

Natural Gas in Iraq, Currently and Future Prospects: A Review

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ABSTRACT

This paper aims to demonstrate the importance of natural gas as a substantial source of energy as an alternative to crude oil, with the increase in global demand for it in the future, and the importance of this source for Iraq at the economic and environmental level. This article provides an overview of Iraq's natural gas reserves and the geographical distribution of this reserve over the regions of Iraq, in addition to the companies operating and developer there. The challenges facing the export and industry of gas in Iraq, the quantities of gas that are flared annually, and the associated financial and environmental damage were also presented. Finally, if the quantities of produced gas were to be invested, Iraq would achieve a significant improvement in the economic and environmental level.

Keywords: Iraq; natural gas; gas flaring; economic; environmental

INTRODUCTION

As an available and clean energy source, natural gas plays an important role in meeting the increasing global demand for many sectors such as power, industry, transport and other (Mesbah et al., 2019). According to International Energy Outlook 2019, global natural gas demand is expected to grow by 40% between 2018 and 2050, reaching around 200 quadrillion British thermal units (Btu) by 2050 (EIA, 2019). As for the participation of natural gas compared to other energy sources, it increased to 24% in 2018, which is one of the fastest growth rates since 1984 as shown in Figure 1 (Spencer, 2019).

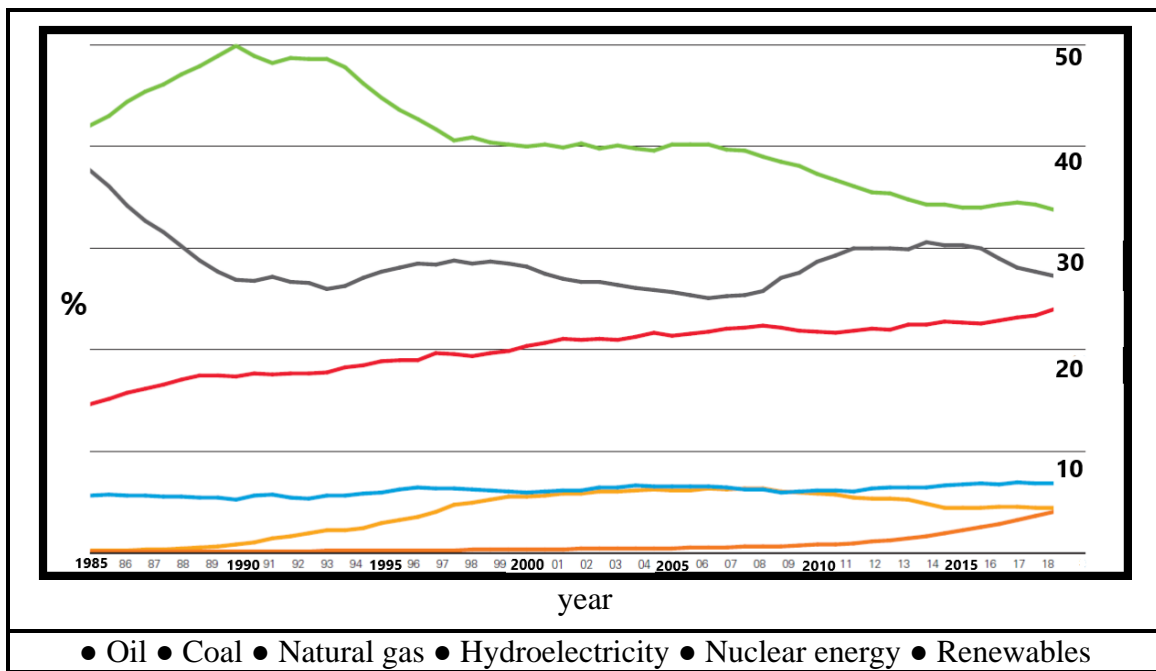


Figure 1: Shares of Global Primary Energy Consumption by Fuel.

The location, type, and depth of subterranean deposits and the geology of the area are the factors upon which the composition of gas produced from wells depends (Ghasem & Al-Marzouqi,

2017). Natural gas consists mainly of methane at a ratio ranging between 75 to 90 %, in addition to different amounts of ethane, propane and pentane. The gas also contains harmful impurities, such as nitrogen, hydrogen, water, carbon dioxide and hydrogen sulfide (Baker & Lokhandwala, 2008).

OIL AND FINANCIAL SHOCK IN IRAQ

Iraq has proven oil reserves of 147.2 thousand barrels, and this reserve constitutes 8.5% of the total global reserves. In addition, there is an estimated gas reserve of 125.6 trillion cubic feet, and it contributes 1.8% to the total reserve, this reserve places Iraq in the eleventh position globally (Spencer, 2019; OPEC, 2019). Iraq's energy resources are easy to extract and are located in simple onshore geographic areas that are largely unpopulated. Oil fields are distributed in different regions of Iraq, Table 1 represents Iraqi oil fields with reserves of more than one billion of crude oil, which are arranged in descending order by reserve (Keyfactsenergy, 2017; IEITI, 2017). The beginning of the year 2020 marks the breaking point for Iraq, with the entry of the oil price crisis, and it warns of an economic collapse that differs from the collapse that occurred in 2014 – 2015. It is evident that the economic situation this year is more fragile than previous years, through the following points:

- Unlike the previous crisis, any serviceable predictor on the current shape of the recovery is notably absent.
- In 2015, Iraq was the world's second-largest contributor to global liquids growth accounting for approximately 75% of OPEC production growth.
- Iraq's role in OPEC is also changing.
- Iraq's share of public spending has increased significantly since 2014. (Mehdi & Al-Saffar, 2020)

Based on the aforementioned, the government is obligated to find other sources of income.

Table 1: Iraqi Oil Fields with Reserves of More than One Billion of Crude Oil.

Field	Reserves Billion barrels	Developed by	Contract Date	Contract Duration	production Target Million bpd	Location	Remuneration
Rumaila	17.7	<i>BP (38%), CNPC (37%), Iraqi state-owned South Oil Company (SOC) (25%).</i>	2009	20 years.	2.85	30°13'49.7"N 47°24'39.9"E	\$2.00 per barrel of oil
West Qurna 2	13	<i>Lukoil (75%), South Oil Company (25%).</i>	2009	25 years.	1.8	30°53'03.9" N 47°17'28.2" E	\$1.15 per barrel of oil
Majnoon	13	<i>Shell (45%); Petronas (30%); Maysan Oil Company (25%).</i>	2009	20 years	1.8	31°04'19.6"N 47°36'32.3"E	\$1.39 per barrel of oil
West Qurna 1	8.7	<i>ExxonMobil (25%), PetroChina (25%), Shell (15%), Pertamina (10%), Oil Exploration Company (25%)</i>	2009	20 years	2.825	31°01'55.6"N 47°18'00.4"E	\$1.90 per barrel of oil
Kirkuk	8.7	<i>North Oil Company.</i>	None	None	0.3	35°31'58.5"N 44°20'08.5"E	None
East Baghdad	8	<i>Iraqi State.</i>	None	None	None	33°21'09.6"N 44°38'54.4"E	None
Nahr Bin Umar	6.5	<i>South Oil Company (SOC)</i>	None	None	None	30°51'51.3"N 47°38'22.8"E	None
Nasiriyah	4.4	<i>Ministry of Oil (Baghdad).</i>	None	None	None	31°21'07.1"N 45°57'58.4"E	None
Halfaya	4.1	<i>CNPC (37.5%), Total (18.75%), Petronas (18.75%), South Oil Company (25%).</i>	2009	20 years, later extended to 30 years.	0.535	31°49'40.8"N 47°25'20.6"E	\$1.40 per barrel of oil
Zubair	4	<i>Eni (32.81%), Kogas (18.75%), Maysan Oil Company (25%), South Oil Company (23.44%).</i>	2010	20 years, later extended to 25 years	1.125	30°23'24.8"N 47°38'17.3"E	\$2.00 per barrel of oil

Badra	3	<i>Gazprom (30%), KOGAS (22.5%), Petronas (15%), TPAO (7.5%), Iraqi state-owned Oil Exploration Company (25%).</i>	<i>2009</i>	<i>20 years, with an optional 5-year extension</i>	<i>0.17</i>	<i>33°02'10.8"N 46°00'36.3"E</i>	<i>\$5.50 per barrel of oil</i>
Maysan Oil Fields	2.5	<i>(CNOOC) (63.75%), (TPAO) (11.25%), Iraq Drilling Company (25%)</i>	<i>2010</i>	<i>None</i>	<i>0.450</i>	<i>32°00'51.7"N 47°26'25.7"E</i>	<i>\$2.30 per barrel of oil</i>
Bai Hassan	2.078	<i>North Oil Company until 2014</i>	<i>None</i>	<i>None</i>	<i>0.195</i>	<i>35°42'00.0"N 44°05'60.0"E</i>	<i>None</i>
Ahdab	1	<i>CNPC (75%), North Oil Company (25%)</i>	<i>2008</i>	<i>23 years</i>	<i>0.140</i>	<i>Wasit province, 180 km south-east of Baghdad</i>	<i>\$6 per barrel</i>

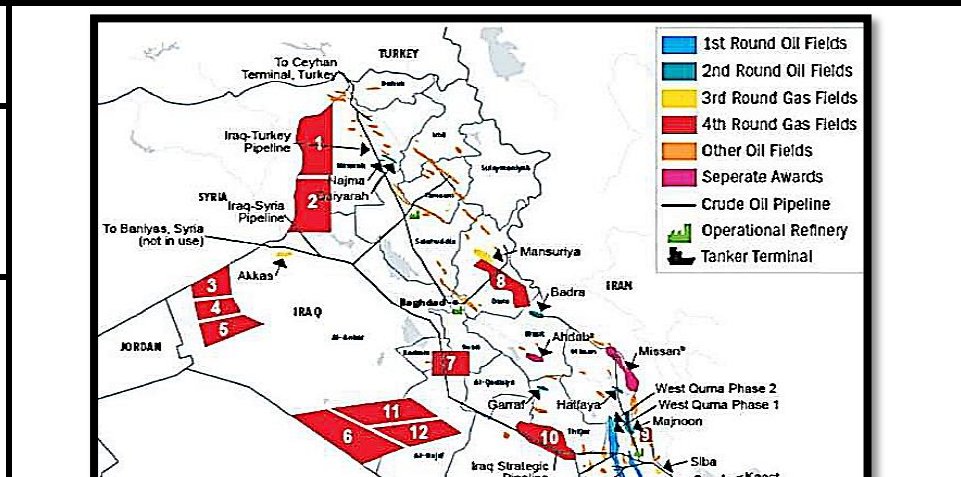
NATURAL GAS IN IRAQ

Iraq has estimated natural gas reserves of 112 trillion cubic meters, the 11th largest in the world according to the International Energy Agency (BGC, 2020) . Most of this gas reserve consists of the associated gas by 81%, while 17% represents non-associated gas, and the remainder of the total amount is the cap gas (Al-Khatteeb, 2013). Geographically, the proven Iraqi gas reserves are distributed in south, center, west and north Iraq with ratios of 71, 9, 4 and 16, respectively. South Oil Company (currently known as Basra Oil Company), Missan Oil Company, Thi Qar Oil Company (not operational during 2016, and was officially opened in 2017), Midland Oil Company, and North Oil Company are the national oil companies operating in the Oil and gas sector in Iraq. National oil companies are responsible for developing oil and gas fields in the regions where they operate (EITI, 2018). Table 2 represents gas fields in addition to all information related to it. Iraq's production of crude oil ramped up to 4,41MMbbl/d in the 2018, as a consequence of that, The APG burning is expected to reach 17.8 billion cubic meters. A study in 2018 estimated that Iraq could save \$5.2 billion over the next four years by reducing flaring and instead recovering and using the gas (Fluenta, 2019).

Table 2: Iraqi Gas Fields.

Field	Reserves	Developed by	Contract Date	Contract Duration	production Target million bpd	Location	Remuneration
Akkas	5.6 tcf	Kogas (75%), North Oil Company (25%).	2011	20 years	400 MMscf per day	30 km south of Al Qaim city on the Syrian border	\$5.50 for each boe produced
Siba Gas Field	1.1 tcf	Kuwait Energy (25%), Türkiye Petrolleri Anonim Ortakligi (TPAO) (30%), Egyptian General Petroleum Corporation (EGPC) (20%), Maysan Oil Company (MOC) (25%).	2010	20 years	100 MMscf per day	30°24'40.9"N 48°06'33.1"E	Non
Mansuriyah	Non	TPAO (37.5%), Oil Exploration Company (25%), Kuwait Energy (KEC) (22.5%), Kogas (15%)	2010	Non	320(MMscf) per day.	34°04'40.8"N 44°57'37.1"E	Non

Fields not Mentioned in the Tables above		Oil Fields that Have Reserves of Less than a Billion barrels	
Fields do not Have Sufficient Information			
Block 1	Block 7		
Block 2	Block 8	Garraf	0.86
Block 3	Block 9	Najmah	0.807
Block 4	Block 10	Qayara	0.8



Block 5	Block 11	Middle Furat	<i>0.6</i>
Block 6	Block 12	Eastern Fields	<i>unknown</i>

FUTURE AGEEMENTS AND ACTUAL REALITY

Iraq's raw gas production is estimated at 2.8 Bcf/d, of which 1.7 Bcf/d is being flared (50- 60%). Only approximately 1.08 Bcf/d is captured. Basra Gas Company (J.V. of SGC, Shell & Mitsubishi) captures 0.94 Bcf/d while South Gas Company captures another 0.15 Bcf/d. If flaring is minimized, Iraq's current reserves would be sufficient to supply 200 years of its current demand (Al-Maleki, 2019). The Iraqi government signed on to the World Bank's "Zero Routine Flaring by 2030" initiative in May 2017, and has been a long-standing member of the Global Gas Flaring Initiative. But past commitments to end flaring have been missed: the deadline for ending flaring in southern Iraq has already been extended from 2016 to 2022 (IEA, 2019). But until this moment, Iraq burns about 55% of the associated gas in the fields of Basra Oil Company, Maysan Oil Company, and Al-Wasat Oil Company, according to the data of the Iraqi Oil Ministry (IMO, 2020). In return, Iraq imports gas from Iran for the purpose of generating electrical energy, and the amount is 980 million SCF / d can be increased depending on the demand for electric energy (Al-Maleki et al., 2019). Based on the assessment of the International Energy Agency and commitment to establish infrastructure, financial allocations and advance planning, the volume of gas flared could fall markedly within the next few years and drop to less than 10 bcm in 2030 (see Figure 2). These volumes can be brought to market and lead to a much greater role for associated gas in overall gas production in Iraq (IEA, 2019).

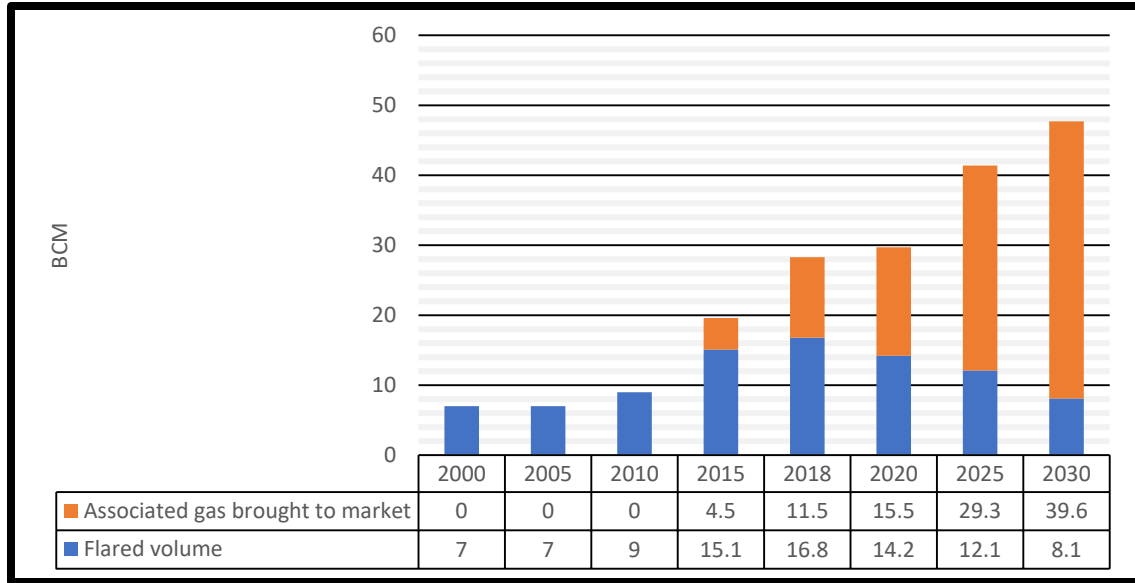


Figure 2: The International Energy Agency prediction the Future of Gas in Iraq (IEA, 2020).

ENVIRONMENTAL AND HUMAN IMPACTS

According to Offshore Energy, Iraq has the second ranking among the top flaring nations after (Russia, Iraq, Iran and the USA were the four most wasteful nations in 2018, flaring over 70 billion cubic meters of natural gas) (EcoMENA, 2020; Offshore Energy, 2020). By Check out the Global Carbon Atlas, the amount of carbon dioxide released to the atmosphere as a result of flaring gas, for Russia is 29 million tons and Iraq is 28 million tons in 2018 (Global Carbon Atlas, 2020). Figure 3 shows the carbon dioxide emissions in Iraq from 2000 to 2018.

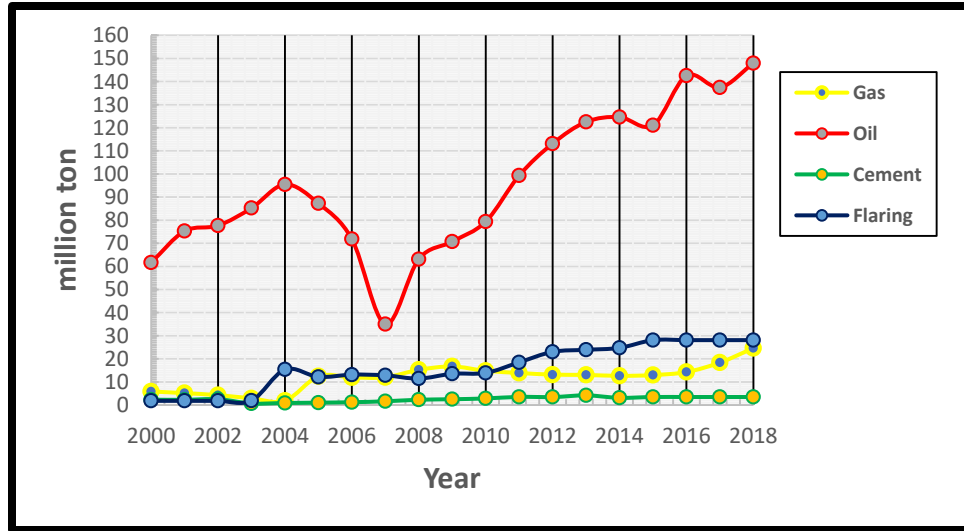


Figure 3: Carbon Dioxide Emissions in Iraq (Our World in Data, 2020).

In addition to the problems of global warming caused by the high percentage of carbon dioxide in the atmosphere, it affects humans and in the long term, with the emergence of many health problems. These include chronic infections, kidney failure, bone atrophy, loss of brain function, as well as an increased incidence of cancer (Bierwirth, 2020).

CONCLUSION

With the increase in crude oil production in Iraq, the amount of gas flared increases because most of the natural gas in Iraq is of the associated type. Which may make it in the future at the forefront of the most gas-flaring countries due to the lack of infrastructure for treatment and the inefficiency of gas collection and processing facilities. In contrast, Iraq has signed the Zero Emission Agreement with the World Bank, which is obligated to do so by 2030. In the coming years, Iraq must develop a strategy that puts an end to gas flaring, and investing this source to revive the economic situation that depends mainly on crude oil. Besides, this will lead to an improvement in the environmental and health situation in the event of reducing carbon dioxide emissions in the long term.

Abbreviation

BGC: Basrah gas company

EIA: Energy International Agency

IEITI: Iraqi Extractive Industries Transparency Initiative

IMO: Iraqi Ministry of Oil

OPEC: Organization of Petroleum Exporting Countries

The biography of the authors

1. Thamer J. Mohammed

- Assistant Head of the Department of Chemical Eng., University of Technology (1997-1999).
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Research Interests

- Interested in industrial & oily wastewater treatment.
- Interested in membrane technology uses in wastewater treatment.
- Interested in hydrodynamics characteristics in bubbly two-phase flow and in fixed-fluidized beds.

2. Mohammad F. Abid

- Got PhD degree in chemical engineering in 2002 from the University of Technology in Baghdad. In 2015 he received the title of Professor in chemical engineering.
- Head of Unit Operation Branch (2006-2012).
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Research Interests.

- Hydrodynamics and kinetics of multiphase catalytic reactors.
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- Interested in neural networks and COMSOL program.

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