



Iraq Petroleum 2018 – Natural Gas Must Be an Asset for Iraq

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LONDON – On February 27-28, 2018, the C.W.C. Group, an energy and infrastructure conference, exhibition and training company, will organize in Berlin, Germany, the twelfth edition of Iraq Petroleum, which is one of the major events concerning Iraq's oil and gas sector. One of the main topics of Iraq Petroleum 2018 will be the development of Iraq's natural gas reserves with the specific goal of strengthening energy-intensive industries to diversify the Iraqi economy.

Correctly, in Iraq, there is a sense of urgency in going ahead with an improved exploitation of the country's natural gas reserves. According to BP Statistical Review of World Energy 2017 (June 2017), at the end of 2016, Iraq ranked 12th in the world in relation to proven natural gas reserves with 3.7 trillion cubic meters (Tcm), or 2% of the world's proven reserves. About three-quarters of Iraq's proven natural gas reserves are associated with oil, and about 70% are in Basra Governorate. However, despite this noteworthy gas

endowment, until now the country has not been able to capitalize on it so much as it has been doing with its oil endowment.

In 2016, Iraq produced 1.1 billion cubic meters (Bcm) of natural gas (this value excludes gas flared or recycled, while it includes natural gas produced for gas-to-liquids transformation), which, after Yemen's production, is the lowest natural gas production of all the Middle East countries. Considering that Iraq primarily produces associated natural gas and that its crude oil production was 4.4 million barrels per day (MMb/d) in January 2018 (2nd OPEC crude oil producer), it is evident that its natural gas production is proportionally very low. The reason behind this low natural gas production is the elevated level of gas flaring.

1. Gas Flaring in Iraq

Until recently, Iraq's associated natural gas has been flared rather than used for power generation. The result of this malpractice concerning natural gas utilization has created an economic loss for the federal coffers. In Iraq, this economic loss is exemplified by the higher costs linked to

- burning oil, heavy fuel oil, or diesel rather than natural gas as fuel for some power plants, when it would be more profitable to export this oil and to burn gas
- importing natural gas from Iran since June 2017 through a pipeline shipping Iran's South Pars natural gas to power plants in Sadr, Baghdad, and Al Mansuriyah
- polluting the environment because gas flaring is a source of volatile organic compounds, carbon monoxide, carbon dioxide, sulfur dioxide, polycyclic aromatic hydrocarbons, nitrogen oxides, and soot

In any case, it must be underlined that, despite the above-mentioned issues, if an oil-producing country does not have the infrastructure required to treat gas, the safest way to dispose of that gas is simply to flare it.

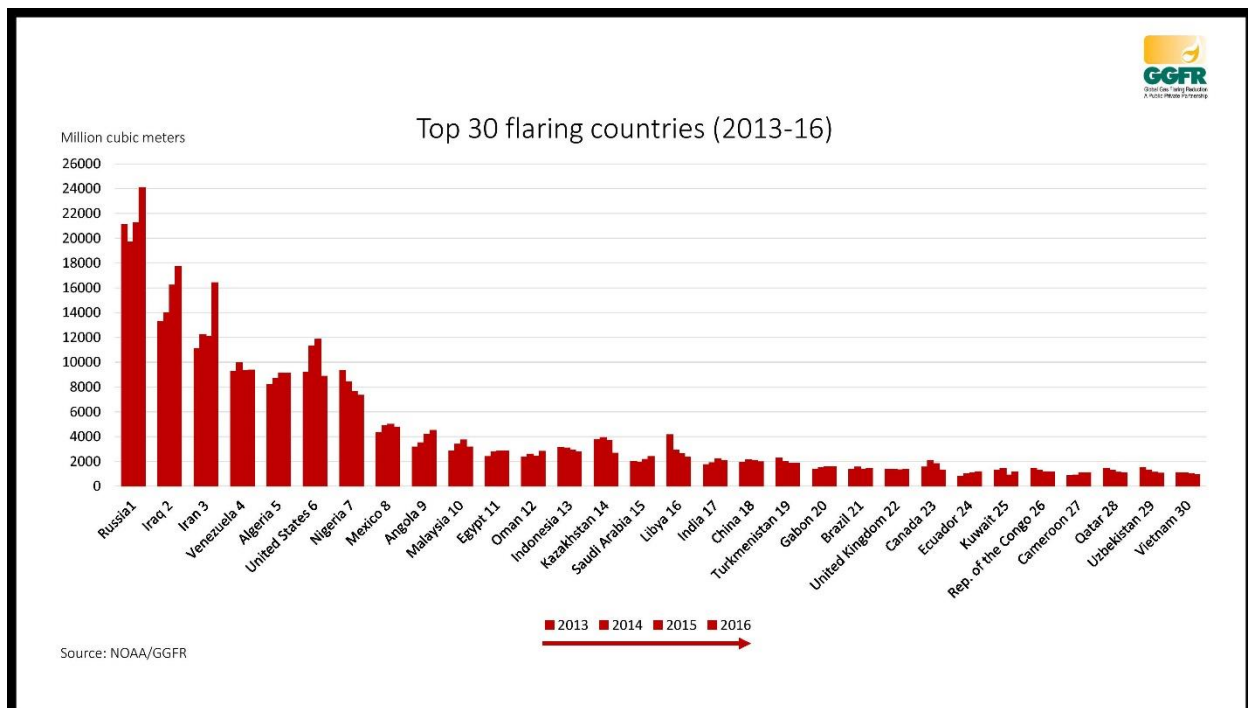
This still persistent incapacity of plainly monetizing on proven natural gas reserves is widespread throughout the Middle East, the region owning the largest share of proven gas reserves in the world with a 42.5% share, or 79.4 Tcm of natural gas—these reserves are mostly concentrated in Iran (33.5 Tcm, or 18% of the world's proven reserves) and Qatar (24.3 Tcm, or 13% of the world's proven reserves). In the Middle East, natural gas demand has been growing by more than 300 Bcm in the last 15 years driven primarily by power demand growth and the expansion of the petrochemicals industry. However, the Middle East region currently flares more than 40 Bcm of associated gas per year.

Natural Gas in the Middle East

Iraq Petroleum 2018 (BACCI, A., Feb. 2018)

- In 2016, the Middle East accounted for:
 - 14.5% of the world's gas consumption (512.3 billion cubic meters)
 - 18% of the world's gas production (637.8 billion cubic meters)
 - 42.5% of the world's proven gas reserves (79.4 trillion cubic meters)
- In 2016, gas production in the Middle East exceeded demand by 126 billion cubic meters
- Only Iran, Qatar, and Saudi Arabia are balanced or net gas exporters

According to the World Bank, Iraq is currently flaring more than 16 Bcm of associated gas each year; it is the second-largest gas flaring country in the world after Russia.



Finally, in 2017, Iraq joined the Zero Routine Flaring by 2030 (Z.R.F.), the United Nations (U.N.) and World Bank global initiative launched in 2015 to end routine gas flaring by 2030. So, Iraq has committed to not routinely flare associated gas in any new oil fields

and will work to end routine flaring in existing oil fields as soon as possible and no later than 2030.

In the spring of 2017, the World Bank stated that the volume of Iraq's flared gas represented an estimated economic loss of about \$2.5 billion. This volume would be sufficient to cover most of Iraq's currently unmet needs for gas-based power generation—in practice, an incremental generation capacity of 8.5 GW of electricity would be available. In this regard, Iraq's Integrated National Energy Strategy (I.N.E.S.), which was released in September 2012, assessed that at that time electricity shortages cost the country about \$40 billion annually.

2. Basra Gas Company (B.G.C.): A Successful Story

With reference to flaring reduction, Iraq's most important action has been the establishment in 2013 of Basra Gas Company (B.G.C.), which is a private-public joint venture between Iraq's South Gas Company (S.G.C., 51%), Shell (44%), and Mitsubishi (5%). The goal of this company is to collect and treat the gas from Rumaila, West Qurna 1, and Zubair, three supergiant oilfields located in Basra Governorate. The cost of this agreement, which will last for 25 years, is \$17 billion. This project is the largest flare-reduction program in the world. At full capacity, B.G.C. will process up to 2 billion of cubic feet per day (Bcf/d) of associated natural gas from the three giant oilfields. The processed associated gas is transformed into dry gas for power generation, liquified petroleum gas (L.P.G., i.e., propane and butane) for domestic use, and condensates for road fuels.

Moreover, if the local demand is satisfied, the company is authorized to export the gas in the form of liquified natural gas (L.N.G.), condensate, or L.P.G. The first export occurred in March 2016, and it consisted of about 10,000 cubic meters of excess condensate. Then, a few months later, in July 2016, B.G.C. exported a pressurized cargo of excess L.P.G. (about 2,000 tons). The export of L.P.G. was quite impressive because, just a year before, Iraq faced a relevant L.P.G. shortage, which forced the country to spend million of dollars in imports to meet its internal demand. In December 2017, B.G.C. reached unprecedented gas processing volumes at 900 MMcf/d of associated natural gas, which is the highest record in Iraq's oil and gas history. According to B.G.C., the company's work is able to power about 8.3 million of Iraqi homes.

However, as for B.G.C. there is a caveat. In fact, this company receives government support for its selling gas prices. In practice, the Iraqi government, via S.G.C., purchases natural gas from B.G.C. at a price higher than the government reselling price in the domestic market. This is a critical point because the subsidized price and the absence of gas infrastructure act as an impediment to attracting other private companies interested in the development of the natural gas industry in Iraq. The federal government might solve this issue by increasing the price of gas for the final customer, but this move is

fraught with political resistance. In many Middle Eastern countries, gas prices do not mirror a real affordability, but mainly political calculations. In the Middle East, current prices for natural gas range from \$1 to \$3 per million British thermal units.

Since the beginning of the Basra project, it was of paramount importance aligning the interest of the government with those of the international energy companies involved in the project—the goal was to have gas for Iraq and a satisfactory return for the foreign companies. According to the agreement, S.G.C. first supplies B.G.C. with raw gas, and then it purchases back processed gas for domestic consumption (dry gas, L.P.G., and condensate)—instead, all the exported processed gas is handled by State Oil Marketing Organization (SOMO). For the B.G.C. partners corporate income tax is set at 35%, while the internal rate of return (I.R.R.) at 15%. However, if the I.R.R. is higher than 15%, the price of raw gas, i.e., the sale price of raw gas from S.G.C. to B.G.C., is raised so that the revenue share of S.G.C. will be higher while the I.R.R. of B.G.C. will be lower.

In specific, the dry gas price is based on the price of high sulfur fuel oil (H.S.F.O.), which is itself based on the price of crude oil. Then, from the dry gas price, it's possible to backward calculate the raw gas price. The formula for the dry gas calculation is:

$$\frac{[\text{crude oil price/ton converted to H.S.F.O. price/ton}] \times [\text{reduction factor}]}{[\text{heating value of 1 ton of H.S.F.O.}]}$$

Indeed, the result of Basra gas project is positive. In fact, it was estimated that, in 2015, 70% of the electricity generated in Basra Governorate and 60% to 70% of all the L.P.G. consumed in Iraq were provided by B.G.C. It's evident that additional natural gas processing capacities must be built in Basra Governorate, which is where Iraq's five largest oilfields generate about 65% of the country's flaring. And, at the same time, Basra Governorate will need to build more gas-fired power plants to absorb all the produced associated natural gas.

3. The Available Natural Gas

Despite its abundant gas reserves, Iraq faces a chronic shortage of natural gas. Increasing natural gas production should be the mandatory choice for the federal government, but progress on this side has not been so continuous as it should be. Moreover, increasing the production of associated natural gas is linked to an increase in the crude oil production. And, OPEC does not look positively at an Iraqi crude oil production that might soon reach 5 MMb/d at a time when OPEC members are limiting their overall production to support the international oil prices. Of course, in Iraq, there might be more gas available in the future from non-associated gas fields, but progress in this regard is quite slow.

In October 2010, Iraq's third bid round put on offer exclusively three gas fields: Akkas, Siba, and Mansuriya. Few small companies showed up the day of the bid round, but all

the three gas fields were awarded. These three fields, Iraq's largest gas fields, have a combined production capacity of 11.2 Tcf.

- **Akkas Field** — At Akkas field, in Anbar Governorate (close to the Syrian border), Korea Gas Company (Kogas) is the operator and now the unique company. The field has proven reserves of 5.6 Tcf of natural gas, and the plateau production is set at 400 MMcf/d. In May 2014 operations stopped because the area came down under the control of the Islamic State. Only in November 2017, did the Iraqi forces recapture the field. Because of the war operations, the field has sustained several damages.
- **Mansuriya Field** — The Mansuriya gas field is in Diyala Governorate, northeast of Baghdad. The field has proven reserves of 4.5 Tcf of natural gas, and the plateau production is set at 320 MMcf/d. The working consortium at the field is formed by Turkish Petroleum (T.P.A.O., 37.5% stake, the operator), Iraq's Oil Exploration Company (O.E.C., 25%), Kuwait Energy (22.5%), and Kogas (15%). No wells have been drilled at this field, but T.P.A.O. stopped completely the operations after the Islamic State overran large parts of Iraq in 2014. It's interesting to note that the Mansuriya field should supply natural gas to the Mansuriya power plant, which, instead, is now receiving gas from Iran.
- **Siba Field** — The Siba gas field is south of Basra. The field has proven reserves of 1.1 Tcf of natural gas, and the plateau production is set at 100 MMcf/d. The consortium working at the field is formed by Kuwait Energy (25%, the operator), T.P.A.O. (30%), Egyptian General Petroleum Corporation (E.G.P.C., 20%), and Iraq's Maysan Oil Company (M.O.C., 25%). In a note in May 2017, Kuwait Energy said it would have started production from the field in January 2018. However, production from the concession had not started yet at the beginning of January.

There is no clear consensus on Iraqi Kurdistan's estimated oil and gas resources. However, the K.R.G.'s Ministry of Natural Resources (M.N.R.) estimates an endowment of 25 Tcf of proven gas reserves. The K.R.G. is currently developing non-associated and associated gas reserves. Data concerning the resources/reserves present in the K.R.G. are often revised.

- **The Khurmala Field** — The Kurdish KAR Group produces associated gas from the Khurmala oil field. Production is currently 100 MMcf/d, but the KAR Group plans to double production to 200 MMcf/d in the coming years. The gas is used domestically.

- **Khor Mor** — The consortium (Pearl Consortium) working at the field consists of U.A.E.'s Dana Gas (35%), U.A.E.'s Crescent Petroleum (35%), Austria's O.M.V. (10%), Hungary's MOL (10%), and Germany's R.W.E. Khor Mor is the first non-associated gas producing field in the K.R.G. Proved plus probable (2P) gas and condensate reserves are 8.5 Tcf and 191 MMb respectively. The gas and condensates production started in 2008, while L.P.G. production started in 2011. The gas from Khor Mor is shipped to the Kurdish Bazian and Erbil power plants to generate electricity. The consortium and the K.R.G. had a dispute under arbitration. It was settled only at the end of August 2017. The dispute had partially stalled the development of the field. Because of the settlement, the consortium has been awarded a total amount of \$1 billion and must increase production from about 300 MMcf/d to 800 MMcf/d in two years. Of the additional 500 MMcf/d, 250 MMcf/d will be purchased by the K.R.G. on agreed terms to boost the gas supply to power generation plants in the K.R.G. The consortium will directly sell the Khor Mor remaining amount of gas to customers within Iraq, export it outside Iraq, or sell it to the K.R.G. to further boost power generation within Iraq. If the Khor Mor and Khurmala proceed as planned, about 750 MMcf/d might be available for domestic power generation in early 2020.
- **Miran and Bina Bawi Fields (still development phase)** — At these two fields, Anglo-Turkish Genel Energy has a 100% working interest. These two fields are destined to export K.R.G. gas to Turkey—it was defined in the 2013 intergovernmental gas-sales agreement between the K.R.G. and Turkey—and to satisfy the domestic gas demand as well. The Miran field has estimated reserves of 4.3 Tcf of natural gas, while the Bina Bawi field has estimated reserves of 7.1 Tcf of natural gas. Genel Energy is currently looking for Turkish farm-in partners for the fields' upstream development because the company does not have the economic resources to develop the fields by itself (\$5 billion of estimated development costs).

Since June 2017, Iran has been supplying Iraq (in the Baghdad area) with natural gas from the Naftshahr region, in Kermanshah Province, through a pipeline diverging from the 6th Iran National Gas Trunkline (IGAT-6). Iran and Iraq had signed an agreement regarding Iran's exports of natural gas to Iraq already in 2013; the agreement included two contracts, one to send via pipeline gas exports to the Iraqi capital, Baghdad, and another contract to send gas exports via pipeline to the southern city of Basra. However, because of security issues and delayed payments, the gas exports started only in June 2017 when Iran began to ship gas to the Baghdad area—Basra should start receiving gas in March 2018 when the infrastructure will be ready. Exports began at the rate of 7 MMcm/d, but, according to the contract, there is the possibility of increasing the exported volume of gas up to 35 MMcm/d. The project was estimated to earn Iran \$3.7 billion a

year in revenues. In November 2017, according to the Iranian Gas Transmission Company (I.G.T.C.), gas supply to Iraq amounted already to 12 MMcm/d.

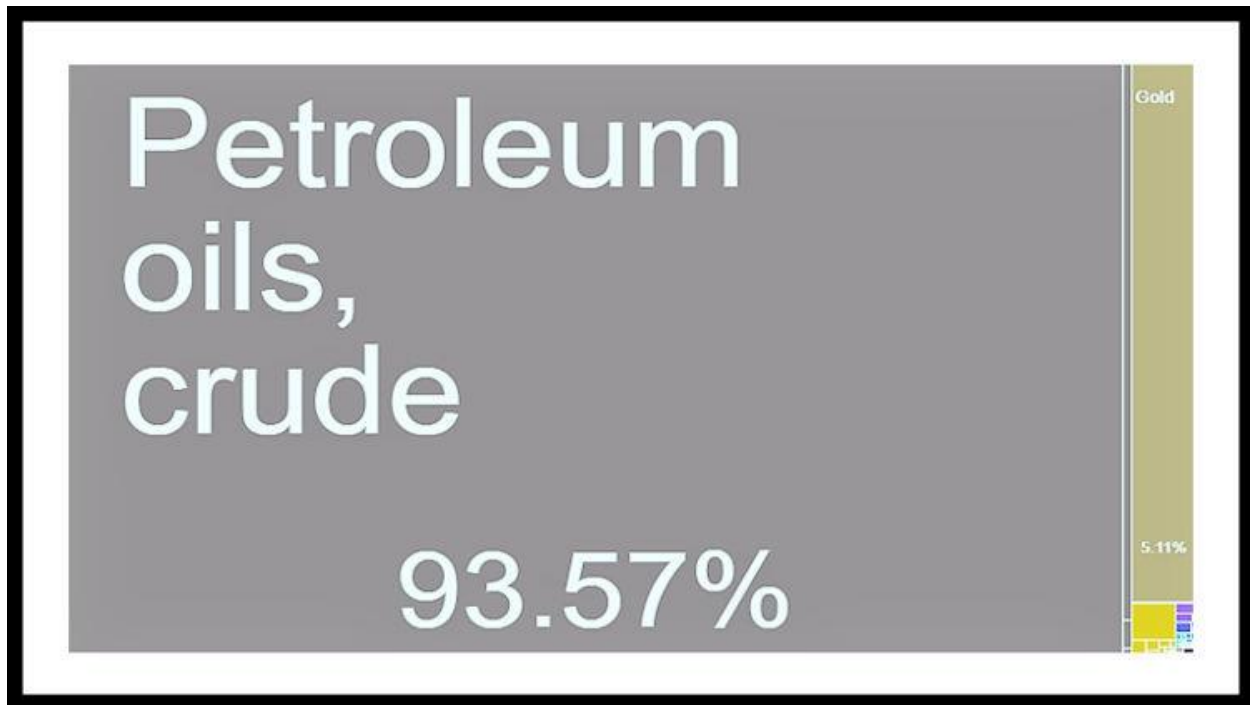
Then, in December 2017, Iraq signed an agreement with Iran concerning Iranian exports of natural gas to Iraq's Diyala Governorate. The National Iranian Gas Company (N.I.G.C.) has recently stated that Iran's natural gas export to Iraq is set to reach 50 MMcm/d (evenly split between Baghdad and Basra) in the next fiscal year, which starts on March 21. The pipeline stretching from Ahvaz, the provincial capital of Khuzestan, to Khorramshahr and then to Basra in Iraq should be ready by March 2018. Basra, which is Iraq's second largest city, needs Iranian natural gas to feed its power plant. The southern city must as soon as possible reduce the recurrent power outages, which foment a persistent source of public discontent. In any case, for Iraq, being consistently dependent on Iran's natural gas is a risky option in the Middle East theater—however, as a matter of fact, currently, there are not viable alternatives.

In July 2017, Iraq's Ministry of Oil and Baker Hughes, a GE company, signed a contract for modular natural gas liquids (N.G.L.) plant solution for flare gas recovery in relation to the Nassiriya and Al Gharraf oilfields. The project is undertaken in two stages. In the first stage, an advanced modular gas processing solution will be deployed to dehydrate and compress flare gas to generate over 100 MMcf/d of gas. Over the second phase, the Nassiriya plant will be expanded to a complete N.G.L. facility to recover 200 MMcf/d of dry gas, L.P.G., and condensate. According to Baker Hughes, at the time of this writing, by addressing the flared gas from these two fields, the company can provide 400MW to the grid.

According to Iraq's South Oil Company (S.O.C.), in 2019, the construction of gas-processing facilities in the fields Misan and Halfaya will be completed and will have a capacity of 600 MMcf/d of gas (300 MMcf/d from Halfaya field and 300 MMcf/d from Misan and other smaller fields). And in 2020, the construction of gas-processing facilities in the fields West Qurna, Majnoon, Garraf, and Badra will be completed and will have an overall capacity of 1,650 MMcf/d (West Qurna 2, 650 MMcf/d; Majnoon, 725 MMcf/d; Garraf, 180 MMcf/d; and Badra 85 MMcf/d).

4. Natural Gas as a Driver to Develop Additional Industrial Sectors

Today, Iraq's economy is the world's most dependent on oil. Approximately 58% of the country's G.D.P. and almost 94% of its exports are petroleum oils; oil provides more than 90% of government revenues and 80% of foreign exchange earnings. Because of these economic conditions, after the victories obtained in 2017 against the Islamic State, the federal government is pushing ahead the agenda of diversifying Iraq's economy. The basic idea is correct; Iraq must diversify its economy to improve its resilience versus low oil prices, broaden its job market, and expand its tax base.



***What Did Iraq Export in 2016? – Source: The Atlas of Complexity,
Harvard University***

However, diversifying a country’s economy is never a quick endeavor—it could easily take a couple of decades for a country heavily depending on one economic sector, such as the oil sector for Iraq. Economic diversification can be defined and measured in many ways, such as using the Economic Complexity Index or the I.M.F. Export Diversification Index. So, under the present conditions, when we consider Iraq, rather talking about “diversifying the economy,” it would probably be more correct to talk about “try to reduce the almost complete dependence on the export of crude oil.”

Consider that also Norway, a country that is always the example of a successful model for all hydrocarbons-exporting countries, does not have a very diversified economy. In fact, in 2016, more than 46% of Norway’s exports were crude petroleum oils, petroleum gases, and refined petroleum oils. And, because of this type of unbalanced economic conditions, two years ago, when oil prices decreased to less than \$30 in January 2016, it was clear that Norway had an overreliance on the oil and gas sector.

In Iraq, natural gas might really be the key driver to develop additional industrial sectors. In fact, natural gas may be used for power generation (electricity), petrochemicals, fertilizers, and other heavy industries in which gas is the primary feedstock. In this regard, some analysts might object that the development of these new industrial sectors would not really change the picture for Iraq because its economic development would still be too linked to the oil and gas sector—in practice Iraq’s economy would continue to be

overaffected by the price of oil and gas. This observation is by no means wrong, but it's also true that, apart from increasing oil exports (and in this regard, it will be important to see how Iraq will deal in the future with OPEC's quota restrictions) to improve its economic standing Iraq does not have many alternatives to developing its natural gas resources and then using them to add other industrial sectors to the economy.

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