of FMNEV</td>
</tr>
</tbody>
</table>
What is the legal and fiscal framework in place to stop flaring and incentivize APG use?

**Regulation:**
- Agencies and analysis
- Legal framework and analysis
- Fiscal framework and analysis

**Government institutions regulating oil production and flaring**

- **FGN**
- **MPR**
- **DPR**
- **NNPC**
- **FMEN**
- **NESREA**
- **NGC**
- **NLNG**

- 70% of FGN revenue comes from NNPC earnings
- The Federal Government of Nigeria (FGN), through NNPC, holds about 55-60% interests in most of these IOCs involved in gas flaring which impedes independent regulation and good governance.
What is the legal and fiscal framework in place to stop flaring and incentivize APG use?

<table>
<thead>
<tr>
<th>Regulation/Policies on Gas Flaring/ APG use</th>
<th>Description</th>
</tr>
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<tr>
<td><strong>1969 Petroleum Act and Regulations</strong></td>
<td>Encouraged use of APG, exempted multinational oil companies from paying royalties</td>
</tr>
<tr>
<td><strong>1979 Associated Gas Re-injection Act (APGRA)</strong></td>
<td>Forbade flaring of APG after Jan 1,1984 without permission from Minister of Petroleum <em>(not met)</em></td>
</tr>
<tr>
<td><strong>1985 Associated Gas Re-injection Act Amendment Decree 7</strong></td>
<td>Insignificant fine (about $0.46 per 1000 Standard Cubic feet flared by 1998)</td>
</tr>
<tr>
<td><strong>1992 Associated Gas Framework Agreement (APGFA)</strong></td>
<td>Fiscal incentives for companies involved in APG utilization</td>
</tr>
<tr>
<td><strong>2004 Associated Gas Re-injection Act and Associated Gas Re-injection Amendment Act</strong></td>
<td>Prohibited flaring without permission from Minister of Petroleum. Obligated all oil producing companies in country to submit detailed plans for gas utilization <em>(not met)</em></td>
</tr>
<tr>
<td><strong>2008 Nigeria Gas Master Plan</strong></td>
<td>Invited foreign IOCs to assist in construction of gas gathering plants and pipelines to supply weak power sector. Also included a flare out target date for companies to stop gas flaring by 2008 <em>(not met)</em></td>
</tr>
<tr>
<td><strong>2008 National Domestic Gas Supply and Pricing Policy and Regulations</strong></td>
<td>Established a domestic gas supply obligation arrangement that guaranteed the supply of a sufficient amount of gas by oil and gas producers to all active power plants in the country. Policy would also regulate the price of gas used in the downstream gas sector</td>
</tr>
</tbody>
</table>
What is the legal and fiscal framework in place to stop flaring and incentivize APG use?

- **2010 Associated Gas Reinjection (Amendment) Bill**
  - Proposed bill was setting a new deadline for flare out at Dec. 31, 2012 with allowance for a Temporary Gas Flaring permit from the MPR with payment of a fee.
  - The Bill, never passed, also stipulated that companies without facilities for APG use would not be permitted to engage in oil production.

- **2010 FGN Accelerated Flared Gas Development program**
  - Controversial directive from the FGN to IOCs mandating the companies to allow 13 third party investors access to oil fields, flow stations or well heads to get gas that would otherwise be flared and employ it in power generation and other APG use projects. A MoU was signed between the MPR and the private investors but directive has faced considerable opposition from many IOCs.
  - Some companies like Shell’s SPDC are reporting compliance with the directive: for 10% of its sites, Shell has been looking for third party investors (with Shell/ NNPC joint-venture building itself the gas gathering facilities for 90% of the sites).
  - As part of a broader Gas Development program, NNPC is also seeking to attract private investment for larger backbone pipelines, in particular the 395-km Calabar-Ajaokuta pipeline and the 740-km Ajaokuta-Kaduna-Kano pipeline, due for completion in 2017.

- **A controversial 2012 Petroleum Industry Bill**
  - Would completely overhaul most of the above acts and raise taxes on IOCs, creating a comprehensive legal framework for the exploitation of gas and petroleum resources in the country. Currently being debated.
What is the legal and fiscal framework in place to stop flaring and incentivize APG use?

- **2012 Petroleum Industry Bill**

  As part of its aims, the PIB is expected to:
  
  - “Enhance exploration and exploitation of petroleum and particularly gas resources in Nigeria and for Nigerian people
  
  - Optimize domestic gas supplies, especially for power generation and industrial developments
  
  - Deregulate and liberalize the downstream petroleum sector
  
  - Create efficient and effective regulatory agencies”
What is the legal and fiscal framework in place to stop flaring and incentivize APG use?

The PIB also includes provisions like:

- The creation of 2 regulatory entities- 1 for technical and commercial matters related to upstream and named the Upstream Petroleum Inspectorate. And one for downstream responsibilities and named the Downstream Petroleum Regulatory Agency

- Provisions for breaking up the NNPC into 3 parts (including a National oil and National gas company) and privatizing 2 parts

- An emphasis on the Domestic Supply Obligation (DSO) for gas created in the 2008 Domestic Gas pricing policy

- However the penalties instituted if the IOC fails to meet the DSO are weak

As well as provisions for a possible transitional gas pricing. There is currently nothing concrete regarding gas pricing in the Bill.
What is the legal and fiscal framework in place to stop flaring and incentivize APG use?

- **Definition and boundaries not followed**
  - Flare out dates are repeatedly shifted forward and not met
  - Weak monitoring and enforcement of regulation
  - No significant penalties for flaring over the last decade, and feeble enforcement of penalties is an issue

- **No independent regulator**
  - MPR is both a participant in, through the NNPC, and regulator of, through the DPR, of oil and gas activities in Nigeria, creating conflicts of interests reflected in the lax enforcement of flaring regulation. At the same time as a joint-venture partner at a very high level (around 60%), NNPC has been more than 1 - 2 years late in paying its equity share of cash calls. Both problems have created a lot of mistrust among the community of investors.
What is the legal and fiscal framework in place to stop flaring and incentivize APG use?

**Regulation: Agencies**

- High Petroleum Profits Tax Act (PPTA) rates (up to 85% of profits) (instituted in 1959) acted as a disincentive to gas utilization and spurred the introduction of an incentive regime (PPTA - Section 10A amended by Decree No. 30 of 1999):
  - Any amount invested in the separation of gas and crude oil from a reservoir as well as any amount associated with gas delivery is ‘Allowable expenses for upstream operations’
  - Gas produced and transferred from the natural gas liquid facility to the gas-to-liquids facilities taxed at 0% tax and 0% royalty
  - Capital expenditure associated with gas-to-liquid facility is cost-recoverable
  - Condensates that are re-injected will not lead to incentives
  - Those incentives are also applicable to non-associated gas

- As of 1998, all downstream gas utilization project-associated profits are taxed under the Companies Income Tax Act (30%) and benefit from the incentives specified by its Section 28 G:
  - Options: Companies eligible for a 3-year tax holiday or a 35% capital allowance
  - Tax deductible interest on any interest payable on any loan taken for a gas project
  - VAT exemption on any plant and equipment bought for gas utilization
  - Tax-free dividends under certain conditions (downstream investment made in foreign currency or goods imports during the tax-free period account for min. 30% of the company’s equity; not applicable if the company chose the 35% capital allowance)
  - Accelerated capital allowance post tax holiday - 90% (+15% if company opted for tax holiday)

**Regulation: Legal framework and analysis**

- Pricing policy of gas supply and power seen as a disincentive:
  - Below market-prices for domestic gas (as of 2009 $0.12/mmbtu domestically vs. $0.50/mmbtu on export markets), denominated in local currency, coupled with the terrible credit rating of the PHCN, former power public utility as well as highly unreliable gas pipelines

**Regulation: Fiscal framework and analysis**
What are some current APG use projects that could serve as a blueprint for future projects?

- Power Generation (IPP)
- Liquefied Natural Gas (LNG)
- Natural Gas Liquids (NGL)
- Gas to Liquid Conversion (GTL)

Notable APG use projects: the Nigeria LNG (NLNG) project with NNPC and Shell as primary shareholders and some GTL, NGL and IPP projects.

Given their distrust of the governance of the oil and gas sector, IOCs currently prefer high return export options like LNG and GTL projects to necessary IPP projects for the country. That said, 1) a PIB Gas pricing policy shifting towards market prices for gas and obligating IOCs to allocate a specified amount of gas to the domestic market along with 2) the recent PHCN privatization and power tariff hikes (due to withdrawal of subsidies) may shift this trend. However some IOCs now state that they have already committed their gas reserves into long term Gas Sales and Purchase Agreements in the export markets.
What power needs could the flared gas satisfy?

- Significant gas reserves often referred to as a “gas country with some oil in it”
  - Proven reserves at 180.5 tcf as of 2011

- The power sector makes up over 70% of the total domestic gas demand.

- With an electricity access rate of 51% and operational installed capacity of only 3500 MW there is significant potential in the use of flared APG to meet the country’s electricity needs.
What power needs could the flared gas satisfy?

- **Power Generation (IPP)**
- **Liquefied Natural Gas (LNG)**
- **Natural Gas Liquids (NGL)**
- **Gas to Liquid Conversion (GTL)**

Demand in the power sector is expected to grow significantly in coming years with more gas power plants being built/renovated following the privatization of PHCN.

APG can be utilized to meet this demand.

Source: Nwachukwu and Eboh, 2013
So why is APG not being used primarily for power generation?

- Unattractive gas pricing and electricity tariff regimes in the country (as described previously)
- Unreliable gas pipeline networks because of poor maintenance on the part of NGC
- By one DPR source, some previous APG for power generation projects from IOCs spurred by the directive to meet the Gas Plan’s 2008 flare out deadline were:
  - A 350 MW plant in Bonny by Mobil
  - A 900 MW, 2-part construction plant in Okpai by Agip
  - The takeover of the Afam and Sapele plants by Shell and the addition of 700 MW
- These efforts failed largely (except for part 1 of the Okpai plant by Agip and part of the Afam plant by Shell presented after) due to:
  - Refusal of the FGN to guarantee steady payments to the IOCs for any power generated and sold to the PHCN
  - Associated wariness of IOCs due to PHCN’s terrible credit rating (it was owing over $60 million to the NNPC for gas supplied as of 2009)
- The recent PHCN privatization efforts and the new PIB Gas Pricing policy might make APG use for the domestic power sector more attractive for oil companies.
APG use company case study: Eni Okpai power plant (IPP)

- **Project Participants:**
  - NAOC - a joint venture of NNPC (60%), Eni (20% and project operator) and Conoco Philips (20%)

- **Project Description and Motivation:**
  - Nigeria’s 1st IPP, completed in 2005 by ENI. Expected to raise power production by ~15%
  - Part of Eni’s 2008 “Zero Gas Flaring” policy and to adhere to 2008 FGN Flare out deadline, also a CDM project. It was originally intended as a 2 part 900 MW construction but scaled back due to factors mentioned in preceding slide.
  - Generates 480 MW of power. 450 MW of this electricity is transferred for consumption by Nigeria’s eastern region, while 30MW are used by Eni.

- **Project Location:**
  - Near the NAOC’s Oil and Gas Processing Plant (OGPP) in the Kwale region in Delta state in southeastern Nigeria

- **Associated Gas Use:**
  - Uses about 80 mmcf/d
  - Uses formerly flared associated gas at Kwale’s OGPP operated by NAOC
  - Also uses gas extracted from its oil areas in the Delta states

- **Project Technology:**
  - Integrated cycled plant with 2 gas turbines and 1 steam turbine
  - 14 km pipeline for transporting fuel gas from NAOC system to power plant, commissioned by NAOC
  - Overhead transmission line of 130 kv, 54km in length, joins plant to national grid in Onitsha, Anambra in Eastern Nigeria
APG use company case study: Eni Okpai power plant (IPP)

Figure: Eni (NAOC) Okpai IPP APG project schematic.

Source: Linzi, Eni
APG use company case study: Shell Afam power plant (IPP)

Project Participants:
- The Shell Petroleum Development Company of Nigeria Limited (SPDC)(JV including NNPC(55%), Shell(30%), TEPNG(10%), NAOC(5%)), Shell is the operator

Project Description and Motivation:
- Motivated in part by 2008 Gas Master plan which stipulated a flare out deadline of 2008
- A CDM project, the Afam VI power plant generates grid electricity from a high efficiency plant utilizing low carbon intensity gas with some allowance for the system to absorb associated gas.
- Operational in 2008 - investment costs by its JV partners of up to $1.3 billion; Reported to have raised Nigeria’s power generating capacity by 14-24%
- Due to reported gas shortages, the plant has suffered numerous shutdowns since it became operational with the most recent being in July 2013.

Project Location:
- Power station located in Rivers state, in the Niger Delta region

Associated Gas Use:
- Gas supply is mainly from the Okoloma gas plant, with gas from the Afam NAPG field, a production capacity of 240MMcf/d of non-associated gas but allowing the system the capacity to absorb associated gas through the NGC regional gas network.

Project Technology:
- Connected to the Nigerian grid with a total installed capacity of about 650MW
- Installation of new combined cycle gas turbines in a plant fitted with air-cooled condensers and 40m high stacks
- Additionally, the Afam VI plant replaces existing Afam I-IV units, which had not been operational for some time.
APG use company case study: Shell Afam power plant (IPP)

Power Generation (IPP)

Liquefied Natural Gas (LNG)

Natural Gas Liquids (NGL)

Gas to Liquid Conversion (GTL)

Figure: Shell Afam VI (in purple) IPP APG project schematic.

Source: UNFCC, CDM
**APG use company case study: NLNG (LNG)**

**Project Participants:**
- NLNG: NNPC (49%) and Shell (25.6%), Total LNG (15%), Eni (10.4%)
- NLNG in long-term gas supply agreements with 3 joint ventures: SPDC (Shell), TEPNG (former EPNL) and NAOC (Eni)

**Project Description and Motivation:**
- One of the most significant APG use projects in Nigeria
- Early motivation was a desire to utilize country’s significant natural gas reserves and meet rising international demand and attractive prices for LNG
- 6 liquefaction units or trains possessing a production capacity of 22 mtpa of LNG or about 8% of global exports as of 2011; First production of LNG in 1999
- Cost of the first 2 trains was about $3.6 bn and financed by NLNG’s shareholders (with NNGC’s share carried by Shell). The 3rd train’s cost of about $1.8 billion was financed by 3rd party investors with loans in 2002. The next 2 trains, 4 and 5, cost around $2.2 billion and were financed by a mix of revenue generated in-house and 3rd party loans in the amount of about $1.06 billion.
- Currently manages 16 long term LNG sales contracts (these buyers include Enel, Repsol Gas Natural LNG (Stream), Botas, GDF Suez, GALP GN, BG LNG, Endesa, ENI, Iberdrola, Shell Western LNG BV and Total Gas and Power Ltd.)

**Project Location:**
- Constructed on 2.27 square km of mostly reclaimed land in Finima, Bonny Island in Rivers State in Southern Nigeria

**Associated Gas Use:**
- Over the 1999-2012 period, converted some 104 billion cubic meters or 3.3 tcf of associated gas to LNG/NGL products for export
- Gas collected by the 3 joint ventures in supply agreements with NLNG from their oil fields
- NLNG has signed Sales and Purchase Agreements (SPAs) with off-takers (all Nigerian companies) to deliver 150,000 tons of LPG into the Nigerian market annually. The first delivery was in 2007.

**Project Technology:**
- 6 LNG processing units or trains with a total capacity of 22mtpa
- Diversified gas supply from APG and NAPG and 6 primary gas transmission pipelines with 4 onshore pipelines through more than 110 communities
APG use company case study: NLNG (LNG)

Figure: Overview of Nigeria LNG project.

APG use company case study: Exxon Mobil Oso condensate project (NGL)

✿ **Project Participants:**
  - Exxon Mobil: 35%, NNPC: 65%

✿ **Project Description and Motivation:**
  - APG used for reinjection to recover NGLs. Producing 110,000 bpd Natural Gas Liquid (NGL) for the export market.
  - Expected, at its inception in 1998, to recover 350 million bbl of NGL from Exxon’s Oso condensate field over its 20+ year lifespan
  - Cost of project reported to be between $218 - $900 million. Mobil fronting 35% of the total cost of the project in equity, NNPC’s 65% share in the project cost is covered by a loan from the World Bank, the International Finance Corporation (IFC), among others - first upstream petroleum project to be sponsored by the World Bank in Nigeria.

✿ **Project Location:**
  - Proceeds from an offshore location at the Oso field and an onshore one at the Bonny River Oil Terminal linked by pipelines
  - Oil Mining Lease No. 70, about 35 miles offshore from Mobil’s Qua Iboe oil Terminal in Ibeno, Akwa-Ibom state in southeast Nigeria

✿ **Associated Gas Use:**
  - Monetize NGLs that are produced together with the natural gas flow from the Oso condensate field and ‘other associated gas production’
  - Associated gas is re-injected as an important NGL recovery system, thereby minimizing flaring.

✿ **Project Technology:**
  - The project consists of 21 oil/condensate wells, 8 platforms, 1 point mooring, and 130 miles of offshore pipelines. It also has 3 primary storage tanks and loading facilities onshore at Qua Iboe Terminal.
APG use company case study: Exxon Mobil Oso condensate project (NGL)

Power Generation (IPP)

Liquefied Natural Gas (LNG)

Natural Gas Liquids (NGL)

Gas to Liquid Conversion (GTL)

Source: Offshore Magazine Vol 58 Issue 10

Figure: Exxon Mobil APG use: Oso NGL project location
APG use company case study: Chevron Escravos project (GTL)

- **Project Participants:**
  - 75% Chevron (CNL) 15% NNPC and 10% Sasol
  - Sasol bringing here its Fischer–Tropsch process technology

- **Project Description and Motivation:**
  - Converts APG to GTL diesel and GTL naphtha
  - Project’s motivations included the establishment of incentives by the Nigerian National Gas Policy of March 1995 (materialized by the incentives of PPTA and CITA established in 98-99).
  - Motivations also included the creation of agreement with NGC to accept and deliver lean (dry) gas from associated gas to domestic markets.
  - The project has a capacity of 34,000 bpd with anticipated expansion to 120,000 bpd.
  - Construction started in 2005 and the project is expected to come online in 2014.

- **Project Location:**
  - Located in the Escravos region in the Niger Delta region of Nigeria

- **Associated Gas Use:**
  - Associated gas from the Okan and Mefa oil fields in the Oil Mining Lease 49, Delta region of Nigeria

- **Project Technology: Includes:**
  - The technology used consists of an offshore gas gathering and compression platform (GSCP), a gas plant onshore, and a floating storage and offloading vessel.
  - After the liquids are extracted from the associated gas, the left over lean gas would be compressed and delivered into a 16-in gas pipeline to the NGC.
  - The West African Gas pipeline links to Chevron’s existing Escravos-Lagos gas pipeline
APG use company case study: Chevron Escravos project (GTL)

Power Generation (IPP)

Liquefied Natural Gas (LNG)

Natural Gas Liquids (NGL)

Gas to Liquid Conversion (GTL)

Nigerian Escravos Gas Project—Full Plan

Source: Oil and Gas Journal Vol. 96 Issue 16

Figure: Chevron Escravos GTL project schematic
Some potential future APG use projects:

- **Power Plants**: The government is requiring all IOCs to build at least one IPP as part of the 2008 Gas Master plan. As a result, Total is developing a 400MW IPP on OML 58 in Rivers State (the project was slated to go online in 2007 but is still currently in progress) and Exxon is developing a 500MW IPP at its Qua Iboe Terminal.

- **Gas Gathering Facilities**: Shell through its SPDC is investing $2bn in two projects to extend gas-gathering facilities to 90% of its operations: the Southern Swamp Associated Gas Solution (SSAPGS) and the shallow-water Forcados-Yokri projects, with a combined capacity of 185,000 barrels of oil equivalent a day at its peak. It is also intended to produce gas for domestic power consumption. Once completed (in 2016), it is reported to reduce Shell’s gas flaring by 95%.

- **Additional pipelines**: NNPC working on building larger backbone pipeline (395-km Calabar-Ajaokuta pipeline and the 740-km Ajaokuta-Kaduna-Kano pipeline) hoping to be completed in 2017. Nigeria has also the ambition to build a trans-Saharan gas pipeline (first proposed in 2002) that would travel through Niger and Algeria, and link Delta gas reserves to European markets. Total and Russia’s Gazprom have shown interest in the project but the hefty cost estimates (of above $30bn) and an unstable security situation in the Delta and Sahara regions have stalled the project.
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