



# Iraq

## Associated Gas Utilization Study

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Thank you to Tom Mitro for his review



**Columbia Center**  
on Sustainable Investment

A JOINT CENTER OF COLUMBIA LAW SCHOOL  
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# Summary of findings

One of the largest flarers

Absence of a strong legal framework and infrastructure network

Discouraging gas pricing policy



A massive landmark project for APG use

Need for more investment in power generation capacity to absorb the APG

Discouraging investment climate

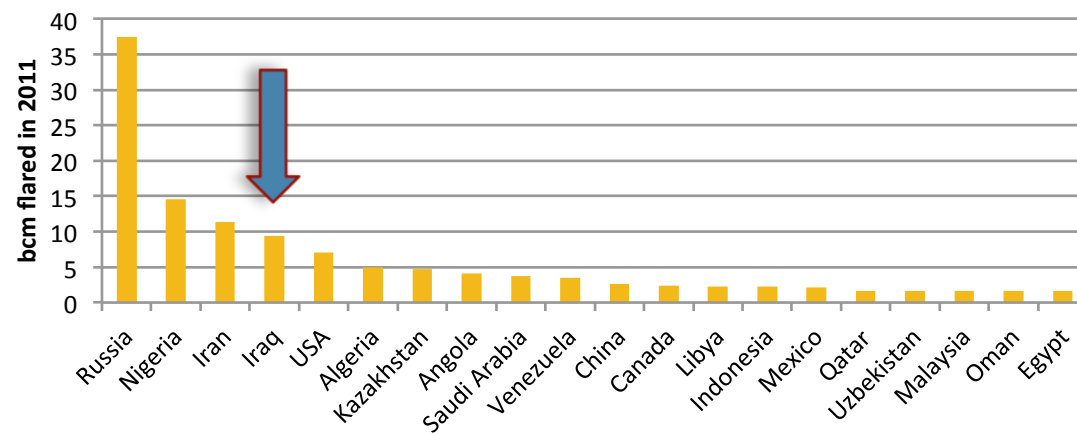
- ♦ Iraq is the world's fourth largest gas flarer while being the second-largest crude oil producer of the Organization of the Petroleum Exporting Countries (OPEC). It has the 11<sup>th</sup> largest gas reserves mainly constituted of Associated Petroleum Gas (APG).
- ♦ Only in 2011, the Iraqi Government proposed prescriptions for APG use in the Federal Oil & Gas Draft Law, but it has not been passed yet. Flaring is regulated by the PSAs in the Regional Government of Kurdistan in the North. Most of the flaring is happening in the South which is also where the oil exports are growing. In addition, there is an absence of sufficient gathering, processing and delivery infrastructure, critical for APG use.
- ♦ Iraq's gas pricing policy has thus far disincentivized the construction of gas infrastructure to sell the APG to the domestic economy.
- ♦ However, the Basrah Gas Company, a midstream gas company responsible for setting up the largest APG use project in the world, has benefited from governmental support for gas prices, with the government buying the gas from it at a much higher price than the domestic price. It processes APG produced by three large oil fields in the South into dry gas for power generation, Liquefied Petroleum Gas (LPG) for domestic use and condensates for road fuels. It is authorized to export once the local demand has been met. Other projects for APG use have just started at the other big oil fields in southern Iraq.
- ♦ More gas-fired power generation capacity is needed to absorb all the APG produced, meet the power demand and satisfy Iraq's oil export ambitions. Low prices and the security situation are delaying both state-led and private investment in gas infrastructure.



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

Statistics on APG flaring

## Top 20 gas flarers in the world (2011)



Source: NOAA satellite data

On the companies  
involved

- ♦ Iraq is the world's fourth largest gas flarer, flaring 9.4 billion cubic meters (bcm) of APG in 2011 according to satellite imaging.
- ♦ Wasted gas may be as high as 12 bcm per year, which is 70% of Iraq's national gas production.
- ♦ Estimates put the opportunity cost of flaring in Iraq at \$1.8 billion.
- ♦ At the field of West Qurna 1, around 150 million standard cubic feet per day (mmscfd) are flared which is "enough to power one million homes and produce 16 million LPG cylinders per year" according to Basrah Gas Company.

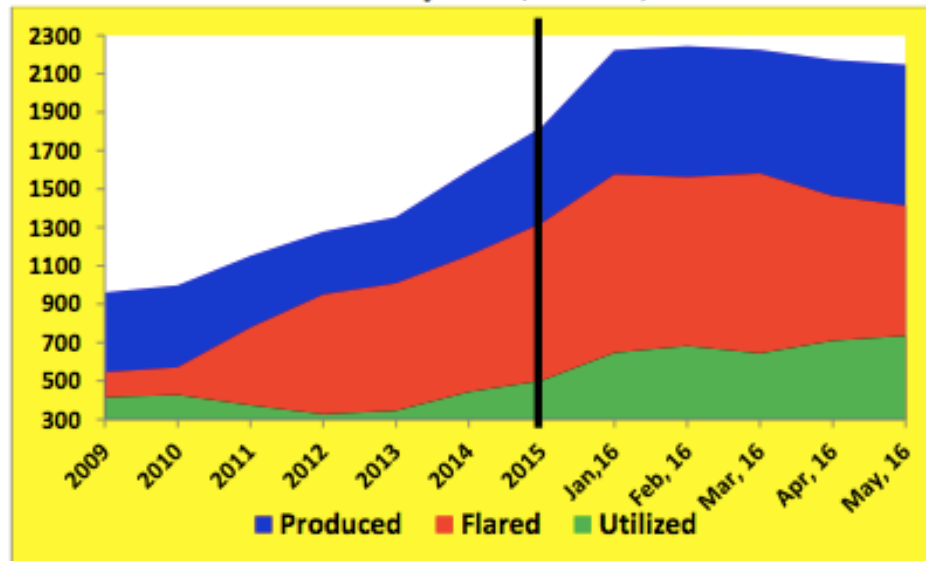


# The statistics of APG flaring in Iraq: How bad is it?

Statistics on APG flaring

On the companies  
involved

Southern APG production, utilization and flaring since 2009 (mmscfd)



Source: Iraq Ministry of Oil and Ahmed Mousa Jiyad

- APG production during the first five months of 2016 was 2,628 billion standard cubic feet per day (scfd): 84% is from the southern oilfields while 16% is from the North Oil Company's (state-owned company in Kirkuk) oilfields.
- Out of this gas volume, 1,714 billion scfd was flared, making up 65% of the total produced APG. Most of this flared gas (89%) was in the south.



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

## Statistics on APG flaring

### Expected oil and gas production, use and flaring: past, present, future

	Oil production ('000 b/d)	Gas produced (bn ft <sup>3</sup> /d)	Gas marketed (bn ft <sup>3</sup> /d)	Gas flared (bn ft <sup>3</sup> /d)
2015	3,100	1,750	500	1,250
2016	4,000	2,500	1,000	1,500
2019	5,000	3,000	2,350	650
2021	6,000	3,700	3,600	100

Source: Iraq Ministry of Oil, 2015

## On the companies involved

- ◆ In 2015, the Iraqi government has set 2022 as the deadline for zero routing flaring.
- ◆ Comparing the 2016 results for the first five months of the year (given in the previous slide) to the pro-rated forecast for 2016 laid out in this slide, the flaring results are 10-12% worse than the target.

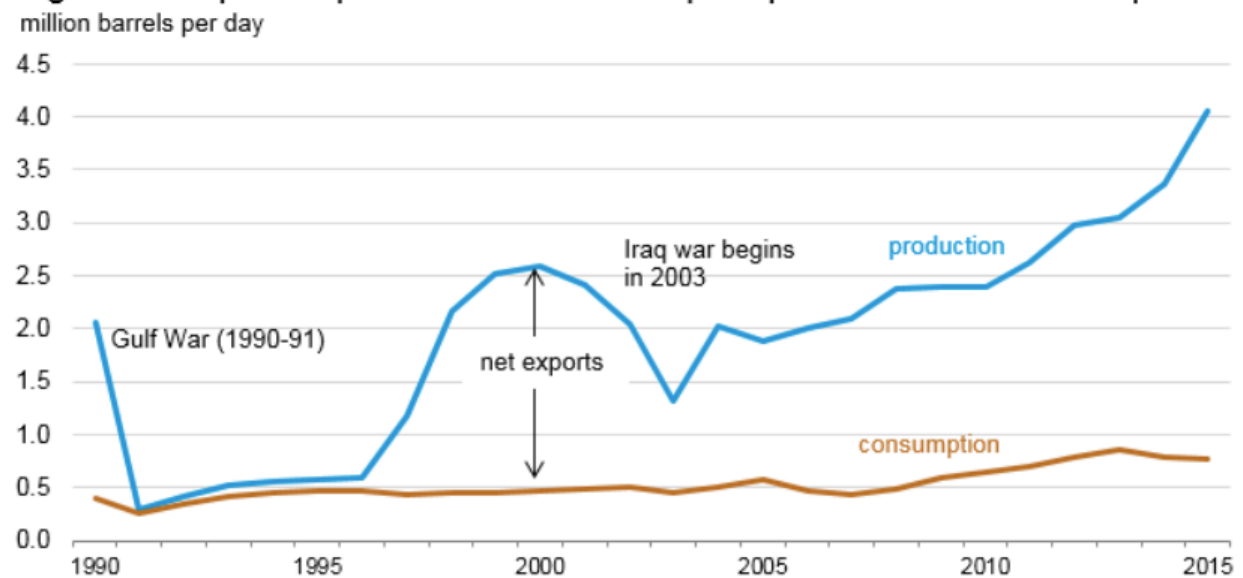


# The statistics of APG flaring in Iraq: How bad is it?

Statistics on APG flaring

On the companies  
involved

## Iraq's total petroleum and other liquids production and consumption

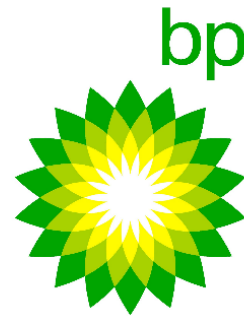


Source: EIA, 2016

- ◆ Part of the reason for its large flaring volumes owes to the fact that Iraq is the second-largest crude oil producer of the OPEC and holds the world's fifth largest proven crude oil reserves.
- ◆ Iraq's crude oil production grew by almost 1.5 million barrels per day (b/d) over the past five years, increasing from 2.6 million b/d in 2011 to almost 4.1 million b/d in 2015.
- ◆ Iraq's estimated natural gas reserves are 112 trillion cubic meters, the 11th largest in the world according to the International Energy Agency – mostly stemming from APG.

# The statistics of APG flaring in Iraq: Who is Involved?

Statistics on APG flaring



On the companies  
involved

- The Ministry of Oil in Baghdad has awarded licenses to 21 International Oil Companies (IOC), including BP, CNPC, Statoil, and Shell who all drill in the country's largest fields.
- Rather than PSA (Production Sharing Agreement) contracts that are offered by the Regional Government of Kurdistan, Baghdad offers technical service contracts. Service contracts might act as a disincentive to invest in APG infrastructure.

# What legal and fiscal framework is 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 Oil	<p>Has broad discretion to regulate extraction of oil and gas in the Federal Provinces of Iraq under Oil Law No. 101.</p> <p>In recent years, the Ministry has set renewed efforts in motion to end flaring in Iraq and has established a goal to “end the burning of gas entirely” in favor of utilization. In 2016, the World Bank awarded the Ministry with a certificate of appreciation for its efforts.</p>





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

Agencies

Legal framework

Fiscal framework

Regulation/Policies on Gas Flaring/APG use	Description
<b>Federal Oil and Gas Law</b>	<p>Federal and regional laws governing the petroleum sector in Iraq are typically multi-layered and complicated, consisting of a mix of laws that are a legacy of the Hussein regime combined with a new legal framework instituted by the new constitution.</p> <p>On August 25, 2011, the Iraqi Government proposed the Federal Oil &amp; Gas Draft Law, including the following prescriptions for APG use:</p> <ul style="list-style-type: none"><li>• The petroleum legislation makes mention of APG and requires holders of exploration and production rights to propose optimal plans for utilization or disposal of associated natural gas in their Field Development Plans.</li><li>• Furthermore, all associated natural gas that is not used in petroleum operations, utilized or re-injected in the field, is to be offered for delivery free of charge to the Ministry.</li><li>• Flaring is only permitted for the purposes of commissioning, testing of installations, safety precautions, or while awaiting the completion of transportation facilities (provided that the flared volumes are kept to a minimum and Ministry is notified).</li><li>• Flaring should be kept to a minimum and not be permitted beyond a maximum period of one year, during which time measures should be made to either utilize the gas or deliver it to a nominated government entity.</li></ul>

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

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Regulation/Policies on Gas Flaring/APG use	Description
<p><b>Kurdistan Regional Government of Iraq (KRG)</b></p>	<ul style="list-style-type: none"> <li>The KRG regulates flaring through PSAs.</li> <li>The relevant clause from the 2011 PSA signed between the KRG and Repsol YPF Oriente Medio S.A. reads as follows:                     <p>“14.6 Flaring of Natural Gas is prohibited, except:</p> <p>(a) in accordance with an Approved Work Program and applicable Permits; or</p> <p>(b) in an emergency.</p> <p>14.7 The Contractor shall submit any request for a Permit for flaring to the Government.</p> <p>14.7.1 The Contractor must include in such request for a Permit:</p> <p>(a) an evaluation of reasonable alternatives to flaring that have been considered by the Contractor together with information on the expected amount and quality of Natural Gas to be flared and proposed duration of the requested flaring; and</p> <p>(b) its consideration and plans for taking all commercially reasonable measures to ensure the extraction of natural gasoline and other liquids from Associated Gas to be flared.</p> <p>14.7.2 The Government may refuse to grant such Permit in the Government’s sole discretion, including the circumstances where the request reasonably shows that flaring would be in the economic interest of the Parties or is necessary for the production of Petroleum, and the Government has no implied duty to provide any Permit for flaring.”</p> </li> </ul> <ul style="list-style-type: none"> <li>Anti-flaring clauses do not appear in PSAs before 2006 and PSAs that have been signed since 2011 are stricter in their regulation of flaring than those signed between 2006 and 2010 .</li> </ul>

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

## Agencies

- ◆ A large barrier to utilizing APG is the pricing policy in Iraq, which acts as an inhibitor to the growth and development of its gas sector.
- ◆ Although Iraq has huge quantities of APG available as a by-product of oil production, the depressed price of gas combined with a virtually non-existent gas transportation infrastructure make investment in the gas sector a low-profit prospect.

## Legal framework

- ◆ By raising the price of gas, the Iraq Government may be able to increase the incentive to invest while reducing its fiscal spending. It has likely avoided doing this due to political sensitivities and instead has relied on individual arrangements with companies to ensure a certain price: the government through its state-owned company South Gas Company buys the gas from the companies at a higher price than the domestic market and resells to the domestic market.

## Fiscal framework

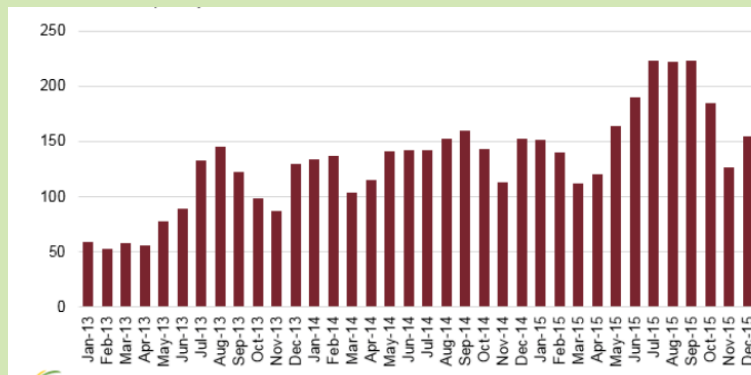
- ◆ For example, the Basrah Gas Company project (detailed in the following slides) was created with the selling price of APG pegged to the price of oil: the dry gas sales price is a direct derivative of the Heavy Sulfur Fuel Oil (HSFO) price, which in itself is based on crude oil price. It follows the following formula:  $[(\text{crude oil price/ton converted to HSFO price/ton}) \times (\text{reduction factor})] / [\text{heating value of 1 ton HSFO}]$ .
- ◆ For a crude oil price between US\$ 75 and \$100 it means a dry gas price between US\$ 3.20 to US\$4.30 per MmBtu. For the same range of crude oil prices, other gas in the Middle East is sold at around  $\pm$ US\$ 2.0-2.5. In Iraq, the industry buys the dry gas price at \$1.2/MmBtu.
- ◆ The Iraq Government bears the burden of providing this artificial price by covering the difference between the domestic gas price and the negotiated price with BGC.

# What power needs could the flared gas satisfy?

Power generation

LPG and condensates

## Crude oil burnt at power stations in Iraq (thousand barrels per day)



Source: EIA, 2016

- ♦ Ironically, while Iraq flares a substantial portion of APG, it actually imports gas from neighboring Iran.
- ♦ In addition due to a limited number of gas-fired power plants, crude oil has been increasingly burnt at power stations depriving the government from export revenues.
- ♦ The current power generation capacity of 13 gigawatts (GW) only makes up for approximately a quarter of the demand (42 GW) and the oil and gas industry is the largest consumer of electricity.
- ♦ Many Iraqis run their own generators, which accounts for roughly 8% of the nation's electricity generation despite being extremely costly. Costs can be as much as \$1000 per month for household electricity, which represents 1/6 of average annual income.
- ♦ According to the IEA, reduction in gas flaring alongside the development of new gas fields is becoming fundamental to meet both export ambitions and growing domestic needs.
- ♦ New power plants that will use the APG as a fuel source for electricity generation are needed: In 2013, Shell estimated that converting the wasted gas into electricity would generate 4.5 GW— which could cover the needs of about 3 million homes.



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

Power generation

LPG and condensates



- ◆ In 2015, the mid-stream gas company, Basrah Gas Company (BGC), was awarded the World Bank's Global Gas Flaring Reduction Partnership Excellence Award.
- ◆ BGC, a joint venture with South Gas Company (51%), Shell (44%) and Mitsubishi (5%) set up in 2011, processes APG produced by the three huge oilfields in southern Iraq – Rumaila, Zubair and West Qurna 1, and turns it into dry gas primarily for power generation, LPG for domestic use and condensate for road fuel. BGC is therefore a midstream gas company.
- ◆ The 25-year program being undertaken by BGC, valued at \$17 billion, is both the largest gas project in the history of Iraq, and the largest flare reduction program in the world. The current oil price drop is slowing down the plans of the IOCs involved in the joint venture and some projects have to be put on hold.
- ◆ In addition, the ability of the government to invest in this project and finance its part is in question at a time of low oil prices, the reduction of northern exports and high expenditure in the campaign against the Islamic State.

# APG-use case study: Basrah Gas Company

Power generation

LPG and condensates

- ◆ BGC started operations in 2013. At capacity, BGC will buy up to 2 billion scfd of APG from the three oilfields. It is as of today processing more than 600 mmscfd of gas. The rehabilitation work (without the expansion) of the infrastructure should lead to a processing capacity of around 1.3 billion scfd, which will capture 80% of the APG produced by the three fields.
- ◆ BGC operates more than 1800 km of pipelines and nine compression stations that it as been rehabilitating. BGC is adding 300 km of pipelines and three new compressors.
- ◆ BGC also operates two gas processing plants that are also under rehabilitation. In the North Rumaila plan, after treatment and separation from the liquids, the dry gas is directly supplied to South Gas Company that then makes it available for local power generation. The natural gas liquids are sent by pipeline to the Khor Al Zubair plant to be further processed into LPG and condensate. These are then pumped to the Umm Qasr Storage Terminal, where they are blended with imports of high octane gasoline and LPG and then delivered to South Gas Company for distribution into the local market, to various bottling plants and to road tanker filling stations.
- ◆ Last, BGC operates the marine terminal, comprised of two main jetties where tankers dock, and a smaller service jetty for small vessels that is now developed by BGC into a new jetty for export/import of LPG to meet future requirements.
- ◆ The infrastructure in place is state-owned and often 30 years old. Years of conflicts and sanctions have delayed their full upgrading and utilization until now.

# APG-use case study: Basrah Gas Company

Power generation



Source: Mitsubishi



Source: LNGWorldNews.com

LPG and condensates

- It is estimated that around 70% of the electricity generated in Basrah province in 2015 and 60% to 70% of the all the LPG consumed in Iraq was provided by the gas produced from the project.
- The contract allows BGC to export the gas as condensates and also LPG once local demand is met. LPG production is now at 3,300 tons per day.
- In March 2016, the first cargo of APG concentrate (very high API oil in gas form that has condensed when rising to the surface) of approximately 10,000 cubic meters was exported by BGC. Two cargos of LPG exports followed sold at \$350/ton . Reportedly, the exports receipts were earmarked to the IOC partners in the joint venture as payment for their past arrears at end of 2015.





# Other smaller APG-use developments

## Power generation

## LPG and condensates

- ◆ Al - Ahdab oilfield: supplies 70 mmscfd to the Wasit province power stations and LPG of more than 240 tons per day as of May 2016.
- ◆ Mejnoon oilfield: a gas processing station (with a capacity in the first phase of 70 mmscfd) inaugurated in April 2016 provides gas to Rumaila gas-fired power-plant. This power station will be completed in 2017 and will generate up to 235 megawatts (MW) per day at peak efficiency during winter months and a minimum of 150 MW in the summer.
- ◆ Gas pipeline: in April 2016, the Ministry of Oil inaugurated a \$150 million liquefied gas pipeline project for the transportation of 3000 to 4000 tons per day of gas from production locations in Khor Al-Zubair to the gas complex in Thi-Qar province.
- ◆ GE and Iraq Ministry of Oil have agreed to partner on a solution to reduce gas flaring in Iraqi oil fields and use it for power generation within a broader partnership between GE and the Ministry on the optimization of the Ministry's power assets as well as management system. GE solutions could add more than 200 MW per site and recover several thousands of barrels per day of LPG.
- ◆ The continuous unsteady security situation might limit additional investment in long gas pipelines, in addition to those of BGC, given the high vulnerability of gas pipelines to sabotage due to their high pressure and the volatility of gas when released, as well as the difficulty in operating maintenance work on both the pipelines and compressors.





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