



Equatorial Guinea Associated Gas Utilization Study

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Thanks to Tom Wairegi for his thoughtful review



**Columbia Center
on Sustainable Investment**

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Summary of findings

Weak fiscal and legal regulation for APG use

Small Domestic Market

Ownership of APG with SOE Sonagas

APG Projects: LNG

3G Consortium

- Little legal regulation surrounding the use of Associated Petroleum Gas (APG) in country, although the 2006 Hydrocarbons law might incentivize the use of surplus APG since APG that is not used in petroleum operations become the property of the state
- No explicit fiscal incentive framework around APG use has implemented
- Small domestic market for gas, with very little use of APG for LPG, methanol, and power production
- The uptick in interest in APG use for export and specifically LNG export started with Punta Europa LNG project in 2007
- Sonagas, the state owned gas company has taken steps to increase the use of APG in country with the creation of the '3G consortium'



The statistics of APG flaring in Equatorial Guinea: How bad is it?

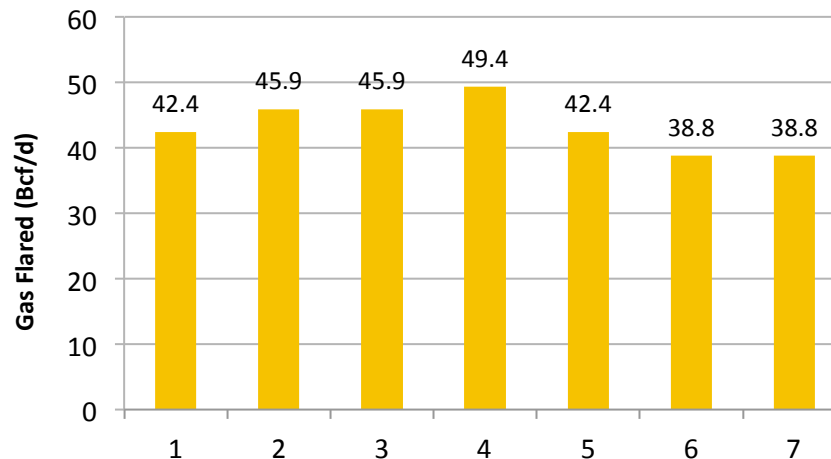
Overview stats on
APG flaring

On the companies
involved

Over the last
decade

And their flaring
trend over time

Flared Gas - Equatorial Guinea 2000-2010



Year (1=00-02; 2=03-05; 3=06; 4=07; 5=08; 6=09; 7=10)

Source: NOAA satellite estimates 2011, GE 2011

- ◆ Equatorial Guinea is the 3rd largest oil producer in Sub-Saharan Africa (SSA) after Nigeria and Angola.
- ◆ Of the 243 Bcf of natural gas produced in 2011, the majority of the gas was either flared or re-injected. A small amount of the gas was used as feedstock primarily for the Punta Europa projects (IPP, LPG, Methanol, LNG).



The statistics of APG flaring in Equatorial Guinea: Who is involved?

Overview stats on
APG flaring

ExxonMobil

TULLOW
INC

HESS

On the companies
involved


Marathon Oil
Corporation.

ne noble
energy

Over the last
decade

And their flaring
trend over time

- ◆ Three IOCs, Exxon Mobil, Marathon Oil and Hess dominate the petroleum sector with Noble Energy and Tullow being smaller investors.
- ◆ ExxonMobil-led consortium's oil field at Zafiro (country's largest but in decline), flared about 75% of APG amounting to around 120 Mmscf/day and Hess's Ceiba field and Okuma complex flared about 40% in 2008. Flaring is claimed to have stopped at Marathon's Alba field while the APG in Hess' Ceiba field and Exxon Mobil's Zafira field are re-injected or used for gas lift when they are not flared.

What is the legal and fiscal framework in place to stop flaring and incentivize APG use?

Regulation:
Agencies

Regulation: Legal
framework and
analysis

Regulation: Fiscal
framework and
analysis

| Government institutions involved in regulation of oil production/flaring | Description |
|--|--|
| Ministry of Mines, Industry and Energy | Charged with overall regulation of the oil and gas industry in Equatorial Guinea |
| Sociedad Nacional de Gas de Guinea Ecuatorial (Sonagas GE) | <p>National gas company, charged with managing the government's shares and interests in the gas industry</p> <p>Sonagas GE has stated that one of its goals is to create an integrated sub-regional system for exploiting surplus associated gas, by building gathering pipelines for surplus APG from producing fields in Gulf of Guinea sub-region. The gas would be processed at Bioko Island. A consortium named 3G would own the pipeline system. The shareholders of the consortium include: state of Equatorial Guinean (15%), Sonagas GE holding (50%), Union Fenosa Gas (20%) and Galp Energia (15%).</p> |



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| Regulation/Policies on Gas Flaring/APG use | Description |
|--|---|
| 2006 Flaring Ban Chapter XVI, article 76 of Hydrocarbons code | Flaring ban instituted in 2006 by Law unless authorized by the Ministry when requested by the Contractor in writing, citing technical, economic, financial and or environmental reasons for the flaring |
| 2006 Flaring Ban Chapter XVI, article 72 of Hydrocarbons code | “All Associated Natural Gas that is produced and not utilized in Petroleum Operations is the property of the State. The Development and Production of all Natural Gas must be carried out in partnership with the National Gas Company” |
| 2006 Flaring Ban Chapter XVI, article 73 of Hydrocarbons code | Contractor must build facilities needed for exploitation of natural gas which is not developed but used for petroleum operations. These facilities include, among others, separation of APG from liquid hydrocarbons. The facilities are used by the National Gas Company to exploit Natural Gas. |



What is the legal and fiscal framework in place to stop flaring and incentivize APG use?

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analysis

- 🔴 Definition and boundaries not followed
 - Flaring not mandated by Law till 2006 and subsequently not met
 - Flaring was supposed to stop in 2006 but that commitment had not happened
- 🔴 Weak monitoring and enforcement of insufficient regulation
 - Lack measurement and reporting of gas flaring figures
- 🔴 Regulatory Approval
 - No explicit framework for flaring approval under the 2006 flaring ban



What is the legal and fiscal framework in place to stop flaring and incentivize APG use?

Regulation:
Agencies

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Regulation: Fiscal
framework and
analysis

| Fiscal Framework on Gas Flaring/APG use | Description |
|---|--|
| | No explicit fiscal framework surrounding APG use |



What power needs could the flared gas satisfy?

Power Generation
(IPP)

Liquid Petroleum
Gas (LPG) and
Methanol

Liquefied Natural
Gas (LNG)

- Significant gas reserves, made up mostly of offshore APG near Bioko Island
 - Proven gas reserves at 1.3 Tcf as of 2013
 - Total gas production of 243 Bcf in 2011; with only 56 Bcf consumed domestically
- Low electricity access (per capita consumption - 152kwh as of 2008 compared with 539kwh in the rest of SSA region); population depends on expensive local diesel-generated electricity
- With about 80% of electricity coming from oil and gas-fired plants, there is significant potential for APG use in power generation – only one power generation project in Bioko Island has been recorded, however. The mainland is supplied by thermal plants whose grids are disconnected from the island.



What are some current APG use projects that could serve as a blueprint for future projects?

Power Generation
(IPP)



Liquid Petroleum
Gas (LPG) and
Methanol

- The main focus for Equatorial Guinea government's strategy of gas utilization has been on Marathon's Alba condensate field and associated plant. Over 800 Mmcf/d of Alba Gas is produced. It provides the feedgas for various projects based at Punta Europa in North Coast of Bioko Island.

Liquefied Natural
Gas (LNG)



APG use company case study: National Power Generation Plant

Power Generation
(NPP)

Liquid Petroleum
Gas (LPG) and
Methanol

Liquefied Natural
Gas (LNG)

🔥 Project Participants

- Owned by the Guinea Government and operated by the state owned power company Segesa

🔥 Project Description and Motivation

- Built in 1999, the 10.4 MW Turbo Gas Power Generation provides electricity to Bioko island in the capital city of Malabo.
- By 2004, an extra 17 MW of generation capacity was added, and in 2011, another 120 MW was added which is more than the current demand at Bioko island.

🔥 Project Location

- Punta Europa in the northern end of Bioko island

🔥 Associated Gas Use

- About 14 Mmcf/d of primarily associated gas from Marathon's Alba field



APG use company case study: LPG Processing Plant and Methanol Plant

Power Generation
(IPP)

Liquid Petroleum
Gas (LPG) and
Methanol

Liquefied Natural
Gas (LNG)

◆ Project Participants

- LPG plant: Marathon Oil (52.2 %), Samedn (Noble Energy, 27.8%) and Guinea Equatorial Oil and Gas Marketing (20%).
- Methanol Plant: Atlantic Methanol Production Company (AMPCO), a consortium of Marathon Oil (45%), Samedn (Noble Energy, 45%) and Guinea Equatorial Oil and Gas Marketing (10%).

◆ Project Description and Motivation

- Condensate and natural gas extracted from the Alba platform are sent to onshore Gas LPG processing Plant at Punta Europa for processing into various LPG fractions for exports. The plant processes up to 20,000 bpd LPG and 65,000 bpd of condensate. The plant was commissioned in 1991 and modernized in 2003-2005.
- Approximately 130 Mmcf/d of the dry gas remains after the condensate and LPG are removed at the AMPCO plant, (built in 2001, on Bioko Island), where 3,000 gross tonnes of methanol is produced daily.
- Methanol is produced for export via 2- 300,000 ton methanol carriers. The plant reportedly has a storage capacity of 900,000 bbls.

◆ Associated Gas Use

- According to the Ministry of Mines, the gas consumed by the methanol plant has eliminated the need to flare gas at the Punta Europa gas processing plant.
- The shareholders of the two projects plan to supply domestic economy with LPG that is currently being exported.



APG use company case study: Punta Europa LNG (LNG)

Power Generation
(IPP)

Liquid Petroleum
Gas (LPG) and
Methanol

Liquefied Natural
Gas (LNG)

◆ Project Participants

- Marathon (60%), GE Petrol (25%), Mitsui (8.5%), Marubeni (6.5%)

◆ Project Description and Motivation

- 2nd LNG project after Nigeria in SSA
- Came online in 2007 – Receiving part from the dry gas from the LPG processing plant (600 Mmcf/d in 2007 and 700 today)
- Production currently close to 883 Mcf/d with 5 shipments per month
- All LNG produced so far has been sold to BG group - set to purchase 3.4 mpta under a 17 year purchase agreement starting in 2007 (an agreement that ought to be reviewed).
- Additionally, negotiations are ongoing with Societe Nationale des Hydrocarbures of Cameroon (SNH) and Nigeria's NNPC to purchase gas for processing at the LNG plant on Bioko Island.

◆ Project Location

- Bioko island near the Punta Europa LPG plant

◆ Associated Gas Use

- Train 1 is designed to process 3 Tcf of associated gas from the Alba field using a pipeline operated by the 3G consortium.
- Train 2 and future LNG trains would process gas from both fields in Equatorial Guinea and neighboring countries.

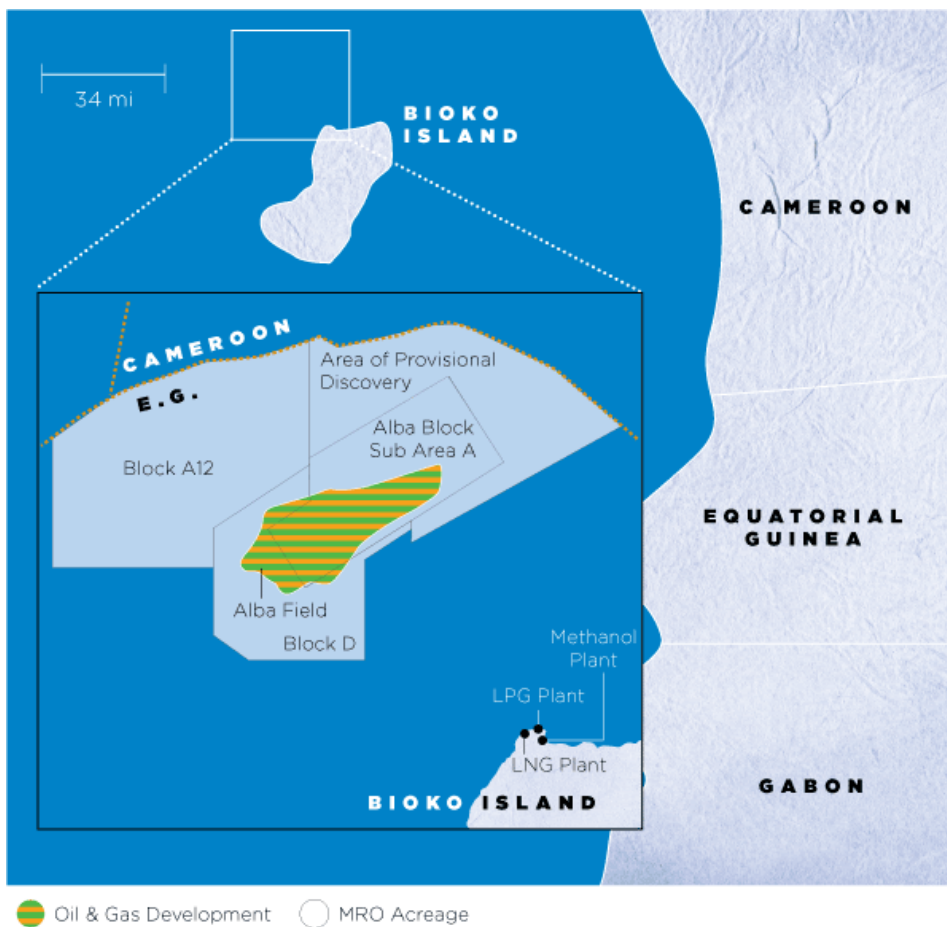


APG use company case study: Punta Europa LNG (LNG) and Methanol Plant

Power Generation (IPP)

Liquid Petroleum Gas (LPG) and Methanol

Liquefied Natural Gas (LNG)



Source: Marathon Oil

Figure: Map showing location of LNG, Methanol Plants, and Alba Field in EG



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