



# Angola

## Associated Gas Utilization Study

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Thanks to Thomas Mitro for his thorough peer-review



**Columbia Center**  
**on Sustainable Investment**

A JOINT CENTER OF COLUMBIA LAW SCHOOL  
AND THE EARTH INSTITUTE, COLUMBIA UNIVERSITY

# Summary of findings

Fiscal incentive regulation for APG use

Ownership of APG

APG Projects: LNG

No domestic market

No independent regulator but...

- Regulation regarding Associated Petroleum Gas (APG) use is still in its nascent stages. However there is an attractive fiscal framework with lower taxation for APG projects and a no flare policy stipulating that the capex borne by companies for the storage and delivery of APG to Sonangol is cost recoverable.
- In addition, an APG use stipulation under the production sharing agreements stating that any surplus APG produced by oil companies not used for field use, must be given free of charge to Sonangol as well as the state ownership of pipelines might act as an incentive for companies to search (possibly collectively) for ways to monetize their APG.
- All of the major oil players in Angola are involved in gas flaring but the biggest flarers are also engaged together in the premier Angola LNG plan under a multi-owner/user scheme fed by APG.
- IOCs currently prefer high return export options like LNG to necessary IPP projects for the country, particularly since there is no domestic market for gas in the country (the source of electricity is mostly hydro-based).
- Lack of an independent regulator reflected in weak enforcement of flaring laws, presents a challenge for future APG use in the country. However, Sonangol has been active in taking a hardline stance on prioritizing APG use even over oil revenue in the country. It is also well known for never being late or defaulting on its equity obligations to the upstream sector.

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

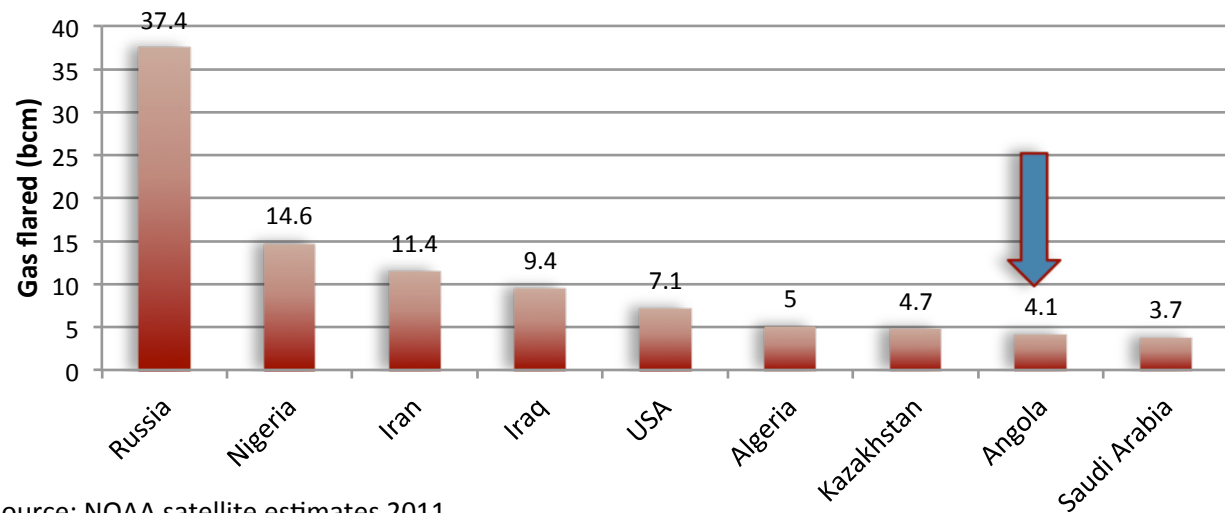
Overview stats on APG flaring

On the companies involved

Over the last decade

And their flaring trend over time

## Top 10 Gas Flaring Countries 2011



Source: NOAA satellite estimates 2011

- ♦ Angola is the 2<sup>nd</sup> largest crude oil producer in SSA and the 8<sup>th</sup> foremost gas flarer in the world.
- ♦ However the APG - based LNG project – a joint undertaking of “the major flarers” will soon show its impacts. Because companies were allowed to continue flaring till the completion of the LNG plant, the impact of the project has not been perceptible till recently.



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

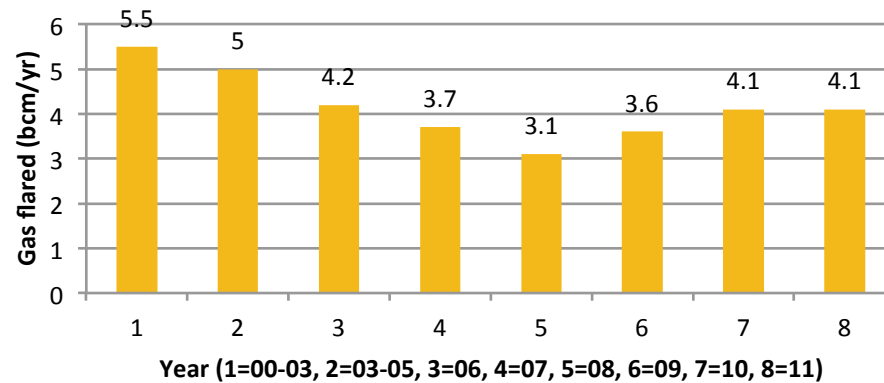
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## Gas Flared (bcm/yr) in Angola 2000-2011



Source: GE, 2011

- Total oil production in Angola is at 1.84mmb/d as of 2011, with natural gas production at 379bcf. Almost all of this gas was APG. In fact, Angola has no significant NAPG reserves.
- Flaring accounts for 75% of the APG produced as of 2009, a figure which increased in 2011.



# The statistics of APG flaring in Angola: Who is involved?

Overview stats on APG flaring

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- All of the major oil players in Angola are involved in gas flaring, but there has been an attempt to engage in APG utilization through the premier Angola LNG plan.



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

Regulation:  
Agencies and  
analysis

Regulation: Legal  
framework and  
analysis

Regulation: Fiscal  
framework and  
analysis

Government institutions involved in regulation of oil production/flaring	Description
<b>Ministry of Petroleum</b>	Charged with overall regulation of the oil and gas industry in Angola and heads a joint ministerial committee to explore gas sector development
<b>Sonangol</b>	The sole concessionaire in the country, has ownership of all gas produced and operates in the natural gas sector through its subsidiary Sonagas. Sonangol is in Profit Sharing Agreement with the IOCs in every hydrocarbon field. In addition to being a participant in the oil industry, Sonangol also acts as a regulator in the industry.



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Regulation/Policies on Gas Flaring/APG use	Description
<b>Petroleum Law 10/04</b>	Replaced its 1978 predecessor. Forbids flaring except with special allowance from the Ministry of Petroleum (though there is currently a 'zero flare' policy in place for all new fields).
<b>General Environmental Law 1998</b>	Provides framework for environmental legislation and regulation in the country
<b>Decree 39-00 concerning Environmental Protection in the Petroleum Industry</b>	Provides for the protection of the environment from pollution caused by discharges of hydrocarbons during petroleum activities. The contractor must prepare and submit an environmental impact assessment to the MPR for approval before starting any petroleum activities. The assessment needs to identify predictable damages to the environment caused by the proposed petroleum activities and outline the necessary measures to decrease said damages.
<b>APG use under PSAs</b>	<p>According to the model PSA, companies have the right to employ any associated gas produced in their petroleum activities and have the right to process the gas and separate any liquids from it.</p> <p>However, any surplus APG remaining after field use by the company, is to be given to Sonangol free of charge wherever Sonangol wishes. The cost of the transportation of this gas by pipeline is described as a 'recoverable cost under the law'.</p> <p>Additionally, over the last decade, following notable deepwater oil discoveries by IOCs, Sonangol has taken a firm stance on requiring that any Development Plans for deepwater oil discoveries include an acceptable plan for the commercialization of APG for approval. 'Acceptable' specifically referred to plans where APG was supplied to the LNG plant in the country .</p>



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- ◆ Definition and boundaries not followed
  - Last flare out date was set for 2010 and subsequently not met
- ◆ Weak monitoring and enforcement of little regulation
  - Very little legislation on flaring and weak enforcement of current legislation driven by lack of an independent regulator for the industry
  - Systematic measurement and reporting of gas flaring figures is lacking from Sonangol and its IOC partners
- ◆ No independent regulator
  - Sonangol is both a participant and regulator in Angola's oil industry, however it has taken a firm stance on promoting APG use in the country, even over oil revenues, and has been an active participant in directing APG towards the LNG project.





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Fiscal Framework on Gas Flaring/APG use	Description
<b>No flare policy</b>	All capital expenditure borne by Contractors for the storage and delivery of associated gas to Sonangol is shouldered primarily by the host government
<b>Incentives on PSAs</b>	<ul style="list-style-type: none"> <li>• A greater share of profits allotted to contractor on gas development schemes</li> <li>• Gas-related Capex recoverable with uplift of 30-50%</li> </ul>
<b>Selected tax incentives specific to the LNG project that has been declared of public interest ( Decree-Law 10/07)</b>	<ul style="list-style-type: none"> <li>• Tax holiday of 144 months</li> <li>• Pipeline access is free and the construction cost of the network is cost recoverable</li> </ul> <p>We note however a sliding scale Gas Sales Tax indexed on the gas prices (with Henry Hub spot price as floor) imposed on the LNG exports.</p>



# What power needs could the flared gas satisfy?

Power  
Generation (IPP)

Liquefied Natural  
Gas (LNG)

Natural Gas  
Liquids (NGL)

Gas to Liquid  
Conversion (GTL)

- ◆ Angola boasts significant gas reserves, made up of mostly APG
  - Proven gas reserves at 10.95 tcf as of 2011
- ◆ With an electricity access rate of barely 26% and installed capacity of only 1160 MW, there is a significant potential in the use of flared APG to meet the country's electricity needs.
- ◆ However, 68% of electricity was sourced from hydroelectric dams as of 2011, with only 2 operational gas turbines in capital Luanda. There has been talk of constructing thermal plants to take advantage of APG in the country.



# 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 Angola LNG project. It is a standout effort in terms of APG use as most of the gas for the LNG project will be sourced from APG.
- It appears that IOCs currently prefer high return export options like LNG to necessary IPP projects for the country particularly, since there is no domestic market for gas in the country.



# APG use company case study: Angola LNG (LNG)

Power  
Generation (IPP)

Liquefied Natural  
Gas (LNG)

Natural Gas  
Liquids (NGL)

Gas to Liquid  
Conversion (GTL)

## Project Participants:

- Cabinda Gulf Oil Company, a subsidiary of Chevron (36.4%), Sonangol (22.8%), BP (13.6%), Eni (13.6%), Total(13.6%)
- The joint-venture owns the LNG plant and the vessels. The different companies own individually the upstream blocks.

## Project Description and Motivation:

- One of the most significant APG-based LNG projects in the world
- Roots in a 1997 feasibility study on the most efficient uses of flared APG conducted by Sonangol and Texaco (bought out by Chevron in 2001) for Block 0, and a 2004 decree required Chevron to end all flaring by 2007
- Since 2002, Sonangol has required all developing plans of deep-water oil discoveries to include a commercialization plan for the APG, and in particular insisted on a plan to supply the LNG plant with the associated gas.
- As part of the agreement to supply gas to the LNG plant, the partners are authorized to continue flaring while waiting for the LNG plant and pipelines to be built. They are also allowed to utilize the non-associated gas in the relinquished parts of Block 2 that was not previously utilized.
- Largest investments made in the country - \$10 billion and construction began in 2008
- Shipment of its first cargo to Brazil's Petroleo Brasileiro SA in 2013 (no long-term supply agreement with Brazil) but future exports to Asia and Europe

## Associated Gas Use:

- Runs on associated gas and receives greater than 28 bcm or 1bcf of natural gas per day from offshore blocks 0,1, 2, 14, 15, 17, and 18, for free. The project gathers and transports associated gas from offshore Angola to an onshore liquefaction plant in Soyo, in the northern region of Angola.
- LPG (butane) is also extracted for export and sale to domestic market (up to 125 mmscfd at zero cost)

## Project Technology:

- Plant starts with 1 train with an expected production of 5 mtpa of LNG
- The pipeline network for the associated gas is built by the associated gas block operators but transferred to Sonangol after completion. No fee is paid to Sonangol for access to pipelines but operating costs are borne by the partners.



# APG use company case study: Angola LNG (LNG)

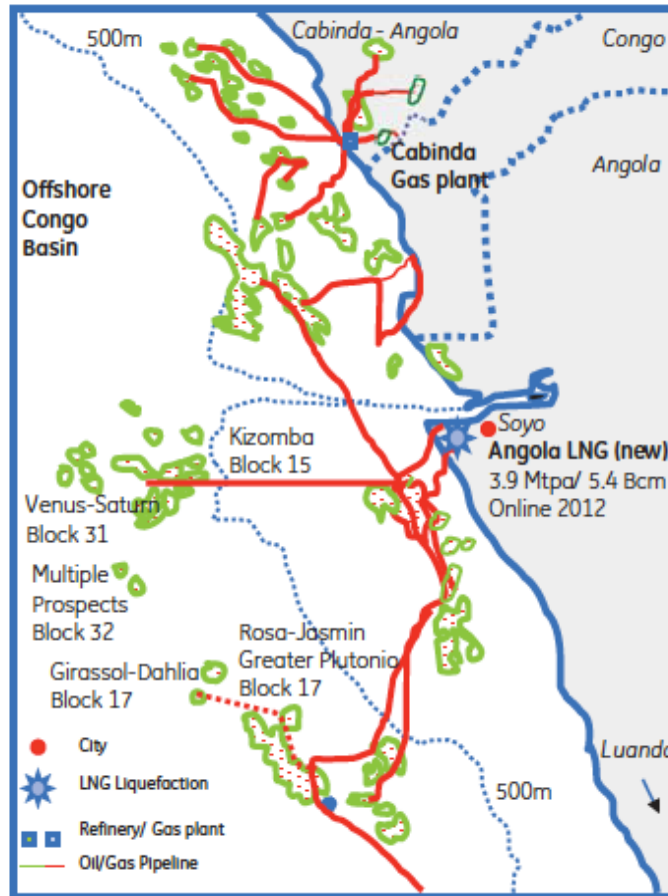
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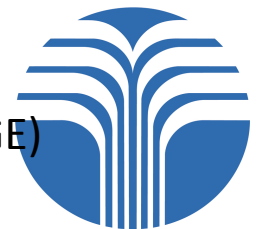
Gas to Liquid  
Conversion (GTL)

Angola Major O&G infrastructure



Source: GE, 2011

Schematic showing location of Angola LNG project at Soyo (GE)



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