



Ghana

Associated Gas Utilization Study

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with thanks to Tom Mitro for his review.



**Columbia Center
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Summary of findings

Weak fiscal and legal regulation for APG use

Strong government policy reform of the power sector

APG Projects: Jubilee's field needs and Atuabo Project for domestic use

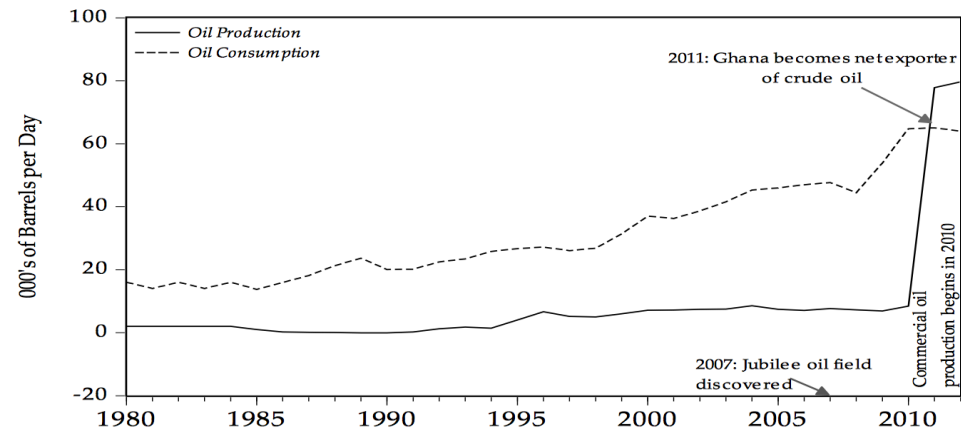
West African Gas Pipeline

- ◆ “Zero Flaring Policy” is the only anti-flaring regulatory program on Associated Petroleum Gas (APG) use and it is not binding. It has not been fully enforced until October 2014. There is also no explicit fiscal incentive framework around APG use.
- ◆ The government has both decided to increase the reliance of the power sector on gas and to increase access to power. Jubilee's field associated gas will fulfill both objectives.
- ◆ Benefiting from CDM, the Atuabo gas processing facility will process Jubilee's associated gas that is not needed for local power needs of the FPSO or for oil recovery enhancements. The gas processed will be used domestically.
- ◆ Further developments on the West African Gas pipeline could expand the opportunities to use Ghana's APG for power generation.



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

Overview stats on APG flaring



Source: International Energy Statistics, U.S. EIA database 2014

On the companies involved

- ◆ Ghana's oil production has increased from 7,000 barrels per day (bbl/d) in 2009 to 99,000 bbl/d in 2013, after the discovery of the **Jubilee oil field** in 2007.
- ◆ Flaring became an issue in Ghana only when Jubilee's first oil came on line in 2010. At the Jubilee field, with government permission, 0.048 BCM of gas was flared between June and September 2014. However, the authorization expired at the end of October 2014. Currently, most of associated gas from Jubilee Field is processed in Atuabo Project.
- ❖ However, less than 0.5% of associated gas of the Jubilee field is made of Isopentane, a highly flammable gas at room temperature and pressure, which makes it difficult to process. The National Gas Company has been looking for buyers of Isopentane who can convert it into energy generating sources to avoid flaring it.

The statistics of APG flaring in Ghana: Who is involved?

Overview stats on APG flaring



On the companies involved

- The companies involved are those who own and operate the Jubilee Field since this is the main producing field in Ghana



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

Agencies

Legal framework

Fiscal framework

Government institutions involved in regulation of oil production/flaring	Description
Ministry of Environment, Science and Technology – represented through the Environmental Protection Agency (EPA)	Leading public body responsible for the protection and improvement of environment in Ghana. Is responsible for issuing environmental permits and pollution abatement notices for controlling waste discharges, emissions, deposits or other sources of pollutants.
Ministry of Energy and Petroleum	Charged with policy-making and oversight responsibility for the oil and gas sector in Ghana.
Petroleum Commission	Is the upstream regulator with responsibility mainly for qualifying licensees, approving exploration and development plans, and implementing local content regulations.
GNPC (Ghana National Petroleum Corporation)	Is the national oil company. Responsible for: commercializing oil and gas, and negotiating petroleum agreements with International Oil Companies (IOCs). It was the de facto regulator until the establishment of the Petroleum Commission in 2010.
Ghana National Gas Company (GNGC)	Implemented the Jubilee gas infrastructure and acted as gas aggregator/marketer. According to the Government of Ghana, GNGC will be merged into GNPC.



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

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Regulation/Policies on Gas Flaring/APG use	Description
No Flaring Policy, 2010	Government maintains a “no flaring or venting of natural gas” policy since 2010, when oil production began. However, there has been exception under the policy. The Environmental Protection Agency and the Ministry of Energy and Petroleum approved the flaring at Jubilee Field arguing that the decision was in the interest of the economy.
EPA Act 1994, Section 2(f)	Issuance of environmental permits and pollution abatement notices for controlling waste discharges, emissions, deposits or other sources of pollutants.
Global Gas Flaring and Venting Reduction Voluntary Standard	Jubilee Field, as recipient of World Bank financial support should comply with the voluntary standards put forth by the World Bank Group’s Global Gas Flaring Reduction Public-Private Partnership.



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

Agencies

Legal framework

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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)

Liquefied Natural
Gas (LNG)

Natural Gas
Liquids (NGL)

Gas to Liquid
Conversion (GTL)

- The use of APG is intended to help solve the perennial power shortage and its attendant outages.
- The Ministry of Energy in 1989 instituted the National Electrification Scheme (NES) as Government's principal policy to extend electricity to all parts of the country over a 30-year period from 1990-2020. There is significant potential for APG use for power generation.
- In Ghana, hydro and thermal have been two major sources of power, with hydro electricity accounting for 55.5% among generation sources, including Akosombo Hydro Power Station, Kpong Hydro Power Station and Bui Hydro Power Station. However, climate change and the changed pattern in rainfall make hydroelectricity less sustainable. It is expected that thermal generation will take the leading place in the generation mix in the next decade. Thus, the Atuabo project will play an important role and associated gas naturally fits into the plan.
- Furthermore, the West African Gas Pipeline that mostly brings the associated from the Escravos field in Nigeria along the West Africa coast including into Ghana could be soon made bi-directional by enabling the APG generated in West Ghana to be transported to Tema, the power station in East Ghana. This is still a project but it could expand the opportunities for APG-to- power use.

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)

- The most significant APG use project so far is the Atuabo gas processing facility project. It is a standout effort in terms of APG use as the anchored gas for the facility is Jubilee's APG and the gas processing facility is designed to process gas for domestic use. The processing facility is designed to process APG from other fields as well.



APG use company case study: Jubilee field

Reinjection

Local power needs

Gas processing
facility

Project Participants

- Owned by Tullow Unit Operator (35.48%), Kosmos Technical Operator (24.1%), Anadarko (23.49%), Ghana National Petroleum Co. (10%) and Petro SA Ghana (4.05%)
- The World bank and IFC have provided significant financial support to the project.

Project Description

- Jubilee field was discovered in 2007, and the first oil was celebrated in December 2010.
- The project relies on an FPSO to process oil and gas, which is an offshore production platform with processing and storage facilities.

Associated Gas Use

- FPSO Power Requirements
- Gas injection for reservoir pressure maintenance and enhanced recovery
- Export of the gas to a processing facility or to market (Atuabo Project)

The target production level of the Jubilee field is 120,000 bbl/oil per day, and associated gas of 120 mmscfd (million standard cubic feet per day). Around 20 mmscfd are used to power the FPSO and another 30 for injection to enhance oil recovery. The remaining 70 units can be brought onshore. **There has been flaring before the availability of the gas processing plant.** Tullow and GNPC are working together on the compression capability at the field to reach a production of 150 mmscfd of associated gas.

APG use company case study: Atuabo Project – Gas Processing Facility

Gas Processing
Facility

Power Generation
(IPP)

Natural Gas
Liquids

🔥 Project Introduction

- Atuabo is a gas commercialization project, which entails building the Atuabo gas processing facility, an offshore pipeline and an onshore pipeline that will transport gas from the Jubilee field to Atuabo.
- 95 mmscfd of lean gas is supplied daily to the power utility, Volta River Authority (VRA) to generate electricity and the remaining gas under the form of Liquefied Petroleum Gas (LPG) is supplied to the local firm Quantum Terminal Limited for onward distribution to the consumers. It is possible that some of it will be used for fertilizer production in the future.
- The project achieved mechanical completion in August 2014, and experienced commissioning from November 2014 to April 2015. In June 2015, it was processing associated gas of 100 mmscfd from Jubilee field, which accounts for 2/3 of installed capacity of the project.

🔥 Project Participants

- Sinopec Petroleum, a Chinese company, leads the construction of Ghana's gas infrastructure, and is a partner with the Ghana National Gas Company Ltd (GNGCL) in developing the infrastructure.

🔥 Project Description and Motivation

- Due to the limited power requirement of FPSO, and limited reinjection level, the two measures could only take a limited portion of the associated gas. The continuous injection of the gas into the reservoir unit has resulted in excessively high reservoir pressure.
- When the Atuabo Project is finished, it is expected to take all the flared gas.

APG use company case study: Atuabo Project

Project Motivation

◆ Project Funding

- Funding for the Atuabo Project comes from the \$3 billion loan from the China Development Bank (CDB), signed in September 2010, and approved by the IMF in December 2010. The start of work was pre-funded by Sinopec.
- The government of Ghana has entered into a commercial agreement with UNIPEC Asia Company Limited, a Chinese firm, to buy Ghana's jubilee oil for the next 15 years. Under the agreement, Ghana will be supplying China with 13,000 barrels of crude oil daily, which is the share of Ghana's oil in the jubilee field, and will be sold at market price.
- The Ghanaian oil is not being used as collateral for the loan. The money will not be paid off using the country's natural resources.
- Ghana National Gas Company (GNGC) explained that the \$700 million gas project which the loan will finance will be able to pay off the \$3 billion loan after five years.

◆ CDM Project: Jubilee Oil Field Associated Gas Recovery & Utilization Project

- Purpose: To recover the associated gas that would otherwise be flared at the Jubilee oil field.
- Participants: Ghana National Gas Company (Host), Carbon Ghana Ltd. (Host) and Carbonswiss AG (both companies are affiliates and help countries achieve GHG reduction and get Kyoto Protocol's Clean Development Mechanisms Credit in exchange).
- CDM helped recover the associated gas at Jubilee in an economically feasible way by increasing the IRR over the minimum threshold.
- UNFCCC confirmed the project on 25 October 2010.



TEN Fields

Reinjection

Local power needs

Gas processing
facility

Project Introduction

- The TEN fields are named after the Tweneboa, Enyenra and Ntomme oil and gas fields in the deep water of Ghana. First oil is expected for mid-2016, with a plateau production rate of 80,000 barrels of oil per day.

Project Participants

- Tullow 49.95% is the operator, with other equity holders including Kosmos (18%), Anadarko (18%), GNPC (10%) and Sabre (4.05%).

Associated Gas

- Tullow and its partners will strictly observe the “No gas flaring” policy at the TEN project.
- The share of associated gas not re-injected in the reservoir will be used to power the FPSO or processed in Atuabo Project. The plan is to retrofit the capacity of the pipelines leading to Atuabo to accommodate Ten’s associated gas.



References

- ◆ Ghana Country Analysis (EIA). Aug. 2014. <http://www.eia.gov/countries/country-data.cfm?fips=gh>
- ◆ “Gas-flaring could extend beyond deadline – Tullow.” – Joy Online, 10 Oct. 2014.
<http://www.myjoyonline.com/business/2014/October-20th/gas-flaring-could-extend-beyond-deadline.php>
- ◆ “Ghana to Lose Millions of Dollars to Gas Flaring.” – All Africa, 12 Jun. 2014. <http://allafrica.com/stories/201406121693.html>
- ◆ “Legal and Policy Framework.” – Tullow, Aug. 2009.
https://www.elaw.org/system/files/Jubilee+Field+Draft+EIA+Chapter+2_5+Aug+09.pdf
- ◆ “Ghana’s Environmental Protection Act of 1994.” 06 July 2011.
<http://ghanaoilwatch.org/index.php/ghana-oil-and-gas-news/931-ghanas-environmental-protection-act-of-1994-act-490-and-the-offshore-petroleum-industry-marine-environmental-pothole-filling>
- ◆ “Review of the Legislative and Regulatory documents for the oil and gas industry.” 19 Oct. to 17 Nov. 2009.
http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2012/07/04/000356161_20120704033542/Rendered/PDF/704350WPOP11970tory0Framework0Final.pdf
- ◆ “EITI Workshop on Oil & Gas.” 18 Jun. 2010.
http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CCMQFjAA&url=http%3A%2F%2Fwww.gheti.gov.gh%2Fsite%2Findex.php%3Foption%3Dcom_phocadownload%26view%3Dcategory%26download%3D81%3Aoil-and-gas-discovery-policy-challenges%26id%3D14%3Aworkshops%26Itemid%3D54&ei=k9EqVbiOEaiwsAT3pYDYBw&usq=AFQjCNGGBtrDYXRNPidMY9YgFlr2EN_IA&sig2=I5_SfGtSLhlZ21CKKLxb2g
- ◆ Ghana (2014) <http://www.reegle.info/policy-and-regulatory-overviews/GH>
- ◆ “Tullow in Ghana”
http://www.tulloil.com/Media/docs/default-source/3_investors/2014-tullow-ghana-report.pdf?sfvrsn=4
- ◆ “Jubilee Field Development.” – June. 2013.
http://64be6584f535e2968ea8-7b17ad3adbc87099ad3f7b89f2b60a7a.r38.cf2.rackcdn.com/Jubilee_Development_Project_Tullow.pdf



References

- ◆ “Tullow Ghana Ltd Jubilee Project.” Apr. 2013.
<https://www.tulloil.com/Media/docs/default-source/operations/ghana-eia/external-independent-monitoring-group-report/tullow-ghana-jubilee-project-report-2013.pdf?sfvrsn=2>
- ◆ “Jubilee Oil Field Associated Gas Recovery & Utilization Project.” 15 Apr. 2012.
<https://cdm.unfccc.int/Projects/DB/DNV-CUK1355897092.73/view>
- ◆ “Ghana lauds China’s oil giant for excellent job on gas plant.” (Xinhua) – 3 Sep. 2014.
http://news.xinhuanet.com/english/africa/2014-09/03/c_133615574.htm
- ◆ “Atuabo Gas Project: Jubilee Partners can’t wait any longer.” (Business & Financial Times) – 8 Apr. 2014.
<http://thebftonline.com/content/atuabo-gas-project-jubilee-partners-can-t-wait-any-longer>
- ◆ “Ghana – Chinese firm Sinopec threatens to abandon gas project.” – 28 Apr. 2013.
<http://africajournalismtheworld.com/tag/early-phase-gas-infrastructure-project/>
- ◆ “Ghana reaps nearly 979 mln USD from oil in 2014.” – 11 Feb. 2015.
http://china.org.cn/world/Off_the_Wire/2015-02/11/content_34789008.htm
- ◆ “Policy Brief: Emissions from flaring jubilee field gas.” – Sept. 2010. <http://www.ecn.nl/docs/library/report/2011/o11016.pdf>
- ◆ “Ghana’s Jubilee Oil Field Partners May Flare Gas.” 30 Apr. 2013.
<http://www.ventures-africa.com/2013/04/ghanas-jubilee-oil-field-partners-may-flare-gas/>
- ◆ “China to hand \$1.2B loan to Ghana for Jubilee Projects.” – 18 July 2012.
<http://www.law360.com/articles/361347/china-to-hand-1-2b-loan-to-ghana-for-jubilee-projects>
- ◆ “In Ghana – The \$3 Billion Chinese Loan and the controversies surrounding it.” 8 Apr. 2012.
<http://www.newstimesafrica.com/archives/25036>
- ◆ “Ghana signs \$1 billion loan with China for Natural Gas Project.” 16 Apr. 2012.
<http://www.bloomberg.com/news/articles/2012-04-16/ghana-signs-1-billion-loan-with-china-for-natural-gas-project>
- ◆ “Ghana Gas looks for a new gas buyer; OKs Tullow’s compressors.” 26 Mar. 2015.
<http://www.ghanaweb.com/GhanaHomePage/NewsArchive/Ghana-Gas-looks-for-a-new-gas-buyer-OKs-Tullow-s-compressors-352000>
- ◆ West Africa Gas Pipeline website : <http://www.wagpco.com>

