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Stubborn Kurdish Petroleum Resources: Surveying Actual data and investigating the declared Numbers

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Taq Taq Second Central Processing Facility; Source: Genel Energy Website.

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Introduction

The confusion over the Kurdish petroleum sector is related to a fundamental paradox which; the more petroleum industry developed and matured, the more financial crisis deepened and the population's living situation worsened. This reverse consequence is an unusual phenomenon neither to the people in the Kurdistan Region of Iraq (KRI) nor for the observers which it mainly stems from the lack in the transparency surrounding the industry. The KRI's Ministry of Natural Resources (MNR) has frequently affirmed the abundance of the petroleum resources and reserves (45-70 billion barrels of oil 'reserves'¹, and 200 trillion cubic feet equal to 5.67 trillion cubic meters of the natural gas reserves²) and repeatedly promised an ambitious target regarding oil and gas production.

In the following disappointing years, The MNR blamed the advent of Islamic state (ISIL) threats along with the oil price dropping as the disruptive factors for its plans. However, still, all have seen that the advent of ISIL provided a golden opportunity to the KRI in controlling some robust and productive oil fields with production in between 150-300 thousand barrels per a day (bpd) and additionally, the Major Fields In the Region never stopped operating. The MNR occasionally tried to provide some data and details concerning petroleum operations in the Region, but it formed a cherry-picking policy which it has never been a comprehensive and continuous process.

These paradoxes and opposite consequences led the Region's citizens to lose their trust in the MNR's statements and periodically provided data and information. The industry, on the other hand, is far from the ambitions, and the financial crisis in one way or another is continuing. Consequently, what the Kurdish populations are desperately hoping for is the continuation of the new federal supplied funds (\$317 millions). Still, neither the MNR makes an effort to explain the actual situation in the sector, nor do the Kurdish media try to follow the mysterious details.

1 Joanna Southcott, 'Kurdistan Oil Consolidation - Waiting for Godot?' (Linked in, 3 May 2015) <<https://www.linkedin.com/pulse/kurdistan-oil-consolidation-waiting-godot-joanna-southcott>> accessed 6 July 2018
2 'Vision' (KRG-MNR, 25 August 2013) <<http://mnr.krg.org/index.php/en/gas/vision-gas>> Accessed 5 July 2018

This research aims in inspecting the KRI's oil and gas industry to find out its actual condition. Section 1 covers the KRI's petroleum resources and reserves by setting out the importance of precision in distinction between resources and reserves. In addition, it presents the detailed data regarding the fields' oil and gas reserves and resources concluding with a technical estimation for possible total Region's resources. Section 2 classifies the Region's petroleum fields in accordance with their production levels and reserves. Section 3 introduces the working petroleum companies in the Region between 2012 and 2018 and also changes in the interests' acquisition besides their fields' status in 2018. Section 4 outlines the problematic dimensions of the KRI's petroleum industry. Section 5 discusses the declining production and reserves as well as the relinquished and suspended fields and blocks. Section 6 briefly focuses on the KRI's oil production, export and destinations and referring to unstable trends of the Regions oil production. Consequently this research ends with a conclusion recommending strategies that may help in avoiding disappointing consequences for the KRI's petroleum industry.

1. The KRI's Petroleum Resources and Reserves

1.1 Resources

The MNR has repeatedly announced its estimation as to the Region's oil reserves at around 45 billion barrels. In March 2011, it raised up the estimation to around 70 billion and also 200 Trillion Cubic feet of Natural Gas. However, these ambitious numbers lack technical and scientific bases since determination of oil and gas reserves is originally subject to several economic, geological, technical and legal factors which the Ministry does not seem to be concerned about.³

Any petroleum perceived reserve should have already been considered according to a set of complex processes so as to be determined and classified. The primary and general criteria are the resources certainty, associated risks, field's efficiency and commercial feasibility⁴. In the KRI, though several working companies have revealed some sort of classification for their petroleum reserves and resources, whereas the MNR neither show any concern about those reserve determinations nor ever updated its overestimated numbers.

³ Southcott (n 1)

⁴ J. A. M. Wim, and H. Swinkels, 'Guidelines for the evaluation of petroleum reserves and resources' [2001] Society of Petroleum Engineers 1-23

According to the US Geological Survey, undiscovered resources in the Zagros fold belt of Iraq, (which a large part of which falls in the KRI) amount at around 41 billion barrels of oil and natural gas liquids and 54 trillion cubic feet of gas.⁵ While in 2012, the International Energy Agency (IEA) estimated that the KRI holds 4 billion barrels of proved reserves.⁶ However, to provide these estimations some sort of certainties, and asserting the extent of their commercial exploitation, the numbers should be turned from estimated resources to a classified and determined reserve.

1.2 Reserves

As the global energy institutes in their ranking for the largest possessors of the petroleum reserves depend on the proved reserves⁷, the KRI's proved petroleum reserves are still limited to a few fields and small quantities (have a look at table 2). After more than one decade of extensive oil and gas investments in the Region, still, the proved reserves remain relatively within small quantities⁸. Many factors supposed to be behind such uncertainties in that shrinking reserves; among most effective factors are the pace in which the MNR wanted to increase the production to 1 million barrel per day (bpd) in late 2015 (and then 2 million in the following years), the sharp drop in oil price during 2015-2016, crowd of working companies, geological problems and also security concerns⁹. The overall situation led the KRI's reserves to remain below the expectations; many petroleum blocks and fields have been relinquished, many others are suspended and several companies suffered repeatedly financial loses¹⁰ which led them to leave KRI complaining the Region's reserve inefficiency¹¹. Consequently, it remains ambiguous to determine precisely the reserve quantity of total proved (1p), proved and probable (2p) proved, probable plus possible (3p)¹². The case is the same for the contingent

⁵ United States Geological Survey, 2000.

⁶ 'Iraq Energy Outlook' (IEA, 2012), 53

⁷ 'Bp statistical Review of World Energy' (Bp, 2017) 12

⁸ Look at the Reserve Table 2 which is prepared to depend on the companies' reserves reports.

⁹ Southcot (n 1)

¹⁰ The numbers of relinquished and suspended blocks and fields are mentioned in section 7.

¹¹ Ron Bousso, 'Shrinking oil reserves crimp Iraqi Kurdistan's allure' (Reuters, 10 March 2016)

⟨ <https://www.reuters.com/article/us-iraq-kurds-oil-idUSKCN0WC1G9> ⟩ Accessed 1 July 2018

¹² **Reserve** as defined by the **SPE PRMS**, and also **Gaffney & Cline associates** is a "quantities of petroleum anticipated to be commercially recoverable by application of development projects to known accumulations from a given date forward under defined conditions." Therefore, Reserves must be discovered (by drilling), recoverable (with current technology), remaining in the subsurface (at the effective date of the evaluation) and "commercial" based on the development project proposed'.

resources in low case (1C), contingent resources in the best case (2C) and contingent resources in a high case (3C)¹³.

Table 1: Classifications and Categories of Petroleum Reserves and Resources¹⁴

Total Petroleum Initially In-place	Discovered Petroleum Initially-In-Place	Commercial	Production		
			Reserves		
			Proved	Proved + Probable	Proved + Probable + Possible
		Sub-Commercial	Contingent Resources		
	Low Estimate		Best Estimate	High Estimate	
	Unrecoverable				
	Undiscovered Petroleum Initially-In-Place	Prospective Resources			
		Low Estimate	Best Estimate	High Estimate	
		Unrecoverable			
	Ranges of Uncertainty.....			

The MNR's estimation as to the KRI's petroleum resources may not be easily classified within the mentioned classes; instead, it could be considered as an initial estimation of the primary perspective resources. Still, several working companies in the large productive fields were able transparently and technically classify and

¹³ **Contingent Resources** according to the Gaffney & Cline associates : "potentially recoverable volumes associated with a development plan that targets discovered volumes but is not (yet) commercial based on the development project proposed'.

¹⁴ John Barker and Tom Hancock, 'I know what Reserves are, but what are Contingent and Prospective Resources?' (Gaffney and cline associates, 29th July 2016) <<http://gaffney-cline-focus.com/i-know-what-reserves-are>> Accessed 6 July 2018

determine their reserves. However, we in this research try basing on the working companies' frequent and updated reports specify the KRI's petroleum reserves within possible limits:

Table 2: Demonstration of the KRI's Oil and Gas Reserves and Resources by Fields

NO	Oil and Gas Fields		1P ¹⁵	2P	3P	1C ¹⁶	2C	C3	Perspective Resources ¹⁷
1	Tawke ¹⁸	Oil/MB ¹⁹	348	513	880	-	91	-	-
		N. Gas Tcf	-	-	-	-	-	-	-
2	Shaikan ²⁰	Oil/Mb	231	615	944	140	239	862	-
		N. Gas Tcf ²¹	-	-	-	0.394	0.953	2.355	-
3	Atrush ²²	Oil/Mb	37.3	102	165	Light	67	68	74
						Heavy	106	228	373
		N. Gas Tcf	-	-	-	0.025	0.047	0.073.3	0.002255
4	Khurmala ²³ Dome ²⁴	Oil Mb	1000			1800			-
		N. Gas Tcf	3.46						-
5	Taq Taq ²⁵	Oil Mb	22	54	90	-	-	-	-
		Cndst ²⁷ /mb	-	191	-	-	-	-	7000 ²⁸

¹⁵ Reserves: Discovered petroleum which is initially in-place and Commercial; Proved (1p), above 90% of certainty, Proved plus probable (2p) above 50% of certainty, Proved and probable plus possible (3p) under 50% of certainty.

¹⁶ Contingent Resources: Discovered petroleum which is initially-in-place, Not commercial yet or sub-commercial.

¹⁷ 'Perspective resources: are undiscovered petroleum initially-in-place. Board of Directors, et al., 'Petroleum Resources Classification System and Definitions' (Society of Petroleum Engineers, February 2000) <<http://www.spe.org/industry/petroleum-resources-classification-system-definitions.php>> accessed 29 June 2018

¹⁸ 'Update on Tawke PSC reserves and resources' (Genel Energy plc, March 2018) <<http://www.genelenergy.com/media/2183/genel-update-on-tawke-psc-reserves-final.pdf>> Accessed 6 July 2018

¹⁹ MB: Million Barrels

²⁰ 'Annual report and accounts 2017' (Gulf Keystone Petroleum, 2017) 16

<http://www.gulfkeystone.com/media/114343/GKP_AR17_Book.pdf> accessed 6 July 2018

'Proposed Restructuring Scheme of Arrangement in respect of the Debt Equitisation and Notes Reinstatement' <<http://www.gulfkeystone.com/media/109609/Supplementary-Prospectus.pdf>>

²¹ Trillion Standard cubic feet of Natural Gas

²² 'Shamran Announces 25% Increase in Atrush Reserves Estimates' (Shamran Petroleum Corp, 15 February 2018) <<http://shamranpetroleum.mwnewsroom.com/press-releases/shamran-announces-25-increase-in-atrush-reserves-estimates-tsx-venture-snm-201802151107188001>> accessed 15 June 2018

²³ Robin Mills, 'A rocky road and Kurdish oil and independence' (Iraq Energy Institute, 19 February 2018) 30

²⁴ Munim Al-Rawi, 'A Silent Giant Oilfield' (2015) Vol. 11, No. 6, GeoEXPro, <<https://www.geoexpro.com/articles/2015/02/kirkuk-a-silent-giant-oilfield>> accessed 6 July 2018.

²⁵ 'Oil reserves and resources update' (Genel Energy Plc, 14 Feb 2018)

<<http://www.londonstockexchange.com/exchange/news/market-news/market-news-detail/GENL/13532180.html>> accessed 25 June 2018.

²⁷ Condensate

²⁸ 'Dana Gas PJSC Report of the directors' (Dana Gas, 30 September 2017) <[http://www.danagas.com/en-us/Investors/Dana%20Gas%20PJSC%20-%20FY%202017%20Directors%20Report%20\(English\).pdf](http://www.danagas.com/en-us/Investors/Dana%20Gas%20PJSC%20-%20FY%202017%20Directors%20Report%20(English).pdf)>

6	Khor Mor ²⁶		N. Gas Tcf	-	8.5	-	-	-	-	75 ²⁹		
7	Fishkhabour ³⁰		Oil/Mb	13	75	292	-	-	-	-		
8	Garmian (Sarqala) ³¹		Oil/Mb		21	40	-	-	-	65		
9	Hawler License Area ³²	Damir Dagh	OIL/MB	-	59	Total	-	-	113	Total	-	109
		Zey Gawra			22	-	-	13	262	-		
		Banan East			23	-	-	61		-		
		Banan Weast			19	-	-	26		-		
		Ain Al Safra			-	-	-	49		-		
10	Chemechemical ³³		Cndst/ Mb	-	119	-	-	-	-	-		
			N. Gas Tsf	-	6.6	-	-	-	-			
11	Kurdamire ³⁴		Oil Mb	-	-	-	-	-	-	366	1000	
			N. Gas/Tcf	-	-	-	-	-	-	1.8	1.0	
12	Benenan ³⁵		Oil/Mb		57.4	118	-	12	-	-	2000 ³⁶	
13	Bastora ³⁷		Oil/Mb		10.9	16	-	-	-	-	--	
14	Miran ³⁸		Oil/Mb	-	-	-	6	23	67			
			N. Gas TCF	-	-	-	1.96	6.6	18.429			
			Cndst/Mb	-	-	-	18	75	233		75	
			Oil/Mb	-	-	-	15	37	78			

Notice: the Quantity 7 billion is for Both Khor more and chemchamal jointly.

²⁶ 'DANA GAS Releases Q1 Financial Results 2016' (Dana Gas, 2016) <https://islamicmarkets.com/publications/dana-gas-releases-q1-financial-results>

²⁹ Ibid

³⁰ Annual Statement of Reserves and Resources' (DNO ASA, 2017) 6

³¹ 'Corporate Presentation' (Western Zagros, March 2017) 4

<http://www.westernzagros.com/wp-content/uploads/2017/05/2017-Mar-WZR-Corporate-Presentation-Final.pdf>

³² 'Oryx Petroleum Announces its Year End 2017 Reserves and Resources' (Cision, 15 February 2018)

https://www.oryxpetroleum.com/data/news/Oryx_Petroleum_Press_Release_YE_2017_Reserves_-

³³ DANA GAS Releases Q1 Financial Results 2016 (n 26)

³⁴ Western Zagros (n 31) 4

³⁵ 'Annual Statement of Reserves and Resources 2017' (DNO ASA, 2017) 8 <https://www.dno.no/en/investor-relations/announcements/2018/dno-releases-2017-annual-report-and-annual-statement-of-reserves-and-resources-records-higher-revenues-profits-production-and-reserves/>

³⁶ Rzger A. Abdula, 'Heavy Oil in Iraq: Review, Journal of Scientific and Engineering Research' [2017] 4(8):134-141, 135

³⁷ DNO (n 35) 8

³⁸ Oil reserves and resources update(n 25)

'Bina Bawi and Miran West gas resource update' (Genel Energy plc, January 2018) <http://genelenergy.com/media/2172/genel-energy-miran-and-bina-bawi-gas-resource-update-final.pdf>

15	Bina Bawe ³⁹	N. Gas TCF	-	-	-	4.6	8.2	13.036	-
		Cndst/Mb	-	-	-	34	62	99	
16	Topkhana ⁴⁰	Oil/Mb	-	-	-	-	55	-	-
		N. Gas Tcf	-	-	-	-	1.6	-	-
17	Chia Surkh ⁴¹	Oil/Mb	-	-	-	-	-	121	218 Risked ⁴²
18	Sheik Adi ⁴³	Oil.MB	-	-	-	-	112	-	-
		N. Gas tcf	-	-	-	-	0.4	-	
19	Pulkana ⁴⁴	Oil/MB	-	-	-	-	409	-	-
		N. Gas tcf	-	-	-	-	1.8	-	
20	Shewa shan ⁴⁵	Oil/MB	-	-	-	-	75	-	-
21	Pirmam ⁴⁶	Oil/MB	-	-	-	-	4	-	-
		N. Gas tcf	-	-	-	-	0.88	-	
22	Taza ⁴⁷	Oil/MB	-	-	-	-	20	-	-
		N. Gas tcf	-	-	-	-	0.006	-	
23	Shakal ⁴⁸	Oil/MB	-	-	--	-	45	-	-
		N. Gas tcf	-	-	-	-	0.138	-	
24	Brada Rash ⁴⁹	Oil/MB	-	-	-	-	250	-	-
	Total Fields	Oil/MB	1651	2879	3545	2186	3867	4073	10701
		N. Gas tcf		18.56		6.979	20.624	35.693	76.002255
	Total 3P plus contingent Resources	Oil.MB	3545(3p)			4073(3C)			10808
		N. Gas tcf	18.56(2p)			35.693(3C)			76.002255
	Total 3p plus contingent Resources	Oil.MB	3545 (3p) + 4073 (3C) = 7618						
		N. Gas tcf	18.56(2p) + 35.693(3C) = 54.253						

According to the data that are shown in Table 2 (the data are from the reports published by the working companies in the KRI, besides Reports and publications of some scholars as they are referenced) the KRI's proved oil reserves until early 2018 could be estimated at around 1.651 billion barrels. Noteworthy, two-thirds of which is solely for Khurmala Dome field, hence if the Khurmala reserve is excluded from that number, the

³⁹ Bid

⁴⁰ Mills (n 23) 30

⁴¹ 'Sale of interest in Chia Surkh PSC' (Genel Energy plc, 29 October 2015)

<http://www.londonstockexchange.com/exchange/news/market-news/market-news-detail/GENL/12558783.html>

⁴² 'Chia Surkh Block' (nrgedge) <https://www.nrgedge.net/project/chia-surkh-block>

⁴³ Mills (n 23)30

⁴⁴ Mills (n 23)30

⁴⁵ Mills (n 23)30

⁴⁶ Mills (n 23)30

⁴⁷ 'Results for the year ended 31 December 2015' (Oil search, 23 February 2016)

http://www.oilsearch.com/data/assets/pdf_file/0011/1622/160223-2015-Full-Year-Results-incl-Appendix-4E-5828d048-c6d5-41cf-8eb9-c8ac9a714486-0.pdf

⁴⁸ Mills (n 23)30

⁴⁹ 'Barda Rash-Report Summary' (Wood Mackenzie, 11 June 2016) <https://www.woodmac.com/reports/upstream-oil-and-gas-barda-rash-13103378>

KRI's proved oil reserve is no more than 651 million barrels. However, its 2p (proved plus probable) and 3p (proved plus probable and possible) are estimated at around 2.879 billion and 3.545 billion respectively (In each of these data, 1 billion accounts solely for Khurmala). As to the KRI's Natural Gas reserves, its 2p is estimated at around 18.56 Tscf. Also, the KRI's contingent oil resources; 1C, 2C and 3C are estimated at around 2.186, 3.851 and 4.073 billion respectively.

The total oil perspective resources are estimated at around 10.808 billion barrels for the mentioned KRI fields in the table 2. Consequently, when taking best estimations into account by collecting total 3P, 3C and Perspective resources (minus the amount of oil which are already calculated within perspective resources) the KRI's total petroleum resources initially in-place could be around 18-19 billion barrels (noteworthy, 40% of which accounts jointly for Khor Mor and Chemchemal at around 7 billion barrels which is geologically risked resources and it is neither discovered nor commercial yet). Moreover, the total natural gas resources initially in-place can be estimated at around 100-115 Tscf (noteworthy, three-quarters of which accounts jointly for Khor Mor and Chemchemal at around 75 tscf which is geologically risked resources and it is neither discovered nor commercial yet).

2. Fields and Production

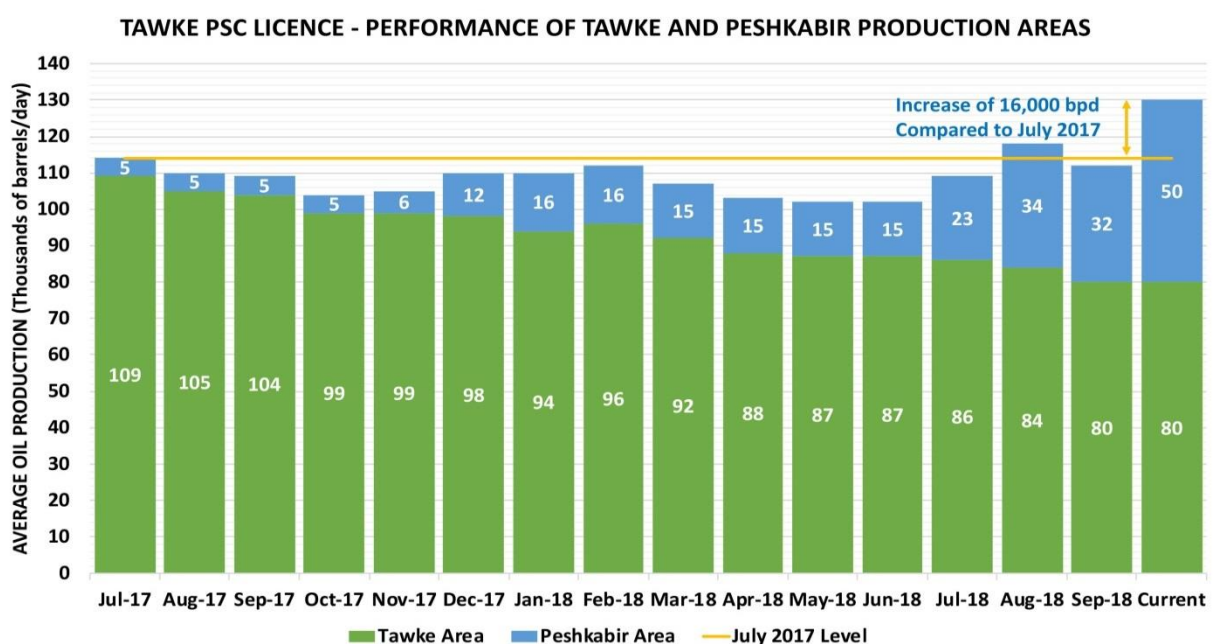
The oil and gas fields in the KRI can be classified according to several criteria. It can be in accordance with their current status, whether the field is a producing one or under development...etc., and also the quantity of production and reserves could be a standard for their classification. In addition, the fields might be classified according the certainty surrounding their reserves, resources and operations as some the fields have a certain degree of certainty regarding their reserves, while others are still ambiguous. Accordingly, an attempt is made in classifying the fields considering those standards.

2.1 Major Fields:

The major fields are the largest oil and gas producing and reserve-holding fields, and also there is some sort of certainty regarding their future status.

- I. **Tawke Field:** In July 2017, the field was producing at around 109,000 barrels of oil on a daily base. But its production since then is gradually dropping to reach 88,000 and then 80,000 in April and October 2018 respectively⁵⁰. At the end of 2011, 13 wells in this field were put on production by DNO⁵¹ and it still has an effective contribution to the overall oil production in the KRI by almost 20%. Furthermore, the field's operator is one of the transparent company (DNO) which publishes and updates its reserves and production regularly⁵².

Figure1: gradual drop of Tawke and gradual hike of Peshkabar between 2017-2018⁵³



- II. **Khurmala field:** This field is another primary field in the KRI and till September 2018, it was producing at around 115,000 bpd⁵⁴. However, according to the last MNR's statement about KRI's oil production and export, the oil export has increased from 325,000 bpd to above 400,000 bpd in November 2018⁵⁵. The statement has not indicated to any increase in the fields' production level individually except for Peshkhabir which it already compensated the decline in Tawke field. In

⁵⁰ <http://mnr.krg.org/index.php/ku>

⁵¹ "Tawke PSC", Genel Energy, retrieved 14 December 2012.

⁵² 'Annual Statement of Reserves and Resources' (n 35) 6

⁵³ From MNR official Website: <http://mnr.krg.org/index.php/ku>

⁵⁴ 'Khurmala Dome-Report Summary' (Wood Mackenzie, 25 April 2017) <https://www.woodmac.com/reports/upstream-oil-and-gas-khurmala-dome-11916490>

⁵⁵ <http://mnr.krg.org/index.php/ku/media-center-ku/press-release/606>

addition, Wood Mackenzie in its report about Khurmala field stated that the production in the field soared to 200,000 bpd⁵⁶. These indications joined with the pre-known ambiguity in the Khurmala field lead to a conclusion that the fields production hiked to around 200.000 bpd. Thus it could be indicated as the most significant field regarding KRI's oil production by around 50% of the total production. The field is operating by KAR group which severely lacks transparency and access to any data concerning its reserves and production is almost locked⁵⁷.

III. **Shaikan Field**; it currently (December 2018) produces around 32000 bpd⁵⁸, when taking its abundant reserves and potential growing capacity into consideration; it could be regarded as a world-scale field and the KRI's richest oil field in terms of reserve, while the reserve is mostly from heavy oil. The field has a potential to increase its production to around 100,000 bpd⁵⁹. According to an agreement between Gulf keystone (the operator of the field) and KRI, the production should be increased to around 55,000 bpd in the second half 2019⁶⁰.

IV. **Khor Mor Field**: Khor Mor is primarily a natural gas and condensate-producing field, it supplies both Chemchemical and Hawler Electric Power Plants with the necessary natural gas. Its daily gas production till August 2018 was about 305 Mscf and also 13,000 bpd of condensate⁶¹. Its Condensate and natural gas production jointly was equivalent to around 70000 bpd of oil⁶². According to the last settlement between Pearl Petroleum and KRI, the field should be developed and expanded to increase its production by 160% in the coming years⁶³. However, the field's natural gas production recently

⁵⁶ <https://www.woodmac.com/reports/upstream-oil-and-gas-khurmala-dome-11916490>

⁵⁷ 'Khurmala Dome-Report Summary' (Wood Mackenzie, 25 April 2017) <https://www.woodmac.com/reports/upstream-oil-and-gas-khurmala-dome-11916490>

⁵⁸ <https://www.gulfkeystone.com/media/119525/Gulf-Keystone-Petroleum-Ltd.-Half-Year-2018-RNS.pdf>

⁵⁹ Baxtiyar Goran, 'Gulf Keystone to increase oil production at Shaikhan block to 110,000 bopd' (Kurdistan24, 6 April 2017) <http://www.kurdistan24.net/en/economy/e56424d3-afa1-480e-abc1-bea234b7adf2/gulf-keystone-to-increase-oil-production-at-shaikhan-block-to-110-000-bopd>

⁶⁰ <https://www.gulfkeystone.com/media/119525/Gulf-Keystone-Petroleum-Ltd.-Half-Year-2018-RNS.pdf>

⁶¹ Jonathan Sheik, 'Crescent Petroleum and Dana Gas to increase gas production from Khor Mor Field' (Arabian OilandGas.com, 22 March 2018) <http://www.arabianoilandgas.com/article-18537-crescent-petroleum-and-dana-gas-to-increase-gas-production-from-khor-mor-field/>

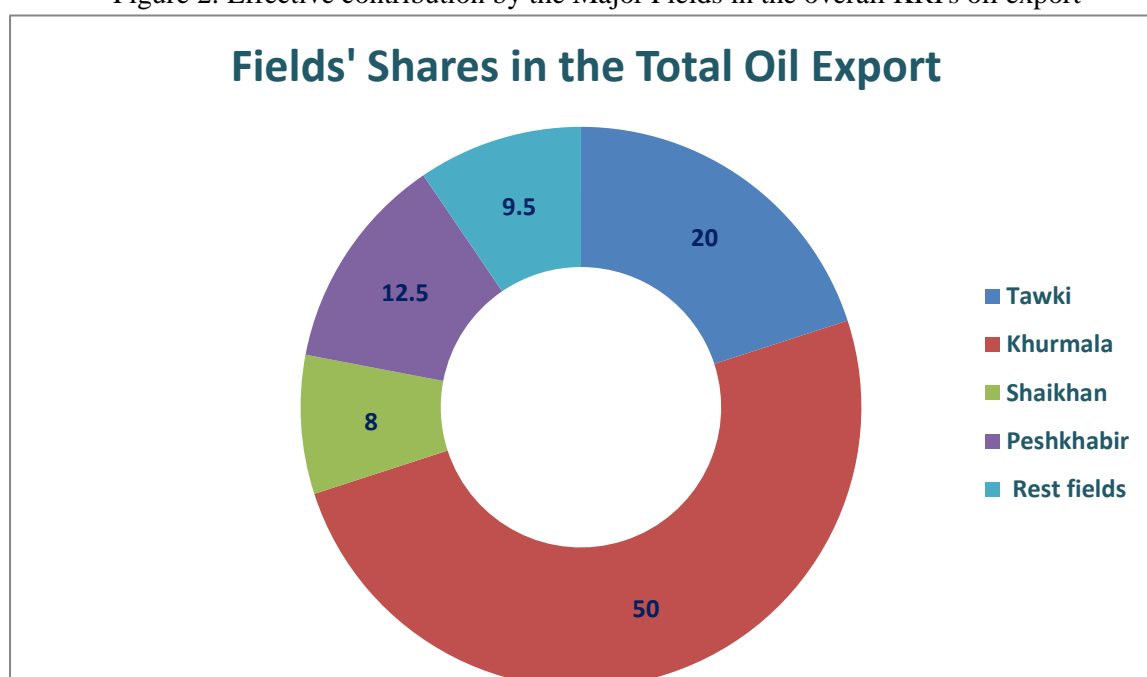
⁶² 'Convert Million Cubic Feet to Barrels Of Oil' Kyle's Converter' <http://www.kylesconverter.com/volume/million-cubic-feet-to-barrels-of-oil>

⁶³ 'KRG, AND PEARL CONSORTIUM reach full AND final settlement' (Dana Gas, 30 August 2017) <http://www.danagas.com/en-us/media-center/press-releases/press-release-details?ID=259>

(November 2018) increased by 30%, so it produces around 400 mcf of natural gas on a daily base besides 15,000 bpd of condensate⁶⁴.

- V. **Fishkhbour Field.** It is a new field next to Tawke which its shares held by Norwegian DNO and Turkish Genel Energy and solely operated by DNO. This field till May 2018 was producing around 16000 bpd. The company in 2018 drilled an additional six wells and from October 2018 on, the additional wells was put on production. Thus the field's oil production soared to around 50000⁶⁵ bpd⁶⁶.

Figure 2: Effective contribution by the Major Fields in the overall KRI's oil export



2.2 Mid-Sized Fields

When taking their reserves, production capacity into account, these types of fields are less significant compared to the major fields. While still, they are producing a considerable amount of oil and natural gas, and also they went through an advanced stage of development:

⁶⁴ <http://www.kurdistan24.net/en/economy/973d298f-b222-47a8-ab48-7f18ae9ca6a2>

⁶⁵ <http://mnr.krg.org/index.php/ku/media-center-ku/press-release/606>

⁶⁶ 'DNO Ramping Up Kurdistan Investments; Reports Strong 2017 Results' (West, 8 February 2018) <https://globenewswire.com/news-release/2018/02/08/1335839/0/en/DNO-Ramping-Up-Kurdistan-Investments-Reports-Strong-2017-Results.html>

- I. **Atrush Field:** In July 2017, the field was put on production with around 27000 bpd, and it was stable in that level of production till early 2018⁶⁷. Its reserves to some extent certain and classified holding about 102 Million Barrel of proved and probable reserves (2p). The field from March 2018 on faced a technical problem which led the production to drop to around 23000-20000 bpd⁶⁸. However, according to a report by Shamaran Company (holds %20 of the field's interest) the production in October recovered to around 27,000 bpd⁶⁹.
- II. **Taq Taq Field:** It has relatively a long history of production compared to other KRI's fields. Taq Taq field was put on production in 2006 topping at a record around 140,000 bpd in 2015⁷⁰. While currently (December 2018), it suffers an instability concerning its reserves and production. From 2015 on, the field faces a sharp decline in its production (also reserves) ending with 13000 bpd in the first half of 2018⁷¹.
- III. **Germian (Sarqala) Field:** During 2017, it was producing around 11,000 bpd, while in April 2018, by operating a new well, The Russian GazProm, the operator of the field, has raised the oil production to around 21000 bpd. This increase compensated the decline in the Atrush field in a critical time for the KRI⁷².
- IV. **Ain Sifni Field:** The field is located in the Shaikhan area and its Production swings around 10,000 bpd and the development in the field continues aiming in raising the production to 30,000 bpd. The extracted oil from this field is transferred by truck to feshkhabir to be injected to the KRI's export pipeline. As production grows, Ain Sifni production could also tie into the Atrush export line⁷³.

⁶⁷ <https://www.shamaranpetroleum.com/news/shamaran-petroleum-corp-atrush-production-update-122492/>

⁶⁸ 'SHAMARAN PETROLEUM CORP: ATRUSH Production Update' (Shamaran Petroleum Corp, 3 April 2018) <https://globenewswire.com/news-release/2018/04/03/1459654/0/en/SHAMARAN-PETROLEUM-CORP-ATRUSH-PRODUCTION-UPDATE.html> + http://shamaranpetroleum.mwnewsroom.com/press-releases/shamaran-announces-atrush-production-update-tsx-venture-snm-gnw_2203798_001

⁶⁹ <https://www.shamaranpetroleum.com/news/shamaran-petroleum-corp-announces-financial-and-o-122698/>

⁷⁰ 'Production falls in Kurdish Taq Taq oil field' (Rudaw, 23 September 2016) <http://www.rudaw.net/english/kurdistan/230920166>

⁷¹ 'Audited results for the year ended 31 December 2017' (Genel Energy plc, 22 March 2018) 2

⁷² 'GAZPROM NEFT Commission Second Well at SARQALA Field' (Gazprom, 25 April 2018) <http://www.gazprom-neft.com/press-center/news/1526698/>

⁷³ 'All's Well in western Kurdistan' (OGInsights, 12 March 2018) <http://oginsights.blogspot.com/2018/03/all-s-well-in-western-kurdistan.html>

- V. **SarSang (Swara Tika) Field**; the field is located north to the Atrush field. At late 2017, the field was producing 15000 bpd, and it is supposed to ramp-up its production to around 30000 bpd⁷⁴

2.3 Less Productive Fields

Both fields of Hawler License Area and Shewashan oil field (khalakan block) are producing in lower rates of 3,300 bpd and 1,000 bpd respectively⁷⁵. However, in April 2018, Gas plus; the field's operator, decided to halt its operation in the Shewashan field due to sharp production decline⁷⁶.

2.4 Promising Fields

Several other fields in the KRI could be further invested and developed in order to bring them to the production level in the few coming years. Relatively abundant reserves of some these fields, installed infrastructures and also the upward trend of oil prices may reinforce these field's future. Among those fields; Kurdamire possesses appropriate contingent petroleum resources of 366 million barrels of oil and 1.8 tcf of natural gas. Chemchemal is another promising field with proved and probable condensate reserves of 119 million and 6.6 tcf of Natural gas as well as Miran with contingent oil resources of 23 million and 6.6 tcf of natural gas. In addition, Bina bawi also possesses a contingent oil resource of 37 million and 8.2 tcf of natural gas besides Benenan with proved and probable oil reserves of 57 million⁷⁷. If these fields brought to adequate production level, they may ramp-up overall KRI oil production to around 500,000 bpd and 1.5 bcf of gas (the references for these data are available in Table 2).

3. The Working petroleum Companies in the KRI

A set of factors incentivised the international petroleum companies to flow toward the KRI especially between 2008 and 2012, aiming in a profitable and secure investment in the Region's petroleum. The MNR's allegation

⁷⁴ Ibid

⁷⁵ 'Gas Plus Khalakan provides update on Shewashan operations in Iraq' (World Oil, 11 January 2018) <http://www.worldoil.com/news/2018/1/11/gas-plus-khalakan-provides-update-on-shewashan-operations-in-iraq>
<http://www.oryxpetroleum.com/en/operations/iraq.php>

⁷⁶ 'Shwashan Filed will be Halted' (Dwarozh, May 2018) <https://www.dwarozh.net/details.aspx?jmare=74710>

⁷⁷ DNO (n 35) 8

of 45-70 billion barrels of extractable oil reserves, the high price of oil, easiness of the authorization obtaining procedures and lack of taxes were among the most incentives. For example, an official from the Resources Industry said “When the KNOC (Korean National Oil Corporation) acquired the stake; the Kurdistan Region of Iraq was considered the land floating in crude oil”⁷⁸. While, on the ground, many complexities and problems arose; such as rough geology, oil price drop, security concerns, some demands for privileges by the local population and also corruption⁷⁹. If we compare table 3 below which demonstrates the petroleum companies that were working in the Region in 2012, with the table 4 which shows the companies in 2018, we will realize that a great deal of change has happened since then. In 2012 around 50 companies were working in the Region, the number is dropped by more than half for 2018 which for now (December 2018) only around 20 companies are present or have interests in the active fields.

Table 3: Petroleum Working Companies in the KRI in 2012

NO	Fields and Blocks	Companies' working Interests(2012)	Status (2018)
1	Tawke (Including Fishkhabour)	DNO 55%, Genel Energy 20% UI 5%, KRG 20%	Producing
2	Shaikhan	Gulf Keystone 51%, Texas 3.4%, MOL 13.6%, Unassigned 12% KRG 20%	Producing
3	Atrush	GKP 80%, Marathon 20%,	Producing
4	Sindi-Amedi	Oryx 45%, Perenco 35%, KRG 20%	Relinquished ⁸⁰
5	Ber Bahr	Genel Energy 40%, Gulf Keystone 40, KRG 20%	Relinquished ⁸¹
6	Sheikh Adi	Gulf Keystone 80%, KRG 20%	Relinquished ⁸²
7	Duhok (Summail Gas Field)	Genel 35%, DNO 40%, UI 5%, KRG 20%	Relinquished ⁸³
8	AL-Qush/ Baeshiqa/ Pirmam/ Qara Hangeer/ East Arbat/ Betwata	Exxon Mobil 80%, KRG 20%	*East Arbat+Betwata+ Qara hanjeer: Relinquished ⁸⁴ *Others: Halted
9	Dinarta	Hess 64%, Petroceltic 61%, KRG 20%	Relinquished ⁸⁵

78Jung Min-hee, 'KNOC Pulls Out of Iraq's Sangaw South Oil Field Project' (Business Korea, 24 August 2016)

<http://www.businesskorea.co.kr/news/articleView.html?idxno=15631>

79 'Korean lawmaker lowers Kurdistan oil prospects' (Ekurd Daily, 19 March 2015) <http://ekurd.net/korean-lawmaker-lowers-kurdistan-oil-prospects-2015-03-19>

80 'Monthly Report' (KRG- MNR, October 2013) Issue 1, 30, <https://www.scribd.com/document/196953168/Kurdistan-Operator-Activity-Map-1>

<https://www.newswire.ca/news-releases/oryx-petroleum-announces-its-year-end-2013-reserves-and-resources-513711401.html>

81 'Trading and operation Update' (Genel Energy plc, 20 January 2016) <http://www.genelenergy.com/media/1888/genel-trading-and-operations-update-200116-final.pdf>

82 Mills (n 23)30

83 Mills (n 23)30

84 'Exxon pulls out of three exploration blocks in Kurdistan: Iraq Oil Report' (Reuters, 6 December 2016)

<https://www.reuters.com/article/us-exxon-mobil-kurdistan/exxon-pulls-out-of-three-exploration-blocks-in-kurdistan-iraq-oil-report-idUSKBN13V0T0>

85 Petroceltic International, 'Iraq: Petroceltic International and Hess to relinquish Dinarta licence in Kurdistan' (Energy Pedia News, 25 March 2015) <https://www.energy-pedia.com/news/iraq/new-163027>

10	Sulevani	Petrol Quest 80% KRG 20%	Exploration-Halted
11	Duhok Central	Murphy Central Duhok Oil 50%, KRG 50%	Relinquished ⁸⁶
12	SarSang	HKN Energy 60%, Marathon 25%, Maersk Oil 15%	Producing
13	Akri-Bijeel	MOL(Kalegran) 64%, Gulf Keystone 16%, KRG 20%	Relinquished ⁸⁷
14	Rove	Reliance(Later Chevron80%) ⁸⁸ 60%, OMV20%,KRG20%	Relinquished ⁸⁹
15	Bardarash	Afren 60%, Komet 20%, KRG 20%	Relinquished ⁹⁰
16	Ain Sifni	Hunt 60%, Afren 20%, KRG	Producing
17	Hair	Marathon 80%, KRG 20% (Later Marathon 45%, Total 35%, KRG 20% ⁹¹)	Relinquished ⁹²
18	Sarta	Reliance(Later Chevron 80%) ⁹³ 60%, OMV20%, KRG20%	Development ⁹⁴
19	Banenan(Erbil) and Bastora	DNO 40%, Gas plus 40%, KRG 20%	Development-Halted
20	Khurmala	KAR OIL & Gas ?%	Producing
21	Hawler License Area	Oryx Petroleum 65%, KNOC 15%, KRI 20%	Producing
22	Mala Omer	OMV 80%, KRG 20%	Relinquished ⁹⁵
23	Shakrok	Hess 64%, Petroceltic 61%, KRG 20%	Relinquished or Halted
24	Safeen	Marathon 80%, KRG 20% (Later Marathon 45%, Total 35% KRG 20% ⁹⁶)	Relinquished ⁹⁷
25	Shorish	OMV 80%, KRG 20%	Relinquished ⁹⁸
26	Qush Tappa	KNOC 80%, KRG 20%	Relinquished ⁹⁹
27	Qala Dze	Repsol 80 KRG 20%(Later Repsol 40%, Maersk Oil 40%, KRG 20%) ¹⁰⁰	Relinquished ¹⁰¹
28	Piramagrun	Repsol 80%, KRG 20%(Later Repsol 40%, Maersk Oil 40%, KRG 20%) ¹⁰²	Relinquished ¹⁰³
29	Khalakan-Shewashan	Gas Plus (Newage 40%, BlackGold 20.1%, Range19.9%) (Later: Dogan Enerji 40%, Black Gold Khalakan 20%, Range Oil & Gas 20%) KRG 20%	Halted (2018) ¹⁰⁴
30	Kewa Chirmala	TTOPCO 80% (Genel 44%, Addax 36%) KRG 20%	Dry well ¹⁰⁵
31	Taq Taq	TTOPCO 100%: (Genel 45%, Addax 55%)	Producing

86 Monthly Report (n 80) 30

⁸⁷'MOL relinquishes Akri-Bijeel block' (the Oil and Gas Year, 11 January 2016) <https://www.theoilandgasyear.com/news/mol-relinquishes-akri-bijeel-block>

⁸⁸'Chevron to acquire Rovi and Sarta in Iraqi Kurdistan' (2bF, August 2012) <https://www.2b1stconsulting.com/chevron-and-reliance-close-deal-in-kurdistan-oil-fields>

⁸⁹ The Oil and Gas Year Book 2016

⁹⁰ Ibid

⁹¹'Iraq: Total farms into Marathon Oil's Kurdistan blocks Harir and Safen' (Energy Pedia, 31 July 2012) <https://www.energy-pedia.com/news/iraq/new-151253>

⁹² (n 98)

⁹³ (n 88)

⁹⁴'Chevron Restarts Drilling in Kurdistan Region of Iraq' (Oil and Gas 360, 19 February 2018) <https://www.oilandgas360.com/chevron-restarts-drilling-kurdistan-region-iraq/>

⁹⁵ Monthly Report (n 80) 30

⁹⁶'Iraq: Total farms into Marathon Oil's Kurdistan blocks Harir and Safen' (n 91)

⁹⁷ Mills (n 23) 59

⁹⁸ Monthly Report (n 80) 30

⁹⁹ Ibid

¹⁰⁰'Maersk Announces Deal for 2 Exploration Blocks' (Iraq-Business News, 16 January 2014) <http://www.iraq-businessnews.com/2014/01/16/maersk-announces-deal-for-2-exploration-blocks/>

¹⁰¹'CONSOLIDATED FINANCIAL STATEMENTS or the financial year 2016' (Repsol.com, 2016) [https://www.repsol.com/imagenes/global/en/2016 Consolidated Financial Statements tcm14-59824.pdf](https://www.repsol.com/imagenes/global/en/2016%20Consolidated%20Financial%20Statements%20tcm14-59824.pdf)

¹⁰² Maersk Announces Deal for two exploration blocks (N 100)

¹⁰³ Consolidation Financial Statement or the financial year 2016 (n 101)

¹⁰⁴ Dwarozh (n 76)

¹⁰⁵ Robin Mills, 'Under the mountains: Kurdish Oil and Regional policies' (Oxford Institute For Energy Studies, January 2016) 16

32	Khor Mor	Pearl Petroleum 80%:(Dana Gas 40%, Crescent 40%) KRG 20%	Producing
33	Chemchemal	Pearl Petroleum 80%:(Dana Gas 40%, Crescent 40%) KRG 20%	development
34	Bazian	KNOC Bazian 80% KNOC 20%	Relinquished ¹⁰⁶
35	Miran	Genel 15% Heritage 75%, UI 10% (Later Genel Energy 100%) ¹⁰⁷	Development
36	Bina bawi	OMV 80%, KRG 20% (Later Genel Energy 100%) ¹⁰⁸	Development
37	Baranan	Talisman 60%, ...? 40%(Later total 80%, KRG 20%) ¹⁰⁹	Relinquished ¹¹⁰ twice ¹¹¹
38	Qara Dag	Niko 49%, Vast 25%, Groundstar 6%, KRG 20% (Later 2013, Chevron 80%, KRG 20%)	Relinquished, awarded again and halted ¹¹²
39	Sangaw North	Sterling 53.33%, Addax 26.66%, KNOC 20%	Relinquished ¹¹³
40	Sangaw South	KNOC 50% Daesung 10% KRG40%	Relinquished ¹¹⁴
41	Kurdamir	Talizman 40%(Later Repsol ¹¹⁵), Western Zagros 40%, KRI 20%	Development
42	Garmian- Sarqala	WesternZagros 40%, KRG 40%	producing
43	Topkhana	Talisman 60%, KRG40%(Later Repsol 80%, KRG20%) ¹¹⁶	Development
44	Taza	OSIL 60%, ShaMaran 20%(Later Total), KRG20%	Relinquished ¹¹⁷
45	Pulkana and Arbat	Shamaran 60% in each,	Both relinquished ¹¹⁸
46	Chia Surkh	Genel 40%, Petoil 40% (Later Genel sold its share to petoil) ¹¹⁹ KRI 20%	Appraisal, Halted
47	Shakal	Petoil Inc 9%, OSIL 15%, Shakal production 36% (Later Gazprom 80%, KRG 20%)	(First relinquished -Shakal Production ¹²⁰)Appraisal- GP ¹²¹
48	Halabja	Gazprom 80%, KRG 20%	Halted ¹²²

¹⁰⁶ Hee (n 78)

¹⁰⁷ 'Bina Bawi and Miran West gas resource update' (Genel Energy Plc, 18 January 2018)

<http://www.genelenergy.com/media/2173/genel-energy-miran-and-bina-bawi-gas-resource-update-final.pdf>

¹⁰⁸ Ibid

¹⁰⁹ 'Total purchases 80% stake in Kurdistan block' (PLS, 18 June 2013) <https://www.plsx.com/news/article/total-purchases-80-stake-in-kurdistan-block>

¹¹⁰ Monthly Report (n 80) 30

¹¹¹ Total (n 109)

* <https://www.thenational.ae/business/energy/maersk-oil-acquisition-marks-change-up-in-strategy-for-total-1.625151>

* Mills (n 23) 59

¹¹² Monthly Report (n 80) 30

¹¹³ Ibid

¹¹⁴ Hee (n 78)

¹¹⁵ Consolidation Financial Statement or the financial year 2016 (n 101) 39

¹¹⁶ Ibid

¹¹⁷ Rick Wilkinson, 'Oil Search exits the Middle East, will focus on Papua New Guinea' (Oil and Gas Journal, 24 January 2017)

<https://www.ogi.com/articles/2017/01/oil-search-exits-middle-east-will-focus-on-papua-new-guinea.html>

¹¹⁸ Monthly Report (n 80) 30

¹¹⁹ Genel exits Kurdistan licences' (Upstream) <http://www.upstreamonline.com/live/1209153/genel-exits-kurdistan-licences>

¹²⁰ Monthly Report (n 80) 30

¹²¹ Gazprom (n 72)

<https://www.dailysabah.com/energy/2017/09/29/gazprom-scraps-halabja-project-in-krg>

<http://www.1prime.biz/news/0/%7BA9F29782-B0D4-4919-99E2-02E1D51455F7%7D.uif>

¹²² 'Gazprom scraps Halabja project in KRG' (Daily Sabah, 29 September 2017)

<https://www.dailysabah.com/energy/2017/09/29/gazprom-scraps-halabja-project-in-krg>

<http://www.1prime.biz/news/0/%7BA9F29782-B0D4-4919-99E2-02E1D51455F7%7D.uif>

Table 4: Current (2018) Petroleum Working Companies in the KRI

NO	Fields and Blocks	Companies' working Interests	Status
1	KRI 20%Tawke	DNO 75%, Genel Energy 25%	Producing
2	Fishkhabour	DNO 75%, Genel Energy 25%	Producing
3	Shaikhan	Gulf Keystone petroleum75%, Texas Keystone 5%,	Producing
4	Atrush	TAQA 39.9%, Shamaran 20.1%, Marathon 15%, KRI 25%	Producing
5	Khurmala	KAR OIL & Gas 100%	Producing
6	Hawler License Area	Oryx Petroleum 65%, KRI 35%	Producing
7	Taq Taq	TTOPCO 100%: (Genel 45%, Addax 55%)	Producing
8	KhorMor	Pearl Petroleum 100%: (Dana Gas 35%, Crescent 35%, OMV 10%, MOL 10%, Rwest 10%)	Producing
9	Garminan-Sarqala	WesternZagros 40%, Gazprom Neft 40%, KRI 20%	Producing
10	Sarsang	HKN 37% operator, KRG 25%, Marathon 20%, Total 18% (Total acquired the share from Maersk)	Producing
11	Ain Sifni	Hunt Oil 80% operator, KRG 20%	Producing
12	Bina bawi	Genel 100%	Development
13	Kurdamir	Repsol 40%, Westernzagros 40%, KRI 20%	Development
14	Miran	Genel 100%	Development
15	Topkhana	Repsol 80%, KRI 20%	Development
16	Chemchemical	Pearl Petroleum: Dana Gas 35%, Crescent 35%, OMV 10%, MOL 10%, Rest 10%.	Development
17	Benenan	DNO 40%, KRI 60%	Development
18	Bastora	DNO 40%, KRI 60%	Development
19	Sarta	Chevron 80%, KRG 20%	Development ¹²³
20	Kurdistan's oil export Pipeline	Rosneft 60%, KAR Group 40%	

4. Problematic Dimensions of the KRI's Petroleum Industry

Several problems such as its geology, security¹²⁴, crude quality, market price volatility and also transparency surround investments in the Region's petroleum sector. Below an attempt is made to identify some of them:

4.1 Geological drawbacks

¹²³ 'Chevron Restarts Drilling in Kurdistan Region of Iraq' (n 94)

¹²⁴ Bousso and Dmitry Zhdannikov, 'Chevron drills oil well in Iraqi Kurdish area after the two-year gap: sources' (Reuters, 20 September 2017) <https://www.reuters.com/article/us-chevron-exploration/chevron-drills-oil-well-in-iraqi-kurdish-area-after-two-year-gap-sources-idUSKCN1BV1UG>

In the wake of the KRI's invitation to the international petroleum companies for investments in its oil and gas resources, many companies believed that only some simple procedural steps are required for the region's oil to flow. This understanding might be stemmed from pre-knowledge of easiness of the Iraqi federal oil extraction. While, they soon realised that such an ambitious approach was somewhat an overestimation from them facing lots of geological problems¹²⁵, which are outlined below:

- **Exploration risks:** breaking in the low reservoirs (presumed from oil leaks), led to a conclusion that the shallow geology cannot be a realistic indicator to the deeper petroleum reservoirs.¹²⁶
- *The reservoir rocks are highly fractured, allowing wells to drain oil rapidly through the cracks. However, the small pores in the reservoir rock matrix here, which hold the bulk of the oil in common fields, are not contributing to production at all. Once the relatively small volume of oil in the fractures is drained, they fill with water¹²⁷.* Complex structure has led to dry wells (such as Kewa Chirmila) and inaccessible oil (such as in the Taza field) and shrinking reserves (Barda rash fields).¹²⁸
- In the majority of the fields, various types of hydrocarbons are found: Natural gas, condensate, both light and heavy oil¹²⁹, this seems good, but the problem is each type requires a different sort of infrastructure and its own standard for extraction, different method of transportation and commercial transaction as well as the additional process of separation.
- Kurdistan petroleum fields are relatively small and holding limited amount of reserves as well as they are scattered in different geographical areas¹³⁰.
- Numerous fields are situated in mountainous areas, more than 2,000 meters elevation which makes difficulties in their exploration and extraction.¹³¹

¹²⁵ Highlights of operations' (Chevron.com) <https://www.chevron.com/worldwide/iraq>

¹²⁶ Mills(n 105)15

¹²⁷ Robin Mills, 'Genel Energy, another victim of Kurdish Geology, The national Business' (the national, 16 April 2017) <https://www.thenational.ae/business/genel-energy-another-victim-of-kurdish-geology-1.21278>

¹²⁸ 'Exploration and Appraisal Drilling Update – June 2015' (Oil search, 2 July 2015) http://www.oilsearch.com/_data/assets/pdf_file/0019/1909/150702-Drilling-Report-for-June-c38e0f7d-a13f-458c-8a5b-ca9149b9b2b5-0.pdf

¹²⁹ Mills (n 105)

¹³⁰ Look at table 2.

¹³¹ Mills (n 23)

- Fractured reservoirs led to instability in output and confused reservoir running. Several companies were obligated to eliminate their reserves – such as Afren at its Barda Rash in January 2015 and MOL in Akri-Bijeel field in September 2015.¹³²
- The distribution of the oil and gas resources throughout the Region and their altitudes and quantities are complicated and hard to be predicted.¹³³

Due to the above mentioned geological features, many companies either reviewed their proved and probable reserves and resources or dropped the field's output. For further understanding the impact of the geological problems in the KRI's oil and gas investments, below two expressive quotes are indicated:

*"The recent reserve downgrades is another blow to optimism about Kurdish oil production," "While there are substantial amounts of oil in this underexplored province, companies are finding it is not as easy to find or produce in the quantities initially expected." said Richard Mallinson, geopolitical analyst at consultancy Energy Aspects'.*¹³⁴

*"If you take a long-term view, you can look through politics and geopolitical risks," BMO Capital Markets analyst Brendan Warn said " .But if you have not got good geology and the oil is not so easily produced, you are much less attractive and no longer a major's acquisition story."*¹³⁵

4.2 Security Problems

Several petroleum fields either located on the border with the disputed territories¹³⁶ or entirely (in some cases partially) situated within them. The Khor Mor and Khurmala fields (major Kurdish

¹³² 'Relinquishment of THE AKRI-BIJEEL Block in the Kurdistan Region of Iraq' (MOL Group, 11 January 2016) <https://molgroup.info/en/investor-relations/regulated-information/3327-relinquishment-of-the-akri-bijeel-block-in-the-kurdistan-region-of-iraq>

¹³³ Mills (n 105)

¹³⁴ Bouso (n 11)

¹³⁵ "If you take a long-term view, you can look through politics and geopolitical risks," BMO Capital Markets analyst Brendan Warn said " .But if you have not got good geology and the oil is not so easily produced, you are much less attractive and no longer a major's acquisition story."

petroleum fields) are on the border or sometimes alleged to be within the disputed territories; both were directly under a serious threat during the 16th October events last year. Shakal, Taza and Palkana fields are almost entirely located within the disputed territories. Moreover, both Kurdish oil export pipeline and also gas pipeline are almost completely vulnerable since they extend along with the disputed territories and in two locations they cross what is known as a green line (pre-2003 border of the KRI), first, where the Gas pipeline cross through Qara Hanjeer block to Qush Tappa; second where the oil pipeline cross through Baeshiqa to Al Qush blocks. In addition, due to its geographical closure, the KRI's oil export remains under constant Turkish threats as it lack any strategic seashore.

4.3 Problems of Crude varieties and inconsistency

Most fields throughout the Region possess mixed reserves of oil, gas and condensate, unlike the fields under the control of Federal Government of Iraq which mostly contains pure oil reserves. Natural gas is a vital source of energy particularly for supplying electric plants and also for exporting to Turkey and elsewhere, but it requires sophisticated infrastructure and more extensive and complicated commercial transactions. Also, several other substances are accompanied with the extracted oil and gas such as; Hydrogen sulphide, toxic and corrosive substances which contributes to extra costs, safety concerns and, in some occasions incidents'.¹³⁷

Heavy oil which is another feature of the KRI's oil reserves (in some fields), particularly in its largest reserves holder; Shaikan field, it is associated with a more laborious process in its extraction, transportation and also has a lower value.¹³⁸ Similarly, Benenan, Miran (mostly) and Atrush (partly), possess heavy oil reserves. The problem of heavy oil, for example, culminated in February 2017,

¹³⁶ Territories beyond 2003 border of the KRI, The Region believes they are geographical, originally, historically and demographically belongs to the Kurdish territories, while federal Iraq does not recognise that claims but reject it.

¹³⁷ Mills (n 105) 16

¹³⁸ Abdula (n 36) 139

when Kurdistan Regional Government decided to halt blending of Shaikan heavy oil into its pipeline for delivery to the Turkish Mediterranean oil terminal at Ceyhan. Alternatively, the KRG has agreed to take responsibility of the additional cost from transporting Shaikan crude by truck and to continue paying Gulf Keystone \$15 million monthly for the former and present exports.¹³⁹

4.4 Price volatility

The most unfortunate curse that happened to the KRI's oil sector was the sharp drop in the oil price in a sensitive time. While the oil companies were at their initial stages of large-scale exploration, wells testing and extraction, the oil price was dropping in a way that endangered the entire companies' investments. Although the majority of relinquished fields were left due to purported reserve insufficiency¹⁴⁰, still, doubts remain triggered as to the crucial role of the oil price drop about the genuineness of the companies' allegation.

5. Declining Production and Reserves, Relinquished and Suspended Fields

From 2015 onward, many oil companies relinquished their blocks justifying this phenomenon by inefficiency in the fields' reserves and lack of a commercial ground for their continuity. In the same time, the sharp oil price decline, activities of ISIS in the region, continuous threats from the central government in Bagdad could not be excluded as effective factors that could be behind the extensive relinquishments of the petroleum field. The main cases of relinquishments, suspensions, declining production and reserves are briefly mentioned below:

I. Afren Plc – Barda Rash Field

Afren Plc, the UK-listed oil explorer, had 60% of working interest in the Barda Rash block since 2011. During 2012, the field was producing around 5,000 bpd of crude oil. In January 2015, the company wiped 190 million barrels of oil of gross proven plus probable (2P) reserves from Barda Rash and also downgraded the field's

¹³⁹ Tamsin Carlisle, 'Iraqi Kurdistan faces obstacles to maintain crude oil export quality: Analysis' (Ekurd daily, 18 March 2017)

¹⁴⁰ Bouso (n 11)

contingent resources to around 250 million barrels from 1,243. Afren wiped the reserves after hitting more water than expected in wells. It is assumed that production from the field halted since the end of June 2015.¹⁴¹

II. MOL Plc – Akri-Bijeel Field

MOL, Hungarian Oil and Gas Plc, the operator of Akri-Bijeel block, is another company which has announced its relinquishment of his block. MOL declared that the relinquishment was based on the result of a broad assessment in the block's prospective resources. Additionally, in 2014, Gulf Keystone which had a 20% interest in the block, suffered \$144.1 million loss in the Akri-Bijeel block. Consequently, in the early 2016, it confirmed its complete exit from the block.¹⁴²

III. OIL Search Ltd - Taza Field

Despite an initial discovery of oil and gas resources, Oil Search Ltd relinquished its interests in the Taza block. The company complained uncertainties in the field's resources and also lack of a commercial ground compared to the oil price then.¹⁴³ The company had loss of around \$39 million solely in 2015 from the field. In addition, it linked its overall loss of \$400 million to the Taza oil field.¹⁴⁴ Oil Search Ltd in its report titled **'Results for the year ended 31 December 2015'**, explained its disappointment in the field as follows; *'As part of our review of the Taza asset in Kurdistan and following drilling and testing in 2015, we downgraded the estimate of gross recoverable 2C contingent resources in this field from 165.8 mm bbl to 56.4 mm bbl. Consequently, we have decided to take a conservative approach to the carrying value of Taza, reducing it to zero, despite still holding a material resource base, resulting in a write-off of US\$399.3 million .This has led to a statutory net loss, after tax, of US\$39.4 million for 2015. Notably, there were no other impairments, with all producing assets assessed against a range of short, medium and long-term oil prices.'*¹⁴⁵

¹⁴¹ Ibid

¹⁴² Joshua Warner, 'Gulf Keystone Ends Costly Saga After Exiting Akri-Bijeel Block' (Alliance News, 11 January 2016) http://www.morningstar.co.uk/uk/news/AN_1452512093181462500/update-gulf-keystone-ends-costly-saga-after-exiting-akri-bijeel-block.aspx

¹⁴³ Wilkinson (n 117)

¹⁴⁴ Anthony Fensom, 'Oil Search records US\$39m net loss' (Morning Star, 24 Feb 2016) <https://www.morningstar.com.au/stocks/article/oil-search/7577>

¹⁴⁵ 'Oil search (n 47)

IV. Genel Energy- Taq Taq Field

Genel Energy downgraded the fields proved and probable (2p) oil reserves from 683 million barrels for 2011, to 356 million barrels in December 2015. This means that the field's oil reserve dropped almost by half. Noteworthy, as of December 2015, the Taq Taq field had produced 184 million barrels gross. Thus the remaining gross recoverable 2P reserve is estimated at around 170 million barrels¹⁴⁶ However, on 28 March 2017, Once again the company reduced the reserves to only 59 million barrels¹⁴⁷. The Taq Taq reserve downgrading continued and on 28 February 2018, the company for the third time downgraded the 2p reserves to only 54 million barrels, while this time seems normal when the extracted oil for one year calculated¹⁴⁸. Taq Taq oil production has also declined sharply from 140,000 (peak- record) bpd to around 14,000 in early 2018.¹⁴⁹ Water level in Taq Taq wells started climbing rapidly in the second half of 2015 confusing expectations and operation. A former boss of BP, states that the reduction was "clearly very disappointing for the Kurdistan Regional Government and us."¹⁵⁰

V. Genel Energy, DNO – Summail (Duhok) Gas field

*'In 2014, after 90 days of natural gas production in a rate of 60 mcf per day, Gas in the field has stopped flowing, or is producing at an extremely reduced rate.'*¹⁵¹ DNO suspended production at the Summail Gas field *mainly because it began producing water'*.¹⁵² Genel Energy in its **'Trading and Operation Update on 20 January 2016'** stated that it has decided to exit its interests in the field¹⁵³.

VI. Gazprom - Halabja block

In September 2017, Director General of Gazprom stated that no further operation and development will be made in the Halabja block; the decision allegedly was made because of the inaccessibility of

¹⁴⁶ 'Taq Taq Reserves Update' (Genel Energy plc, 26 February 2016) <http://www.genelenergy.com/media/1900/genel-energy-taq-taq-reserves-update-290216-final.pdf>

¹⁴⁷ 'Taq Taq Reserves Update' (Genel Energy plc, 28 March 2017) <http://www.genelenergy.com/media/2036/genel-energy-taq-taq-reserves-announcement-final.pdf>

¹⁴⁸ 'Oil Reserves and Resources Update' (n 25)

¹⁴⁹ Mills (n 127)

¹⁵⁰ 'Production Falls in Kurdish Taq Taq Oilfield' (Rudaw, 23 September 2016) <http://www.rudaw.net/english/kurdistan/230920166>

¹⁵¹ Bouso (n 11)

¹⁵² 'Landmark Kurdish Gas Field Suffers Output Slump' (Energy Intel, 26 September 2014)

<http://www.energyintel.com/pages/login.aspx?fid=art&DocId=861904>

¹⁵³ Mills (n 127)

Trading and Operation Update (n 81)

the oil resources, besides the fears of landmines that could have been left behind during the past military conflicts in the area.¹⁵⁴

VII. Shamaran Petroleum Corp - Pulkana, Arbat block

In January 2012, Shamaran Petroleum Corp stated that it has signed an agreement with the KRI to relinquish the 60% working interests held in each of the Arbat and Pulkhana fields. In return, the Company should have paid to the KRG of consideration valued at \$25 million for its relief of all obligations in both blocks.¹⁵⁵

VIII. Gulf Keystone petroleum - Shaikh Adi, Ber Bahr Fields

On 17 March 2016, Gulf Keystone Petroleum decided to pull out from the Sheikh Adi block arguing that it is associated with a high development cost risk. The field's proved and probable reserves plus Contingent resources were estimated at around 531 million barrels for January 2016, while it has been dropped to the only 112 million barrels by January 2017.¹⁵⁶ The decision to withdraw from the Sheikh Adi block came after three months of its announcement to exit another non-core asset, the Akri-Bijeel block. Gulf Keystone and Genel Energy were also pulled out from Ber Bahr block arguing that it needed to focus on its main block; Shaikhan.¹⁵⁷ On 20 January 2016, Genel Energy in its '**Trading and Operation Update**', mentioned that the 'oil price dropping and an assessment of resources potential' were the main factors behind its pull out of Ber Bahr block¹⁵⁸.

IX. Oryx petroleum- Damir Dagh and Zey gawra

Oryx Petroleum (Canadian Oil Company) downgraded the fields' proved plus probable (2p) oil reserves from 202 million barrels for 2016 to only 122 million in 2017. Noteworthy, it previously had downgraded the reserve from 238 million barrels in 2015. That significant reduction in capacities is attributable to the Zey

¹⁵⁴ (n 122)

¹⁵⁵ 'Shamara Petroleum Finalises Agreement With KRG to Relinquish Pulkhana and Arbat Blocks in Kurdistan' (Market wired, 18 January 2012) <http://www.marketwired.com/press-release/shamara-petroleum-finalises-agreement-with-krg-relinquish-pulkhana-arbat-blocks-kurdistan-tsx-venture-snm-1608432.htm>

¹⁵⁶ Mills (n 23) 30

¹⁵⁷ 'Gulf Keystone exits Kurdistan block' (The oil and Gas yearbook, (17 March 2016) <https://www.theoilandgasyear.com/news/gulf-keystone-exits-kurdistan-block/>

¹⁵⁸ Trading and Operation Update (n 81)

Gawra field which its proved and probable reserves in 2016 was 76 million barrels, while it was dropped to only 22 million barrels by 2017.¹⁵⁹ In addition, Oryx Petroleum halted work in two wells in Demir Dagħ field after hitting the water, '*raising suspicions of similar geological problems elsewhere*'¹⁶⁰.

X. Exxon Mobil – Qara Hanjir, Betwata and Arbat East

Exxon Mobil, the world's most prominent oil and gas Firm, pulled out from three exploration blocks it had operated in the KRI. The abandoned blocks were Betwata, Qarahanjir and Arbat East.¹⁶¹

XI. Chevron - Rove Field

Chevron, the second-largest U.S. oil company after Exxon Mobil, pulled out its interest in the Rovi block but it is supposed to stay in test wells in the Sarta area.¹⁶² Chevron relinquished its Rovi block without explanation after drilling exploration wells.

XII. 'In March 2015, Irish explorer Petroceltic International PLC and the U.S.'s Hess Corp. relinquished the Dinarta block, mentioning disappointing well results'.¹⁶³

XIII. Gas plus Khalakan - Shewashan (Khalakan) field

The field was discovered in 2014 and it was put on oil production in early 2016. Its infrastructure is sufficiently built for producing 10,000 bpd in the early stages. It was scheduled to increase its capacity to 30,000 bpd¹⁶⁴. However, in June 2018, the field was producing around 4,000 barrels on a daily base, while latter, the company decided to halt its entire operation in the field since the production gradually dropped to reach only 800 bpd, turning it to a non-commercial field.¹⁶⁵

¹⁵⁹ Oryx Petroleum Announces its Year End 2017 Reserves and Resources (n 32)

¹⁶⁰ Bousso (n 11)

¹⁶¹ Bousso and Zhdannikov (n 124)

¹⁶² Bousso (n 11)

¹⁶³ 'Hess, Petroceltic to pull out of Iraqi Kurdistan licence' (Reuters, 15 March 2015) <https://www.reuters.com/article/petro-interntl-irag/update-1-hess-petroceltic-to-pull-out-of-iraqi-kurdistan-licence-idUSL3N0WR2TR20150325>

¹⁶⁴ 'Shewashan-Report Summary' (Wood Mackenzie, 23 April 2018) <https://www.woodmac.com/reports/upstream-oil-and-gas-shewashan-32423079>

¹⁶⁵ Dwarozh (n 76)

XIV. Total S.A- Harir, Taza, Baranan, Safen Blocks

Total, French multinational integrated oil and gas company, was holding 35%, 20%, 80% and another 80% of interests in each one of Harris, Taza, Baranan, Safen Blocks respectively. The company gradually abandoned them ending with a complete exit from the KRI early 2017. While by the acquisition of the Maersik interests in the Sarsang field, the company brought back, but it most likely sells its small interest in the Sarsang¹⁶⁶.

XV. DNO, Genel - Tawke Field

The field's oil production averaged 135,000 bpd in 2015, and in May 2015, it peaked at 180,000 bpd. While the field's production capacity gradually dropped throughout 2016-2017 to reach at around 96,000 bpd in January 2018, losing around 28% of its production capacity in comparison with its 2015 production capacity. The reduction is continued during 2018 to reach only 80,000 bpd in November 2018¹⁶⁷. Thus, if the decline continued in that pace, the production in the field may not be more than 50,000 bpd in the next two years.

XVI. Niko Resources Ltd, Vast Exploration Inc, Groundstar Resources Ltd- Qara Dagh Block

The former partner petroleum companies of the Qara Dagh block interests relinquished the block at the end of 2012, arguing that they could not establish a commercial level of production. The partners' initial exploration activities proved some petroleum resources, while it did not convince them as a profitable project¹⁶⁸.

'The former owners were Calgary independents Niko Resources Ltd., operator with a 49% interest, Vast Exploration Inc. 25%, and Groundstar Resources Ltd. 6%. The KRG had a 20% carried interest. Niko, Vast, and Groundstar relinquished their interests in exchange for proceeds equal to the carrying amount

¹⁶⁶ Robin Mills, 'Maersk Oil acquisition marks change-up in strategy for Total' (The National Business, 3 September 2017) <https://www.thenational.ae/business/energy/maersk-oil-acquisition-marks-change-up-in-strategy-for-total-1.625151> <https://www.total.com/en/media/news/press-releases/total-announces-jisik-discovery-kurdistan-region-iraq>

¹⁶⁷ 'Genel Alleviates Concerns As Tawke Reserves Rise' (Alliance, 18 March 2016) http://www.morningstar.co.uk/uk/news/AN_1458299772291083100/update-genel-alleviates-concerns-as-tawke-reserves-rise-alliss.aspx

¹⁶⁸ editor, 'Niko notes relinquishment of Qara Dagh block' (Oil and Gas Journal, 14 February 2013) <https://www.ogj.com/articles/2013/02/iraq--Niko-notes-relinquishment-of-qara-dagh-block.html>

of the asset. Niko Resources said it expects to receive \$15 million within 60 days of the earlier of formal signing of the production-sharing contract between the KRG and Chevron on May 31¹⁶⁹.

XVII. KNOC- Bazian, South Sangaw, Sangaw North and Qush Tappa Blocks

Korean National Oil Corporation (KNOC) had ambitious expectations regarding its five oil and gas blocks in the KRI; Bazian, Sangaw South, North Sangaw, Qush Tappa and Hawler License Area. However, successively it relinquished four of them, starting with Sangaw North Block and Qush Tappa Block as it could not determine crude oil discovery there, resulting in a loss of \$192 million¹⁷⁰. The corporation also withdrew from Bazian Block in 2014 with another loss of \$117 million in the block. Lastly, the company pulled out from Sangaw South in 2016, because the project has no profitability. Noteworthy, the company had invested around \$200 million in the sangaw blocks since 2008¹⁷¹.

XVIII. OMV- Mala Omer and Shorish Blocks

After having experienced drilling problems and dry wells, the Austrian MOV relinquished two KRI's Blocks; Mala Omar and Shorish. OMV, the operator of the blocks, abandoned both blocks after failing to discover petroleum resources since exploration contracts were signed in 2008. *"There was no commercial discovery," said OMV spokesperson Robert Lechner, elaborating on a recent trading statement in which OMV referred to Mala Omar and Shorish as "unsuccessful licenses."*¹⁷²

¹⁶⁹ OGI Editors, 'KRG awards Qara Dagħ block to Chevron' (Oil and Gas Journal, 22February 2013) <https://www.ogi.com/articles/2013/02/iraq--krġ-awards-qara-dagħ-block-to-chevron.html>

¹⁷⁰ Korean Lawmakers Lowers Kurdistan Oil Prospects (n 79)

¹⁷¹ Hee (n 78)

¹⁷² Iraq Oil Report, OMV to relinquish two blocks in Iraq Kurdistan' <https://www.iraqoilreport.com/news/omv-to-relinquish-two-blocks-in-iraqi-kurdistan-9113/> Accessed on 1 January 2019

XIX. Talisman-Baranan block

The field relinquished by the company in 2013.¹⁷³

XX. Perenco, Oryx - Sindi-Amedi West

The block's interests were holding by Oryx, Perenco, and KRG with different shares of 45%, 35% and 20% respectively¹⁷⁴. Oryx petroleum in its '**Announcement of the year-end 2013 Resources and Reserves**', wiped the block's contingent oil resources (best estimate) of unrisks 110 million barrels and risks 8 million barrels to zero. Furthermore, it announced that *'the Sindi Amedi license area was relinquished in October 2013'*¹⁷⁵.

1. The KRI's Oil Production, Exports and Destinations

In 2014, the average oil production from five essential fields in the KRI was as follows; Tawke 91,000 bpd, Taq Taq 103,000 bpd, Khurmala 100,000bpd, Shaikan 23,000 bpd and Khor Mor 26,000 bpd (condensate) and their collective production for that year was around 343,000 bpd¹⁷⁶. In 2015, it jumped to around 410,000 bpd reinforced by a significant increase in the production from both Tawke and Taq Taq fields. Tawke production in 2015 averaged around 135,000 bpd and Taq Taq was at around 116,000 bpd¹⁷⁷. While from 2015 onward, despite the exploitation of the abundant and easy extracted oil of Kirkuk fields, the production from KRI's fields was declining (look at Figure 3 and 4). As it was noticed, after Iraqi federal force re-controlled the Kirkuk oil fields, (the 16th October events) the KRI's oil production was around 273000 bpd for April 2018. This indicated to the continuous decline in its fields and also lack of investment in the new fields. During the last few months, the KRI's oil production relatively recovered reinforcing by an increase in the production from both Feshkhabir and Khurmala fields. In May 2018, the Kri's overall oil export ramp-up to around 291000 bpd, and for June, it even further increased to 325000 bpd (Look at figure 3 and 4)¹⁷⁸. In December 2018, the MNR announced an export of more than 400,000 bpd of oil supporting by recent increase

¹⁷³ 'Total acquires further KRG block: report' (Egyptoil-Gas.com, 23 June 2013) <http://egyptoil-gas.com/news/total-acquires-further-kr-g-block-report/>

¹⁷⁴ <https://www.scribd.com/document/196953168/Kurdistan-Operator-Activity-Map-1>

¹⁷⁵ Oryx Petroleum Announces its Year End 2013 Reserves and Resources (n 80)

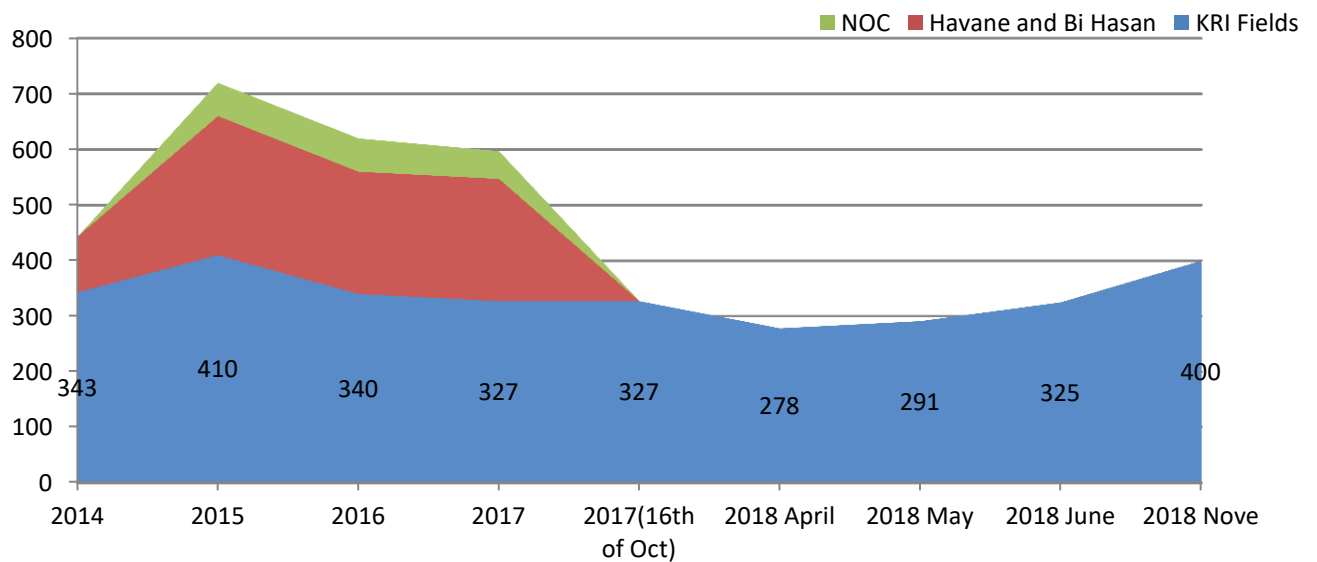
¹⁷⁶ Mills (n 105)23

¹⁷⁷ Iraqi Energy Institute (n 23) 41

¹⁷⁸ The Tanker Tracker, <http://TAnkertrackers.com>

in the production of Khurmala field of 200,000 bpd. However, the concern over Tawke field is increasing, since only during last four months, the field lost 20,000 bpd of its production capacity. Thus, is the Taq Taq's fate waiting for Tawke? Will it undermine the recent increase in Khurmala and Feshkhabir as Taq Taq did in the past?

Figure 3: demonstrates the gradual decline in the KRI oil production from 2015 onward¹⁷⁹



¹⁷⁹ Mills (n 105) 23
<http://TAnkertrackers.com>
 Iraqi Energy Institute (n 23) 41

Figure 4: the downgrade of the KRI oil export aftermath the 16th October events ¹⁸⁰

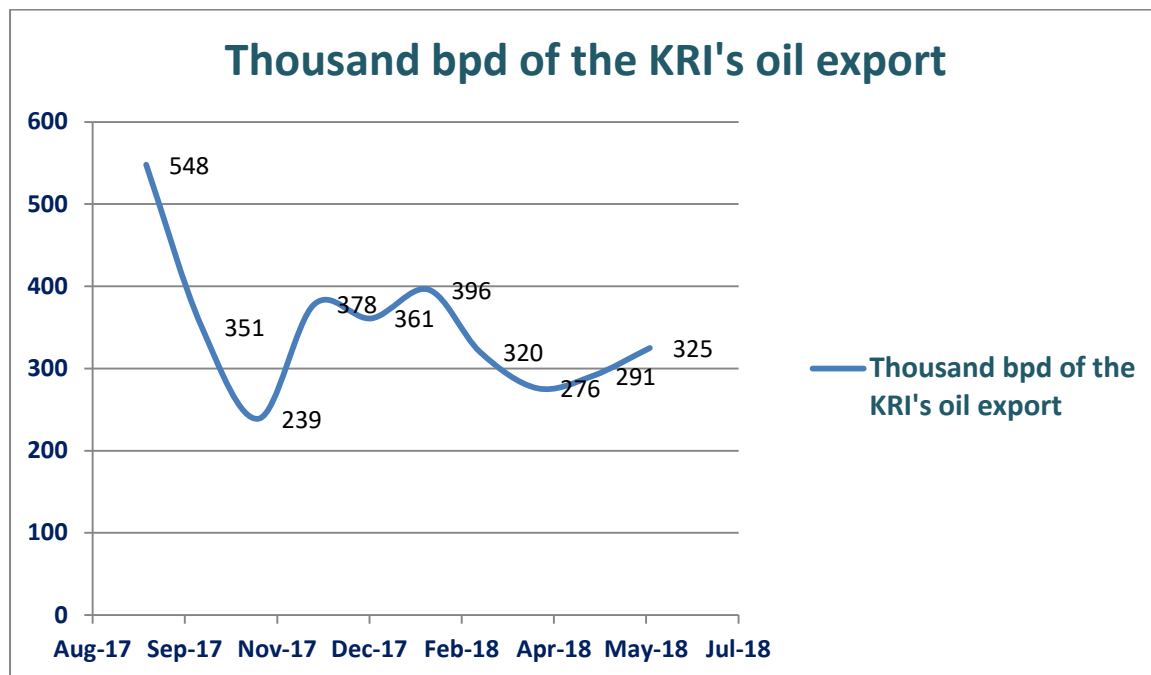
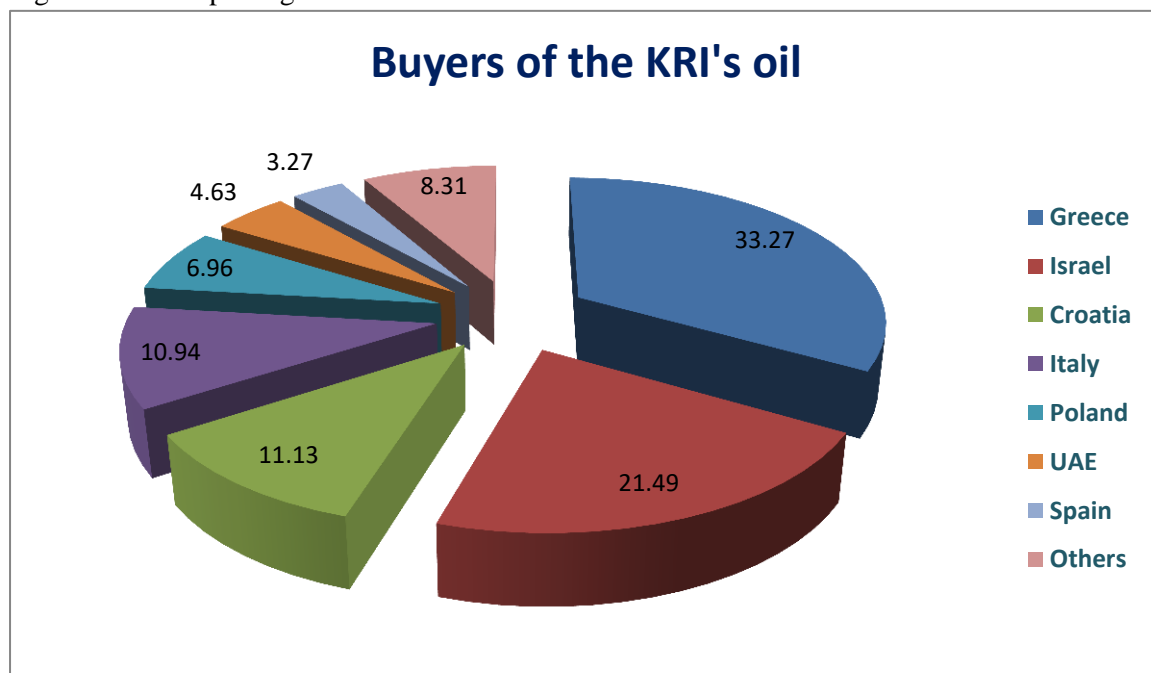


Figure 5: The Importing countries of the KRI's oil



¹⁸⁰ <http://TAnkertrackers.com>

Conclusion

During this decade, the KRI has managed to set up its petroleum industry though accompanied by several problematic dimensions. From the very beginning, the MNR and the mainstream media have passed huge numbers concerning the Region's petroleum reserves, productions and exports leading in one hand, to incentivizing the International oil companies to flow toward the KRI, and on the other hand; the Region's citizens were directed to an overestimation as to their resources with anticipating an imminent prosperity. This ambitious trend from both the companies and citizens was further reinforced by the regional oil-rich territories, vast Kirkuk fields and Gulf countries. Accordingly, still the Kurdish people believe that a latent plot rules their oil; neither the MNR's data and numbers nor the published revenues are the actual ones.

Despite what the MNR alleged of 45 or even 70 billion barrels of oil and 200 tscf of Gas are by no means considered reserves, while the KRI still may have reasonably well resources. According to the companies' reports and academic researches, the total region's oil reserves, contingent and prospective resources may amount at around 18 billion barrels. As to gas reserves, contingent and perspective Gas resources, it may amount at around 100-115 trillion standard cubic feet. While, in spite of more than a decade of extensive investments in the sector and flow of the international petroleum companies to the region, still only a few numbers of fields are put on an effective production. Moreover, it should be well understood that the amount of resources may not be a proper indicator of the availability of commercial and efficient reserves. The KRI's petroleum resources prove not to be like those in the federal Iraqi territories but further complicated by several geological, political, geographical, security, type consistency, administrative difficulties. To understand this point, a reference to some examples may work: Afren Company relinquished Barda Rash field though it was supposed to hold around 1,243 million barrels of reserves and resource, and in its worst situation the resources remained at 250 million barrels. Although the number seems commercially interesting, whereas the water flow prevented its exploitation. In 2011, Taq Taq field was supposed to possess 683 million of proved and probable reserves, while by 2016, the reserves overnight dropped to only 54 million barrels plus 138 million that already has been produced. Akri-bijeel was supposed to possess 173 million barrels of oil

resources, but it has been relinquished due to disappointed geology. Shaikan field which has fairly good heavy oil reserves and resources suffers from crude quality. The KRI in an attempt to keep its crude in a better quality was obliged not to mix the Shaikhan's heavy oil with the rest crude through its pipeline and bears the additional cost for its production, transportation and sale. The advent of ISIL led half of the international oil companies to leave the KRI overnight. Drop in oil price between 2015 and 2016, subjected many relinquished blocks to suspicion over the genuineness of the companies' reports about their reserve inefficiency. Thus, the existence of solely petroleum resources may not mean that a robust industry prevails, that is why, the mentioned factors should be well considered in determining the future of the sector.

The KRI did not consider those factors; subsequently, the KRI's oil production in 2018 is lower than in 2015. Still, some recommendation may work; The KRI should be more transparent with both international oil companies and the KRI's citizen. The geology of KRI requires modern and sophisticated technology, the fields and blocks are not accessible just by their discovery and these matters should be considered before the process initiated. The KRI should be stricter in relinquishing the fields as it may not be understandable for the new companies to trust in investing in those relinquished fields. Under the status quo, considering 1 million barrel of oil export is unpractical and even if it was possible, it would lead the KRI's reserves to depletion. Instead of the high level of export, in this stage, high level of investment in exploration and development is seriously required.

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