NATURAL GAS DEVELOPMENT IN KURDISTAN

A FINANCIAL ASSESSMENT

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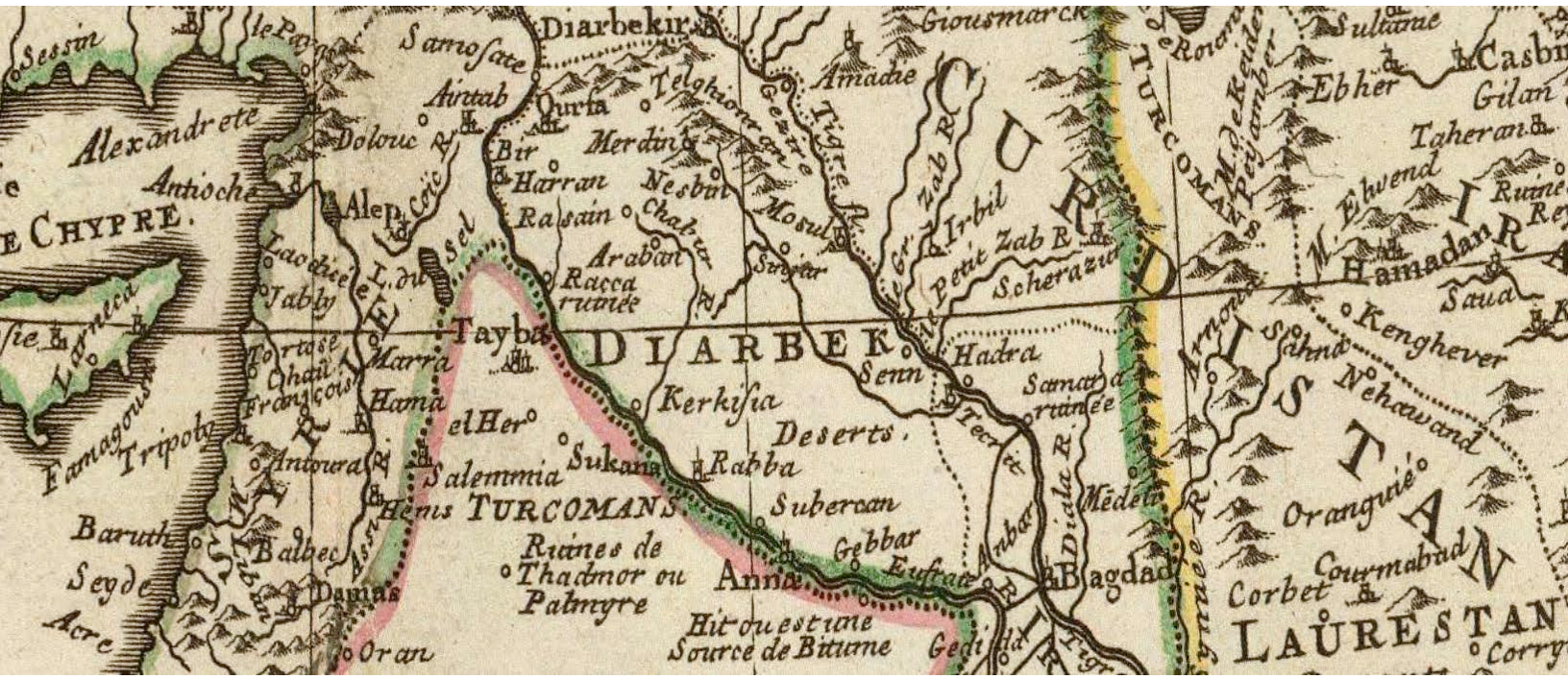
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TABLE OF CONTENTS

Acknowledgements **3**

Note on the August 30, 2012 revision **7**

1 Executive Summary **9**

2 Purpose and methodology **12**

3 Introduction **14**

4 The context of natural gas development in Kurdistan **16**

4.1 Natural resource wealth in Iraq and Kurdistan 17

4.1.1 The dominance of oil 17

Figure 1: World Oil Reserves, Production, and Exports 18

4.1.2 The relative neglect of natural gas 18

Figure 2: World Natural Gas Proved Reserves, Production, and Exports 19

Figure 3: Oil and gas fields in northern Iraq 20

4.2 Iraq's internal division 22

4.2.1 Divisive internal politics and divergent economic politics 22

4.2.2 Federalism 24

4.2.2.1 The potential for new federal regions 24

4.2.2.2 Lack of resolution on the "disputed territories" 25

Figure 4: Oil and Gas in the Kurdistan Region and Disputed Territories 27

Figure 5: Iraq's "Green Line" 28

Figure 6: The Exxon Deal and the Disputed Territories 29

4.3 The revenue sharing dispute, exports, and production contracts 30

4.3.1. Dependence on export revenues 31

4.3.2 Lack of progress on a national hydrocarbon law 32

4.3.3 Contract design 33

Figure 7: Remuneration Fees under Baghdad's TSCs (Fee per barrel vs. R-factor) 34

Figure 8: Flow of Natural Gas Revenues Under a PSC 35

Figure 9: Heritage Oil's Profit Sharing Profile for Natural Gas under the KRG's PSC (Share of profits petroleum vs. R-factor) 36

4.4 Kurdistan's march forward 38

4.5 Potential Markets for Kurdish Natural Gas 39

4.5.1 The Domestic Market 39

Figure10: Iraq Electricity Masterplan—Capacity and Demand 40

4.5.2 The Turkish Market 41

Figure 11: Turkey's natural gas imports by source country (Bcf per year) 42

4.5.3 Europe 43

4.5.4 The "Southern Corridor" Pipelines 44

Figure 12: The proposed Nabucco Pipeline 44

Figure13: Major Russian gas pipelines to Europe 46

Figure14: Southern Corridor Gas Transit Options 46

4.5.4.1 Liquefied Natural Gas 47

4.5.5 A note on security 47

4.6 Geopolitical Context 47

4.6.1 Iraq 47

4.6.2 Turkey 47

4.6.3 Europe 48

4.6.4 The United States 48

5 A FINANCIAL MODEL 49

5.1 Scenario 1: Domestic Electricity Generation 49

5.1.1 Assumptions 49

5.1.2 Calculations 50

5.2 Scenario 2: Export to Turkish Border 51

5.2.1 Assumptions 51

5.2.2 Calculations 52

6 ANALYSIS 53
6.1 Scenario 1: Domestic Electricity Generation 53
6.2 Scenario 2: Export to Turkish Border 54
7 DISCUSSION 56
8 APPENDICES 57
8.1 Abbreviations 57
8.2 Units 57
8.3 Sample Financial Model 60
8.4 Other Figures 61
Figure15: Iraqi Governorates 61
Figure 16: Disputed territories claimed by the KRG 62
Figure17: International gas pipeline projects through Turkey 63
Figure 18: KRG-Dana Gas profit-sharing 64
9 BIBLIOGRAPHY 65

NOTE ON THE AUGUST 30, 2012 REVISION

This report was finalized five months ago while we were in our final semester of the Joint Degree MPP/MBA program at Harvard. Since the report was submitted, conditions in Iraq have gotten worse and the political impasse remains. Major unsettled issues include:

- **A profound political crisis between Baghdad and Erbil**. The crisis has deepened since Prime Minister Nuri al-Maliki's government had issued an arrest warrant earlier this year for Vice President Tariq al-Hashimi (who found refuge in Kurdistan, then Turkey). The Kurdistan Alliance led sympathetic blocs in Iraq's parliament advocating al-Maliki's removal. In response, al-Maliki's government, backed by the military, has moved to consolidate its power.

- **A continued revenue-sharing dispute**. In June, the Kurdistan Regional Government reported that Iraq's central government was only paying the KRG 10.7% of its budget, whereas a 2004 Baghdad-Erbil agreement entitles the KRG to 17%.[1]

- **The constitutionality of KRG oil and gas contracts with foreign companies.** Because producers were not being reimbursed by Baghdad, the KRG suspended oil exports from April to August. Baghdad has been angered further, considering the KRG's new deal with Chevron in July and impending deals with Total and Gazprom to be acts of illegal resource development.[2]

- **A stand-off between the Iraqi army and Kurdish Pershmerga**. An impasses between Iraqi Prime Minister Nouri al-Maliki and Kurdistan's President Massoud Barzani regarding a joint agreement on the Iraqi defense forces and the Kurdish Peshmerga—specifically, on paying the Peshmerga out of the national military budget, rather than the KRG's share of revenue—has culminated in the Peshmerga preventing the Iraqi army from deploying to patrol Iraq's border with Syria.

- **The status of the "disputed territories."** As we discussed when this report was first written, the conflict over the "disputed territories"—the underlying national sovereignty vs. regional autonomy debate—has continued unabated.

Although this report (originally submitted on March 20) does not discuss these and other recent developments in Kurdistan and Iraq, we believe it still provides two valuable perspectives: first, the financial assessment we lay out of natural gas development in Kurdistan and its potential to benefit all of Iraq; and second, a comprehensive discussion of the broader context in which energy development in Kurdistan must be considered.

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[1] "KRG Accuses Baghdad of Reducing its Budget Share," *Al-Hayat*, 14 June 2012, translated version online at http://www.al-monitor.com/pulse/business/2012/06/krg-accuses-baghdad-of-reducing.html.
[2] Sargsyan, 2012.

Above all, we hope this report still demonstrates the value and imperative of resolving the energy development impasse in Kurdistan.

1 EXECUTIVE SUMMARY

This report summarizes the context of natural gas development in the Iraqi Kurdistan Region (Kurdistan), assesses the major risk factors and opportunities, and presents a financial model for natural gas development projects.

Iraq and Kurdistan are home to one of the most significant oil and gas reserves in the world: Iraq is estimated to hold over 115 billion barrels of proven oil reserves (4th largest in the world) and at least 112 trillion cubic feet of proven natural gas reserves (11th largest in the world). **However, Iraq has historically focused on oil** (from which it derives almost all of its revenues)**, and has generally neglected gas.** There has been substantial gas flaring in the associated fields in the south (where oil and gas are both present), limited development in the north, and, up until recently, limited exploration or development activity despite the fact that significant gas-processing capacity sits idle and most of Iraq faces dire electricity shortages.

Natural gas development in Kurdistan faces both the inherent disadvantage of natural gas development compared to that of oil as well as the additional risks and costs specific to the Kurdistan context. Several main features define the Kurdistan context:

- **A fundamental debate about state sovereignty and the identity of modern Iraq.** The natural resources debate is more than an issue of money and resource control: the Kurdistan Regional Government (KRG) in Erbil struggles for autonomy and the central government in Baghdad struggles to maintain sovereignty.

- **Kurdistan increasingly looks like a different (richer) country than the rest of Iraq**. The sovereignty debate is worsened by the significant gains in well-being that have been won in Kurdistan compared to the rest of Iraq.

- **Erbil and Baghdad vie for control over the "disputed territories" which contain high quality oil and gas resources, particularly Kirkuk**. The KRG's most recent contracts with ExxonMobil go beyond the "Green Line" to develop fields in those territories.

- **There is great ambiguity about natural resource control, exports and revenue sharing**. The Iraqi Constitution recognizes Kurdistan as an autonomous region but is subject to contesting interpretations about who controls resource production (regions or the central government) and how revenues shall be administered. In addition, a national hydrocarbon law drafted in 2007 has yet to be passed in parliament. The most significant consequence is that, **currently, there is no export authorization for Kurdish natural gas**.

- **The KRG's production-sharing contracts (PSCs) are far more generous than Baghdad's technical service contracts (TSCs), creating (at least the perception of)**

contract renegotiation risk. The KRG maintains that it is necessary to offer international oil and gas companies (IOCs) greater rewards to attract them to projects in Kurdistan; Baghdad maintains that the KRG is giving up too much value to outsiders. The dispute creates a risk—perceived by contractors—of renegotiation in the future and the possibility of a "natural resources trap" by which contracts must be generous enough to compensate IOCs for the risk of renegotiation, which in turn increases the risk of renegotiation.

The priorities for marketing Kurdish natural gas are as follows:

(1) **To satisfy the urgent electric power needs of the Iraqi people**. Kurdish gas generates over 20 hours of electricity a day for residents of Kurdistan; however, the rest of Iraq suffers from severe shortages that leave Iraqis without electricity for most of the day, an existential issue.

(2) **To export natural gas to Turkey**. Turkey, being a stable, prosperous, credit-worthy and large neighbor with significant energy demand and an over-dependence on Russian gas, is an obvious export market for Kurdish gas. However, the infrastructure must be built to pipe gas to the border and the Iraqi resource control dispute must be resolved in time for Kurdish gas to compete for Turkish gas contract renewals.

(3) **To export natural gas further afield to Europe via pipeline or liquified national gas (LNG) transport (both via Turkey)**. Turkey's natural gas demand is large enough that this option is not a strong priority for the KRG. Furthermore, there are significant challenges to making pipeline gas from Iraq competitive in Europe, especially as it competes against cheaper-to-transport Russian gas. However, Europe has a great interest in diversifying its energy supply: it too is over-dependent on Russian gas.

Geopolitically, exporting Kurdish natural gas could create a corridor of mutual interest from Iraq through Turkey to Europe, promoting the development and security of all. This would be in the interests of all parties except Russia, who could be expected to act strategically to make Kurdish gas less attractive than Russian gas.

Our financial analysis suggests that natural gas investments in Kurdistan are very attractive, with potential rates of return as high as 30% or more. However, the fact that many companies are still hesitant to invest in Kurdish natural gas suggests that there is a significant risk premium demanded for investing in Kurdistan.

We looked at two of the marketing scenarios above to analyze the returns of a potential natural gas project and found the following:

- **Domestic electricity generation scenario.** We found that several hundred million dollars could be spent on well and pipeline development capital expenditures and the project would still be highly profitable for contractors because of the market price certainty given by the domestic electricity subsidy.

- **Exporting to the Turkish border.** We found that returns are very sensitive to both total volume and natural gas prices due to the nature of the PSC: higher gas prices or large export volumes can significantly enhance returns. This uncertainty necessitates securing long-term contracts upfront.

In summary, the risks that must be considered in Kurdish natural gas development are as follows:

- **Price Risk.** Price appears to be the key determinant of project returns. Are Turkey and Europe willing to pay a price premium to diversify away from Russian gas? What price for natural gas can reliably and consistently be achieved?

- **Political Risk.** The PSCs incentivize developers to secure long-term contracts to minimize uncertainty, but if long-term contracts are secured what is the risk that existing contracts will be renegotiated?

- **Export Risk**. What is the risk that an export and revenue sharing agreement is not arrived at by Erbil and Baghdad?

- **Timing Risk.** Can the projects be developed in time to meet the emerging energy needs of Turkey and Europe before alternative plans are negotiated and long-term contractual obligations are locked in place?

- **Volume Risk.** How much volume can consistently be sold to domestic or foreign customers? Are developers willing to take volume risk without long-term contracts?

- **Security Risk.** What is the probability that infrastructure or production is disrupted by war or violence? Are potential markets perceived as impossible because of the security uncertainty, thus limiting commercialization options?

By creating the possibility of large returns to compensate for these risks, the PSCs offered by the KRG appear to be compensating for the risks specific to Kurdistan gas, particularly in light of Exxon's decision to sign KRG contracts against Baghdad's wishes. Nevertheless, these risks will remain salient for natural gas developers eyeing Kurdish gas.

2 PURPOSE AND METHODOLOGY

The purpose of this study is to discuss the challenges of natural gas development projects in the Iraqi Kurdistan Region[3] and develop a financial model for analyzing the factors affecting their financial viability and attractiveness. The primary output of this study will be investment templates and scenarios to facilitate discussions within the U.S. State Department with other government and private sector representatives. Primarily, this report aims to contribute to the level of understanding at the State Department regarding the political context and commercial prospects for natural gas and power development in Kurdistan.

This report is structured as follows:

First, this report summarizes **the context of Kurdish natural gas development** (Section 4), covering the following:

- Iraq's natural resource wealth (Section 4.1)
- Iraq's internal divisions (Section 4.2)
- National revenue sharing (Section 4.3)
- Kurdistan's independent oil and gas development activity (Section 4.4)
- Potential markets for Kurdish natural gas (Section 4.5)
- The geopolitical context (Section 4.6)

This summary is based on a literature review and interviews with key industry and government actors in Turkey, the Kurdistan, and the U.S.

Second, this report introduces a **financial model** based on interviews with key players and oil and gas investment professionals and case studies on natural gas development (Section 5).

Third, the financial model is applied to a couple of **investment scenarios** with the aim of identifying and highlighting opportunities and challenges for natural gas development in Kurdistan (Section 6).

Finally, the reports concludes with a **discussion** of how the investment model might be applied to other natural gas development projects in Kurdistan and what areas merit further investigation (Section 7).

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[3] In this report, we use "Kurdistan" to refer to the Iraqi Kurdistan Region and "KRG" to refer strictly to its government. We use the adjective "Kurdish", where appropriate, to mean "of the Iraqi Kurdistan Region" or "of the KRG".

A brief note on units and conversions:

This report uses British imperial units, not the metric system (e.g., BTUs vs. joules, cubic feet vs. cubic meters), to be consistent with other reports on Kurdistan's resources, including information that the Kurdistan Regional Government (KRG) publishes. For unit abbreviations and conversions, please see Appendix 8.2.

3 INTRODUCTION

The Iraqi Kurdistan Region is host to a vast quantity of proven and probable natural gas reserves that, if properly developed, commercialized, and exported, could significantly improve the economic and human condition of Kurdistan, the rest of Iraq, and contribute to the development and security of Turkey and even Europe.

For Iraq in particular, lack of adequate power generation is an existential issue that can be solved by Iraqi natural gas. Electricity shortages throughout Iraq, especially in the summer when air conditioning loads cripple the system, have left citizens with only several hours of electricity, and lack of power during a 2010 summer heat wave resulted in violent riots that forced the Electricity Minister to step down and strained a government grappling with many other crises.[4] The Kurdistan Regional Government (KRG) has improved Kurdistan's situation dramatically by contracting Dana Gas to produce natural gas for electricity generation (Erbil now enjoys almost around the clock electricity)[5]; nevertheless, adequate electricity supply is still lacking in many areas and rapid development of natural gas for power generation is a major priority.

Up until recently, however, Iraq—Kurdistan included—has focused on developing oil, even at the expense of natural gas (for example, by flaring natural gas associated with oil wells in the south). In Kurdistan, this historical neglect is due to two sets of challenges: one of the general disadvantages of natural gas compared to oil, and the other of challenges unique to the Iraq context.

In general, natural gas is a more difficult resource to monetize than oil. Fundamentally, oil is an easier resource to develop, produce, and sell: it is a global commodity that can be sold to the highest bidder worldwide and can be transported from the well by truck. Natural gas, however, is generally restricted to regional markets, contracts to sell it span years, and transporting and storing it requires special handling and compression, making it more capital intensive and operationally expensive. Therefore, monetization of natural gas resources takes longer and until a contract is agreed upon, there is large price and volume uncertainty.

The Iraqi context exacerbates the difficulty of developing and monetizing natural gas. The political divide in the country between the semi-autonomous KRG and the central Baghdad government poses a large obstacle to developing natural gas. Given the constitutional requirement that natural gas revenues be redistributed fairly throughout Iraq, natural gas development, even in

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[4] Spencer, 2010.
[5] Iraq Business News, n.d.; Pflüger & Duero, 2011.

Kurdistan, would appear to be in all Iraqis' interests. Indeed, petroleum revenues overwhelmingly supply the revenues that flow to the KRG and Iraq's central government. However, the central government views any secession of natural resource control to the KRG—which is the perceived result of allowing the KRG to export its resources—as surrendering part of Iraq's sovereignty.

Another challenge is that, to generate more revenues, the government relies on the experience and expertise of international oil and gas companies (IOCs) to explore, develop, and produce gas. However, because of the risk involved in doing business in Iraq—especially the security risk that dominates the south, raising all costs of doing business, and the political risk of conflicting natural resource claims between Erbil and Baghdad—companies will not pursue gas development unless a clear and reliable monetization path exists.

One obvious way to offer a greater reward for natural gas development is by creating the option to export it. Exporting natural gas to Turkey and Europe (and, possibly, as LNG to countries further afield) is one of the most attractive monetization paths for natural gas developers. However, the political conflict in Iraq has prevented Kurdistan export option from being realized, frustrating many in Turkey and Europe (particularly the Nabucco Consortium that has been actively seeking the gas volumes that would make a Turkey-to-Austria pipeline economically viable).

In summary, there are many risks and uncertainties involved with natural gas development in Kurdistan; some are general to natural gas and others specific to the Kurdistan context. To unlock the potential of natural gas for Kurdistan, Iraq, and the region, either the risks must be reduced (political in particular) or the potential rewards must be raised.

4 THE CONTEXT OF NATURAL GAS DEVELOPMENT IN KURDISTAN

Several key issues characterize natural gas development in Kurdistan:

- **Iraq and Kurdistan have significant, untapped natural gas resources that could fuel domestic electricity production and be exported**. Up until recently, however, Iraq has focused almost exclusively on oil production.

- **Iraq's government overwhelmingly relies on hydrocarbon resources**. Oil revenues alone supply over 95% of Iraq's revenues and Iraq depends on increased monetization of its petroleum resources to fuel investment in its economic and human development.

- **Kurdistan is geographically well positioned to export to Turkey and Europe; however, any export plan is subject to pipeline politics and contract-timing risk**. The Nabucco pipeline has been repeatedly delayed and is being scaled down in ambition, although other pipeline projects may be able to transport Kurdish gas to Europe (like the proposed Trans-Anatolian Pipeline, TANAP). The KRG's immediate interest after satisfying domestic power demand is to supply gas to Turkey, but there is a narrow window of opportunity to build the infrastructure and resolve the internal Iraqi conflict in time to compete for Turkish import contract renewals.

- **Geopolitically, exporting Iraqi natural gas would be in the interest of Iraq, Turkey, Europe and the U.S.** Actors in Iraq, Turkey, Europe and the U.S. all agree that exporting Kurdish natural gas could benefit everyone and create a corridor of mutual interest from Iraq through Turkey to Europe, promoting the development and security of all. Recognizing this, one might expect Russia to act strategically to make Kurdish gas less attractive than Russian gas (e.g., by constructing a uniform gas price frontier, see Section 4.5.4).

- **Unfortunately, Iraqi politics are divided over a fundamental debate about state sovereignty and the identity of modern Iraq**. Essentially, Baghdad and Erbil are at odds over the KRG's desire for autonomy and the central government's desire for sovereignty and control. This dispute generates significant political risk for natural gas development in Kurdistan.

Ultimately, despite the potential benefits to the region that Kurdistan's gas resources hold, domestic and geopolitical interests are subordinated by Iraq's internal political impasse.

4.1 NATURAL RESOURCE WEALTH IN IRAQ AND KURDISTAN

4.1.1 THE DOMINANCE OF OIL

Oil is the overwhelmingly dominant source of natural resource wealth in Iraq, generating over 95% of government revenue.[6] Iraq sits atop one of the largest reserves of oil in the world, with 115 billion barrels (bbls) of proven reserves.[7] This figure likely underestimates Iraq's oil resources, as the U.S. Energy and Information Administration (EIA) notes:

> *… these statistics have not been revised since 2001 and are largely based on 2-D seismic data from nearly three decades ago. Geologists and consultants have estimated that relatively unexplored territory in the western and southern deserts may contain an estimated* additional *45 to 100 billion bbls of recoverable oil.* [8] [emphasis added]

In 2010, Iraq's Deputy Prime Minister for Energy, Hussain al-Shahristani, revised the Iraqi estimate upward to 143 billion bbls,[9] a figure that makes Iraq home to the fourth largest reserves in the world (behind Saudi Arabia, Venezuela, and Canada).[10] However, despite these large reserves, Iraq was only the 12th largest oil producer in the world in 2010 at 2.41 million bbl per day (MMbpd), just behind Kuwait's 2.45 MMbpd (see **Figure 1** below for a comparison of reserves and production rates); resolving this disparity between oil reserves and production has been the major focus of Iraq's reconstruction efforts.

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[6] Wing, Oil Exports From Iraq Continue To Stagnate, 2012.
[7] CIA, 2011.
[8] Energy Information Administration (EIA), 2010.
[9] Bloomberg, 2010; Deutsche Bank, 2010.
[10] Central Intelligence Agency (CIA), 2011.

FIGURE 1: WORLD OIL RESERVES, PRODUCTION, AND EXPORTS

Proved Reserves (2009)	(billions of barrels)
1 Saudi Arabia	266.7
2 Canada	178.1
3 Iran	136.2
4 Iraq	115.0
5 Kuwait	104.0
6 Venezuela	99.4
7 UAE	97.8
8 Russia	60.0
9 Libya	43.7
10 Nigeria	36.2
11 Kazakhstan	30.0
12 USA	20.7
13 China	16.0
14 Qatar	15.2
15 Brazil	12.6

Production (2010)	(1,000 bpd)
1 Saudia Arabia	10,521
2 Russia	10,124
3 USA	9,648
4 China	4,273
5 Iran	4,252
6 Canada	3,457
7 Mexico	2,983
8 UAE	2,813
9 Brazil	2,746
10 Nigeria	2,458
11 Kuwait	2,450
12 Iraq	2,408
13 Venezuela	2,375
14 Norway	2,134
15 Algeria	2,078

Exports (2009)	(1,000 bpd)
1 Saudi Arabia	7,300
2 Russia	7,007
3 Iran	2,407
4 UAE	2,270
5 Norway	2,125
6 Kuwait	2,124
7 Nigeria	1,939
8 Angola	1,874
9 Algeria	1,773
10 Iraq	1,764
11 Venezuela	1,719
12 Libya	1,525
13 Kazakhstan	1,299
14 Canada	1,137
15 Qatar	1,077

Source: www.eia.gov, accessed 2/27/12

4.1.2 THE RELATIVE NEGLECT OF NATURAL GAS

In addition to its oil abundance, Iraq has one of the largest natural gas reserves in the world, enough to meet its domestic electricity needs with substantial volumes leftover to export to Turkey and even Europe; unfortunately, these natural gas reserves are severely underdeveloped.

Iraq possesses an estimated 112 trillion cubic feet (Tcf) of natural gas,[11] the tenth largest reserves in the world.[12] However, as with its oil reserves, Iraq's gas reserves numbers are likely significantly underestimated. According to the EIA, "Probable Iraqi reserves have been estimated at 275-300 Tcf, and work is currently underway by several IOCs and independents to accurately update hydrocarbon reserve numbers."[13] Planned exploration in the north and the west (for which Baghdad is holding a fourth bidding round in the summer of 2012) are expected to reveal substantially more reserves.

At these higher estimates, Iraq could have one of the largest natural gas reserves in the world, trailing only Russia, Iran, and Qatar (see **Figure 2** for a comparison of natural gas proved reserves and production rates). Of these large natural gas reserves, 70% lie in the southern part of the country in the Basra governorate. Moreover, over two-thirds of this natural gas resource is

[11] 3.1 trillion cubic meters (Tcm).
[12] EIA, 2010.
[13] EIA, 2010.

associated gas (combined with an oil field). It is estimated that less than 20% of all natural gas in Iraq is non-associated (independent of an oil field) and the remaining 10% is salt dome gas.

FIGURE 2: WORLD NATURAL GAS PROVED RESERVES, PRODUCTION, AND EXPORTS

Proved Reserves (2011)	(Tcf)
1 Russia	1,680
2 Iran	1,046
3 Qatar	896
4 Saudi Arabia	276
5 USA (2009 figure)	273
6 Turkmenistan	265
7 UAE	228
8 Nigeria	187
9 Venezuela	179
10 Algeria	159
11 Iraq	112
12 Australia	110
13 China	107
14 Indonesia	106
15 Kazakhstan	85

Production (2010)	(Bcf)
1 Russia	20,915
2 USA	21,577
3 Russia	20,915
4 Canada	5,390
5 Iran	5,161
6 Qatar	4,121
7 Norway	3,756
8 China	3,334
9 Netherlands	3,131
10 Saudi Arabia	3,096
11 Algeria	2,988
12 Indonesia	2,917
13 Malaysia	2,171
14 Egypt	2,166
15 Uzbekistan	2,123

Exports (2010)	(Bcf)
1 Russia	7,934
2 Norway	3,552
3 Qatar	3,351
4 Canada	3,263
5 Netherlands	2,102
6 Algeria	1,970
7 Indonesia	1,457
8 USA	1,137
9 Malaysia	1,130
10 Turkmenistan	879
11 Australia	858
12 Nigeria	848
13 Trinidad and Tobago	720
14 Germany	573
15 UK	553

Source: www.eia.gov, accessed 2/27/12

The majority of the non-associated natural gas reserves are in fields located in the northern part of Iraq in Kurdistan, including the Ajeel, Bai Hassan, Jambur, Chemchemal, Kor Mor, Khashem al-Ahmar, and al-Mansuriyah fields (see the fields in red in **Figure 3**).[14] According to the KRG, and based on a study by the U.S. Geological Survey, Kurdistan sits atop roughly 60 Tcf of natural gas reserves.[15] The KRG Minister of Natural Resources, Ashti Hawrami, has recently estimated as much as 100-200 Tcf of gas in Kurdistan alone.[16]

The size of new gas discoveries in Kurdistan is substantial: recent Kurdish gas discoveries amount to roughly 20 Tcf, not including the 4 to 5 Tcf discovered at the Khor Mor and Chemchemal fields (both dedicated to producing electricity for domestic consumption).[17] Iraq's gas reserve estimates are likely to go up even further as the winners of this summer's fourth bidding round explore twelve new blocks, seven of which are expected to contain gas.[18]

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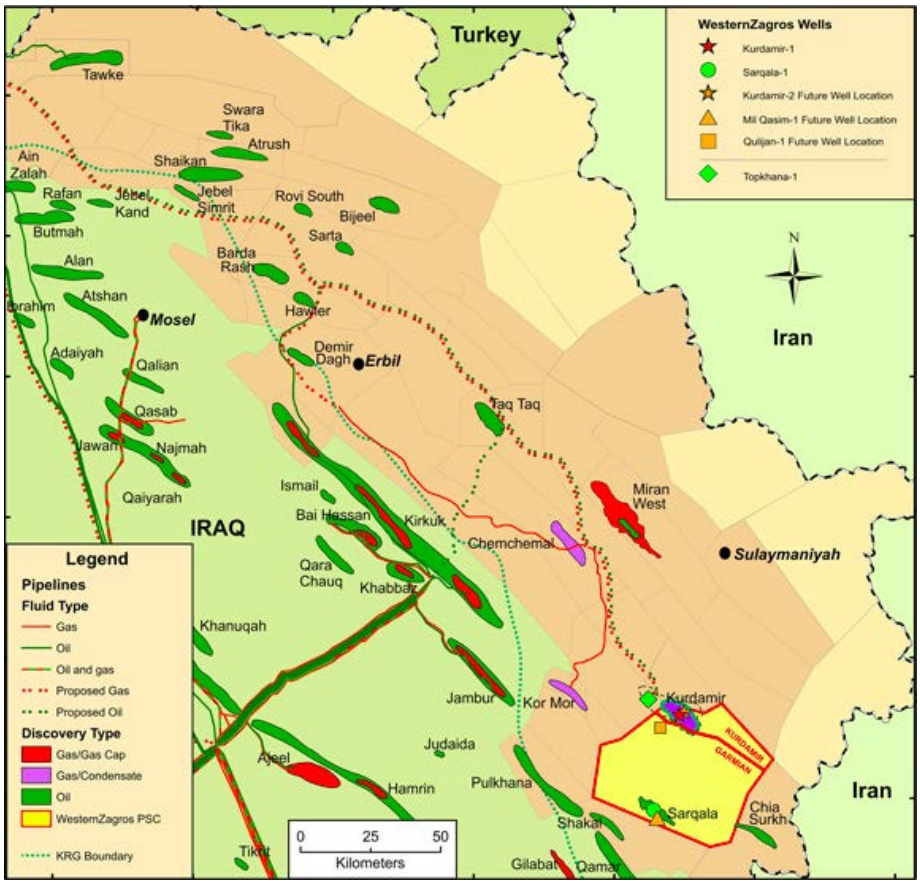
[14] EIA, 2010.
[15] Blas, 2011a.
[16] KRG, 2011.
[17] KRG, 2011.
[18] See the map of blocks to be auctioned in http://www.iraqog.com/oil/oillaw/jiyad62011.pdf

FIGURE 3: OIL AND GAS FIELDS IN NORTHERN IRAQ



Source: Western Zagros web site (http://www.westernzagros.com/operations/index.html)

Due to the vastness of its reserves and geography, Iraq—and Kurdistan in particular—has the potential to become a major exporter of natural gas, especially to Europe. Some estimates put Iraq's export potential by 2030 at 0.5 to 1.1 Tcf of natural gas per year, which would help meet Europe's energy demand requirements in the future and lower its dependence on Russian gas.

However, current natural gas production is far below optimal levels. Production estimates vary but are as high as 522 billion cubic feet (Bcf) annually or about 1.4 Bcf per day[19] and increasing; in September 2010, Iraqi Oil Ministry officials listed current production levels at 2 Bcf per day.[20] Still, at these levels Iraq lags far behind the world's top natural gas producers (for example, the U.S. produces nearly 60 Bcf per day, see **Figure 2**). A lack of processing ability is not to blame—in fact, over 500 Bcf per year (22 Bcm) of processing capacity remains unused[21]—rather, it is the

[19] EIA, 2010.
[20] UPI, 2011.
[21] EIA, 2010.

underdevelopment of Iraq's natural gas transportation infrastructure and the poor commercialization options (i.e., lack of power generation facilities, reliable export paths, and a national hydrocarbon law, discussed in Section 4.2) that have left Iraq's gas wealth unexploited.

Currently, the main uses of gas include reinjection into oil fields to enhance petroleum recovery, use in the petrochemicals industry, and, most egregiously, gas "flaring" (burning off natural gas that comes out of oil wells). Because the economics of lifting and commercializing oil are so favorable compared to those of gas, associated fields in the south have been developed without regard for the opportunity cost of flaring natural gas. The Climate Change Team of the Environment Department of the World Bank reported in July 2011:

> *In its attempt to rapidly increase its production of crude oil,* Iraq is flaring an estimated 9 billion cubic meters [318 Bcf] of associated gas this year, *ranking it among the top five flaring nations in the world. The gas currently flared in this country is* enough to fuel all of Iraq's electric power needs, *most of which is unmet or generated by heavy fuel and crude oils.*[22] [emphasis added]

If exported, this gas flaring volume would have made Iraq the 22nd largest exporter of natural gas in 2010, after Libya (352 Bcf).[23]

Indeed, not only is gas not being developed for power generation and export, its underdevelopment leaves many Iraqis using diesel generators for electricity, a costly activity given the price that oil could command if exported.

While flaring is rampant in associated fields in the south, Kurdish gas in the north has no export route and is currently limited to satisfying Kurdistan's power demands. The largest natural gas developer in Kurdistan is Dana Gas, a subsidiary of U.A.E.-based Crescent Petroleum, which produces nearly all of Kurdistan's gas and is responsible for the significant improvement in power generation in Kurdistan: Erbil enjoys almost uninterrupted electricity, whereas other areas of Iraq might receive electricity for as few as four or five hours a day. Hoping that the future holds an export path to Europe for Kurdish gas in the medium- to long-term,[24] Austria's OMV and Hungary's MOL each bought a 10% interest in Pearl Petroleum (Crescent Petroleum and Dana Gas's investment vehicle in Kurdistan) and Crescent and Dana reciprocated by purchasing

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[22] Lesnick, 2011.
[23] EIA website, http://www.eia.gov.
[24] Blas, 2011a.

interests in MOL.[25] For reasons discussed below, it is uncertain when and under what arrangement the KRG will be able to export its gas.

4.2 IRAQ'S INTERNAL DIVISION

The most important feature of the politics between Baghdad and Erbil is not a competition for money or land, but the tension between the KRG's desire for autonomy and the central government's desire for sovereignty.[26] Above all, the central government is suspicious that the KRG is laying the foundation for its full independence in the future.

This tension creates significant risks for natural gas development in Kurdistan. For example, one salient risk for private companies is that a combination of political and legal change might force established contracts to be renegotiated.[27] Another salient risk is that gas developers will not find a way to monetize their gas due to the impasse on natural resource exports from Kurdistan. Companies will not invest in the face of these risks unless they can earn a premium for their risk-taking.

4.2.1 DIVISIVE INTERNAL POLITICS AND DIVERGENT ECONOMIC POLITICS

Since 1991, the KRG has enjoyed a relatively high level of transparency, legitimacy, security and efficiency compared to the rest of Iraq, which suffers from severe political gridlock and physical insecurity due to continuing domestic conflict and terrorism. The divisive politics and divergent economic paths threaten Iraq's political stability and generate uncertainty about the fate of contracts signed with the KRG and the future of its exports.

Iraq today is, broadly speaking, divided among Kurds in the north, Sunnis in the west and north, and Shiites in the south. Shiites, who constitute a majority of the country, form the leading faction in the central government. Though divided among themselves, Shiites have been able to govern in coalition with Kurds. Sunnis, while enjoying some positions in Baghdad, feel underrepresented and persecuted by security forces loyal to Prime Minister, Nouri al-Maliki, a Shiite.[28] This was most apparent recently when, after the U.S. forces withdrew, the Prime Minister sought to arrest the Vice President, Tariq al-Hashimi, a Sunni, who promptly fled to Kurdistan.[29] Furthermore, some Sunnis and Shiites suspect that the Kurdistan Alliance, consisting of the two main Kurdish

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[25] Dana Gas, 2009.
[26] For example, in areas where the KRG is seen as trying to craft its own foreign policy. Consider the fact that one of the authors visited Erbil with a visa granted by the KRG, not by the central government.
[27] Atherton, 2012.
[28] Vali, 2006.
[29] Parker, 2012.

political parties the Kurdistan Democratic Party and the Patriotic Union of Kurdistan, harbors separatist designs.

In the largely homogenous Kurdistan (the overwhelming majority of the region is Kurdish, although 10% of the seats in Kurdistan's parliament is reserved for non-Kurds[30]), social, political and economic development has been progressing rapidly. The Kurds are focused intensely on economic development, an activity that has greatly benefited from Kurdistan's relatively autonomous status as a federal region granted by Iraq's Constitution (see Section 4.2.2). For example, the average gross domestic product (GDP) per capita has risen some fifteen-fold over a decade from being one of the lowest in the world at $375 in 2002 to being comparable to healthy developing economies at $5,500 in 2011 (a figure only one-third less than that of Turkey).[31] No coalition forces have been killed in Kurdistan, and there have been no terrorist attacks since 2007.[32] In many areas of Kurdistan, electricity is available over 20 hours per day and residents travel freely.

Compare this to the rest of Iraq, which has been characterized as "something close to a failed state."[33] Ned Parker, a former *Los Angeles Times* reporter who covered Iraq from 2007 to 2011, writes in *Foreign Affairs*:

> *The Iraqi state cannot provide basic services, including regular electricity in summer, clean water, and decent health care; meanwhile, unemployment among young men hovers close to 30 percent, making them easy recruits for criminal gangs and militant factions. Although the level of violence is down from the worst days of the civil war in 2006 and 2007, the current pace of bombings and shootings is more than enough to leave most Iraqis on edge and deeply uncertain about their futures. They have lost any hope that the bloodshed will go away and simply live with their dread. Acrimony in the political realm and the violence in the cities create a destabilizing feedback loop, whereby the bloodshed sows mistrust in the halls of power and politicians are inclined to settle scores with their proxies in the streets.*[34]

As a result, the rest of Iraq has an overall GDP per capital of only about $3,600,[35] may only receive several hours of electricity per day, and continues to suffer from frequent terrorist attacks (in 2011, Iraq saw 11 civilian deaths per day from suicide attacks, vehicle bombs, gunfire and

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[30] Gunter, 2010.
[31] Pflüger & Duero, 2011.
[32] Kent, 2012.
[33] Parker, 2012.
[34] Parker, 2012.
[35] Iraq's GDP per capita overall is estimated to be $3,900 (CIA, 2011), Removing the contribution of the KRG, which comprises 17% of the population and whose GDP per capita is $5,500, the rest of Iraq's GDP per capita is roughly $3,600.

executions[36]). Politics aside, the rest of Iraq's insecurity stifles economic development and severely raises the cost of doing business.

Kurdistan and the rest of Iraq look like—and in many cases operate as—two separate countries.

4.2.2 FEDERALISM

Understanding the federalism defined by the Iraqi Constitution[37] is critical to understanding the gridlock between the Erbil and Baghdad. Section 5 of the Constitution officially recognizes Kurdistan as a federal region north of the so-called "Green Line" which includes the bulk of three provinces—Erbil, Dohuk, and Suleimaniya—with Kurdish majorities (see **Figure 4**). Although the Constitution only formally established Kurdistan as a federal region, it left open the possibility of the creation of new regions in the future, and it also laid out a referendum process to settle disputes over territories along Kurdistan's border. These two issues—the potential for new regions to form and the unresolved "disputed territories"—are particularly significant in explaining Iraq's current internal divide.

4.2.2.1 THE POTENTIAL FOR NEW FEDERAL REGIONS

The KRG's success and the possibility of forming new regions are both an opportunity for and a major challenge to Iraqi development. The 2008 Washington Institute for Near East Policy report, *Provincial Politics in Iraq*, explains:

> *The frustration of subnational political awakening and the desire for greater autonomy may have strong negative effects on Iraqi national cohesion. One obvious effect might be to make the formation of new single or multiprovince regions more likely. The Kurdistan Regional Government's existence has already created some pressure for the formation of equivalent blocs, and this pressure will grow if Iraq's provinces feel frustrated by the federal government's continued resistance to decentralization.*[38]

Indeed, in late 2010, in response to corrupt national revenue sharing practices and the neglect of Basra province's local development, Basra's provincial council voted for a referendum on becoming another federal region; the central government ignored it.[39] The success of the KRG model and its rapid development is motivating leaders in other regions to consider a similar path,

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[36] Iraq Body Count, 2012.
[37] Available online in English at the United Nations Assistance Mission in Iraq (UNAMI) website, http://www.uniraq.org/documents/iraqi_constitution.pdf, last accessed 2/26/12.
[38] Knights & McCarthy, 2008.
[39] Parker, 2012.

and leaders from around Iraq have traveled to Erbil to investigate how to manage a federal region.[40]

On the one hand, with respect to natural gas development, the KRG could benefit from other federal regions developing: it would value being able to deal with an empowered regional official acting independently of Baghdad, perhaps in the contiguous Sunni areas, who could guarantee demand for Kurdish natural gas sales to the south. Currently, because the KRG lacks confidence that demand contracts would not be subject to the uncertainties of the political system in the south (e.g., late or withheld payments, which are currently commonplace), it has not pushed to supply natural gas outside of Kurdistan.[41]

On the other hand, any attempt to form another federal region would introduce more instability to already stressed national politics and could exacerbate the conflict over natural resource development and revenue sharing. The *Provincial Politics in Iraq* report cautions:

> *It must be remembered that the KRG developed over a ten-year period that included a major Kurdish civil war. So the formation of further regions at such a delicate moment in Iraq's history would be perilous as well as a distracting to the nation-building and economic reconstruction efforts.* [42]

4.2.2.2 LACK OF RESOLUTION ON THE "DISPUTED TERRITORIES"

The "disputed territories" that run along the border of Kurdistan (see **Figure 4**, **Figure 6**, and **Figure 16**) constitute perhaps the biggest flashpoint between Erbil and Baghdad. Eugene Palka, former Professor and Head of the Department of Geography and Environmental Engineering at the U.S. Military Academy at West Point, summarizes the history and central nature of the territorial dispute in Iraq:

> *Historic rivalries between Iraqi Kurds and Arabs contribute to current social and political unrest, and pose an even greater challenge to long-term stability in the country. One of the most volatile issues fuelling Kurd-Arab tensions concerns the "Green Line", which on various maps separates Iraq's Kurdish and Arab populations. Initially established by Saddam Hussein in 1991, the ambiguous boundary has shifted north during Arabisation schemes and south as a result of Kurdish settlement and encroachment. More recently, on 19 March 2003, the Green Line was defined as the area controlled by the Kurdish Regional Government (KRG) and recognised by the Iraqi Transitional Government when it passed the Transitional Administrative Law (TAL) in 2004. Although the Iraqi Constitution recognises Kurdistan as a federal region, the precise boundary remains contentious. At stake are the historical ties to the territory along the Green Line, the associated oil reserves, and the status of the symbolic city of Kirkuk. Resolution of the disputed*

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[40] Interviews with KRG officials.
[41] Interviews with KRG officials.
[42] Knights & McCarthy, 2008.

> *territories along the Green Line, the associated revenue sharing of the oil wealth, and the fate of Kirkuk, constitute a single, complex, multifaceted issue that will have a decisive impact on the future stability, if not integrity, of Iraq.*[43]

Article 140 of the Iraqi Constitution specifies that territorial control can be settled by a census concluding with "a referendum in Kirkuk and other disputed territories to determine the will of their citizens." The KRG maintains that these territories are not "disputed," and KRG officials have encouraged Baghdad to take the issue to court and settle it with a referendum in accordance with the Constitution, a process that that the KRG is confident it would win.[44]

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[43] Palka, 2011.
[44] Interviews with KRG officials.

FIGURE 4: OIL AND GAS IN THE KURDISTAN REGION AND DISPUTED TERRITORIES

Source: Crisis Group, "Iraq and the Kurds: Trouble Along the Trigger Line," 2009

The wealth of oil and gas under the disputed territories fuels the dispute (see **Figure 4**). An International Crisis Group report explains, "one of the KRG's main problems is that the largest quantities of oil lie in the disputed territories … and this is also of the best quality. The closer you get to Kirkuk, the better it gets. This offers high potential for conflict."[45] Indeed, recent actions by the KRG that ignore the Green Line have angered Baghdad, especially the development of oil and gas fields in the disputed territories.[46] As the KRG Minister of Peshmergas explained, "The

[45] Crisis Group, 2009.
[46] For a detailed discussion of this issue Crisis Group, 2009, p11.

Green Line was created by Saddam Hussein and we don't acknowledge it."[47] And therein may lie the problem: to Iraqi Arabs, the Green Line represents a post-Saddam settlement between Arabs and Kurds; to Iraqi Kurds, it represents a continuation of the long repression of the Kurdish people. (See **Figure 5** for a visual history of the Green Line.)

FIGURE 5: IRAQ'S "GREEN LINE"

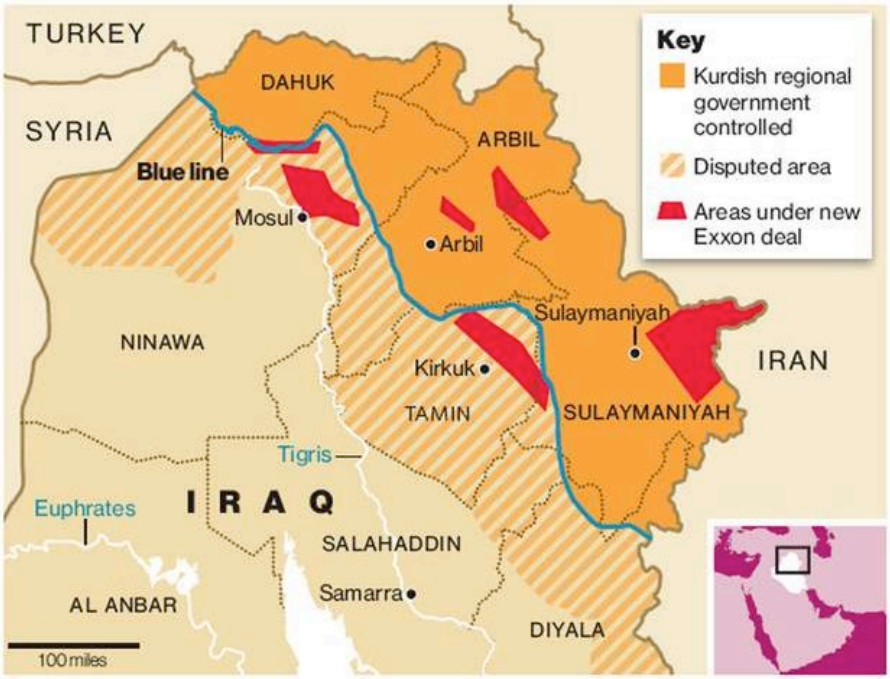
Source: U.S. Army map, published in Palka, 2011

The most significant example of flouting the Green Line is the KRG's recent signing of an exploration and production contract with Exxon—over Baghdad's threats against both the KRG and Exxon—confirmed by Exxon in its 10-K filing to the United States Securities and Exchange Commission in February, 2012.[48] In addition to the significance of Exxon being the first major oil and gas company to disregard Baghdad's claim that resource development contracts with the

[47] Crisis Group, 2009.
[48] Ordonez, 2012.

KRG are illegal, the contract itself covers three fields located in the disputed territories: two in Nineveh and one in Kirkuk (see **Figure 6**); furthermore, Exxon has major interests in its petroleum technical service contracts (TSCs) with Baghdad in southern Iraq,[49] and Baghdad has repeatedly admonished Exxon against negotiating with the KRG,[50] even threatening to replace Exxon with Royal Dutch Shell at the West Qurna 1 oil field.[51] In January, Baghdad seemed to retreat from its threats by giving Exxon the option to keep its West Qurna contract if it terminated its relationship with the KRG,[52] but it has excluded Exxon from an oil and gas block auction coming up in May.[53] And although Exxon has kept its contract with the KRG, no action has been taken (yet) by Baghdad: the Exxon-KRG contract has yet to be taken to court.[54] Worse for Baghdad, Chevron, Total and Gazprom have also started doing deals with the KRG.[55]

FIGURE 6: THE EXXON DEAL AND THE DISPUTED TERRITORIES



Source: Cockburn, "Exxon's deal with the Kurds inflames Baghdad," *The Independent*, 12/9/11

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[49] Cockburn, 2012.
[50] A short summary of all the warnings Baghdad has given to Exxon can be found in Wing, 2012.
[51] Cockburn, 2012.
[52] Mackey, 2012.
[53] UPI, 2012.
[54] Wing, What's Next for Exxon, 2012; also, Reuters, "Oil's big players rais the stakes in Iraqi Kurdistan," 2012.
[55] Reuters, "Oil's big players rais the stakes in Iraqi Kurdistan," 2012.

It is clear that the disputed territories are a flashpoint in Iraq's petroleum politics; it is far from clear how Baghdad will ultimately respond to the KRG's increasingly aggressive oil and gas development activities.

4.3 THE REVENUE SHARING DISPUTE, EXPORTS, AND PRODUCTION CONTRACTS

Another major source of political and financial uncertainty for natural gas development in Kurdistan is the export and revenue sharing dispute. The lack of a clear export pathway is a major impediment to investing in Kurdish natural gas, especially because of the investment and time required to develop and transport natural gas (years for gas versus months for oil).[56]

Article 112 of the Constitution addresses the issue of revenue sharing within Iraq and nominally guarantees the KRG 17% (based on the size of the Kurdish population) of all Iraqi natural resource revenues:

> *First: The federal government, with the producing governorates and regional governments, shall undertake the management of oil and gas extracted from present fields, provided that it distributes its revenues in a fair manner in proportion to the population distribution in all parts of the country, specifying an allotment for a specified period for the damaged regions which were unjustly deprived of them by the former regime, and the regions that were damaged afterwards in a way that ensures balanced development in different areas of the country, and this shall be regulated by a law.*
>
> *Second: The federal government, with the producing regional and governorate governments, shall together formulate the necessary strategic policies to develop the oil and gas wealth in a way that achieves the highest benefit to the Iraqi people using the most advanced techniques of the market principles and encouraging investment.*[57]

The ambiguity of the language lends itself to a couple of interpretations:

(1) Baghdad's position that there must be an agreement between the federal government and the regions on development and export; or

(2) Erbil's position that only the management of "present fields" (as of the time of the Constitution) requires a joint approach, but that new fields can be developed at the discretion of the KRG.

Again, the differences in interpretation originate from the tension between the KRG's desire for autonomy and the central government's desire for sovereignty. While the Kurds are greatly

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[56] Chouach, 2012.
[57] Available online in English at the United Nations Assistance Mission in Iraq (UNAMI) website, http://www.uniraq.org/documents/iraqi_constitution.pdf, last accessed 2/26/12.

interested in an "automatic revenue sharing system" administered by an independent third party (like Pricewaterhouse Coopers) that would assure KRG autonomy and remove uncertainty in national budgetary grants and payments,[58] the Sunnis and Shiites desire "constitutional guarantees [to address their] trepidations … with regard to federalism, future Kurdish aspirations, and the unity of Iraq."[59]

4.3.1. Dependence on export revenues

Although Baghdad firmly insists on its position in the export and revenue sharing debate, it is hamstrung by its heavy dependence on petroleum revenues (which, as mentioned above, supply 95% of its budget).[60] As Patrick Cockburn of *The Independent* writes:

> *The Iraqi government is totally reliant on its oil revenues to pay its soldiers, police force and civilian officials. It needs vast sums to rebuild the country after 30 years of war, civil war and sanctions.*[61]

This dependence on oil and gas revenues tempers Baghdad's stance against the KRG. Most notably, Baghdad actually authorized the KRG to export oil from the Taq Taq field (developed by China's Addax Petroleum and Turkey's Genel Enerji) and the Tawke field (developed by Norway's DNO) in 2009 and early 2010.[62] This was a major break-through for the KRG, which had never before been allowed officially to export oil. Baghdad permitted it for the annual revenue generation it promised of up to $2 billion, of which it would receive 83% due to population-based revenue sharing.[63] (Unfortunately, this did not set a precedent for allowing Kurdistan to export petroleum because the oil was exported by SOMO, the Oil Marketing Company of the Republic of Iraq, along existing Iraqi pipelines to Ceyhan, Turkey.[64])

The deal came with major complications, however. First, the KRG was forced to direct revenues to a federally managed fund (as opposed to an independent account managed by a third party). Second, because the KRG's contracts with DNO, Addax and Genel were not recognized by Baghdad, no arrangement was initially agreed upon between Erbil and Baghdad for reimbursing the production companies for their costs. *Fast Company* reported that,

> *[In 2009], DNO and Turkey's Genel Enerji demanded that the Kurdish government pay for the oil they had already put into the pipelines. "The companies are almost broke,"*

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[58] Hawrami, 2012.
[59] Kane, 2010.
[60] Zulal, 2011.
[61] Cockburn, 2012.
[62] CNW, 2009; Lesova, 2010.
[63] Crisis Group, 2009.
[64] Crisis Group, 2009.

> *explains [International Crisis Group's] Hiltermann, "and the KRG said, 'Sorry, that's Baghdad's responsibility.'" Baghdad refused to pay, saying it didn't recognize the contracts and that the Kurds should pay out of the 17% of oil revenue it receives from the central government for oil sales elsewhere in the country. […] As the stalemate wore on, the Kurds cut off all exports. [As of 2010] "The companies," says Hiltermann, "have received not a single penny since investing."*[65]

Over a year after exports were scheduled to commence, in February 2011, the central government acquiesced moderately to pay contractor's costs (but not profits)[66] and some exports resumed.[67] *The Financial Times* reported in December 2011:

> *Nearly five years after the company built a 44km pipeline linking Tawke with the Iraq-Turkey pipeline to export its oil, it continues to sell the bulk of the field's output in the local Kurdish market, where artisanal refineries buy it at less than half the international price. … DNO has so far received two payments for the fraction of its production that it is able to export through the international pipeline, although Kurdish officials believe more money is on its way. The difficulties have forced the company to put on hold a plan to nearly treble the oilfield's maximum production capacity to 200,000 barrels a day.*[68]

The situation continued until this year, when DNO was forced to book a loss in the second quarter because it could not reconcile its accounts for 2009, 2011, and 2012 exports for which it never received payments. However, under a new agreement with the KRG, DNO hopes to recover its share of cost and profit oil that was laid out in its original PSC.[69]

Because of the impasse on oil and gas exports and revenue and cost sharing, Erbil must find ways of circumventing Baghdad. As a result, Kurdish oil is being sold domestically and, according to some reports, even smuggled by truck over the Kurdistan-Iran border.[70] This activity (or merely the perception of this activity) completes a vicious circle in which the Iraqi government delays revenue sharing payments and withholds cost reimbursement to the KRG, and the KRG sees no choice but to act independently of the Iraqi government.

4.3.2 LACK OF PROGRESS ON A NATIONAL HYDROCARBON LAW

Although Erbil and Baghdad agreed on a draft national hydrocarbon law in 2007, it was never finalized in parliament. Subsequent to the release of the draft national hydrocarbon law, the KRG developed its own Oil and Gas Act in August 2007 under which it started issuing scores of

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[65] Hammer, 2010.
[66] Iraq Business News, 2011.
[67] Genel Energy, 2012.
[68] Blas, 2011b.
[69] Iraq Business News, 2012. The original PSC is online at http://www.krg.org/pages/page.asp?lngnr=12&rnr=296&PageNr=1.
[70] Zulal, 2011; McEvers, 2010.

development contracts to independent IOCs in a process Baghdad has criticized as being opaque and anti-competitive.[71] Baghdad refuses to recognize the KRG draft law and the contracts signed under it and has withheld reimbursements to foreign oil companies operating in Kurdistan.

After the Iraqi cabinet approved the draft oil law in August 2011,[72] there was optimism that it would be passed by the end of the year; however, conflicts persisted between the Sunni, Shiite and Kurdish representatives. The Iraqi Parliament's energy panel then released its own draft law, creating a new debate about who has the right to introduce laws in parliament. Key players are now skeptical that anything will be passed in 2012. One of Iraqi Prime Minister Nouri al-Maliki's advisors concludes, "With these chronic political differences I can't see any possibility of having an oil law this year."[73] The KRG has also become pessimistic: whereas in 2011, Minister Hawrami was optimistic that Erbil and Baghdad would resolve their differences and that the Iraqi parliament would pass the necessary hydrocarbon revenue sharing legislation,[74] now many in Kurdistan believe it is unlikely that anything will be passed this year.[75] Although the 2012 national budget allows the KRG to export 175,000 bpd of Kurdish oil, Erbil halted oil exports from April to August citing Baghdad's nonpayment of over $1.5 billion due to foreign oil producers.[76]

This failure to agree on a national hydrocarbon law is at the heart of the revenue risk for IOCs. The 2009 DNO/Addax/Genel export case (described in the previous section) provides the cautionary tale that, even with an export arrangement with the central government, the KRG was unable to ensure timely payments to the IOCs for their costs.

4.3.3 Contract design

As indicated earlier, the issue of state sovereignty versus regional autonomy is core to the debate. The KRG believes the Constitution gives it the ability to develop *regional* resources and the right to draft its own laws as long as they are constitutional;[77] Baghdad believes it should be able to issue contracts with companies to extract Iraq's *national* mineral wealth. [78] Article 115 of the Iraqi Constitution reserves for the regions (or governorates not organized under a region) all rights that are not explicitly reserved for the federal government (like the U.S. Constitution) and, further, gives priority to regional (or governorate) law in cases of dispute. According to Justin

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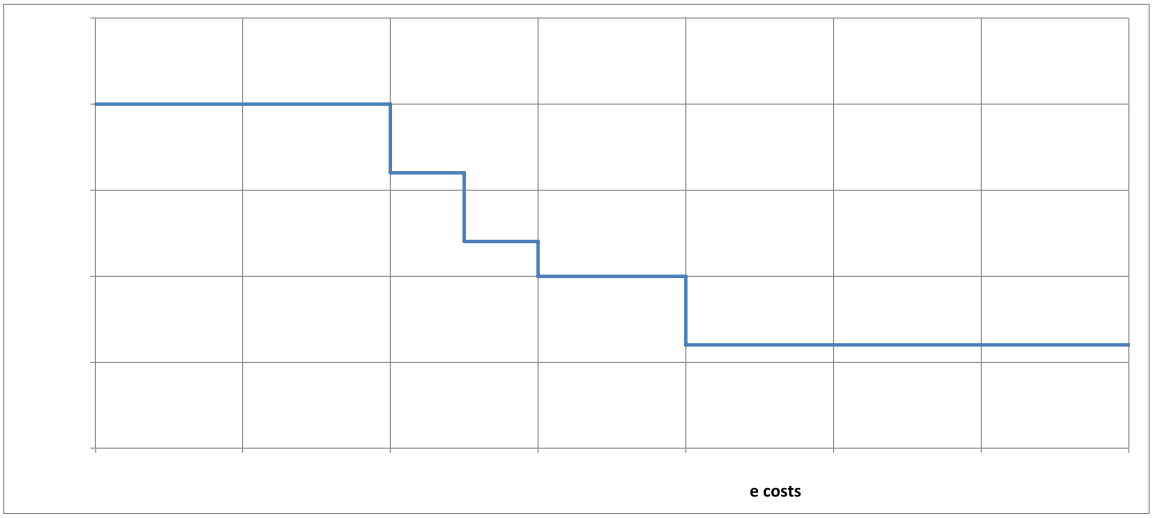
[71] Revenue Watch Institute, 2011.
[72] Reuters, 2011.
[73] Reuters, "Iraq Oil Law Deal Festers As Crisis Drags On," 2012.
[74] KRG, 2011.
[75] Interviews with KRG officials and company representatives.
[76] AFP, 2012.
[77] Hawrami, 2012.
[78] See, for example, "The Deputy Holds the Key," Uticensis Risk Services, 2011.

Dargin of the Dubai Initiative at the Harvard Kennedy School of Government, "The KRG … views Article 115 as a trump card that vests it with authority to have its own petroleum law on the grounds that a comprehensive petroleum law does not exist [in 2007]."[79] In its 2007 Oil and Gas Act, the KRG adopted PSCs to immediately attract IOCs; Baghdad responded by proclaiming it would not recognize contracts signed with the KRG under its 2007 Act.

A large source of the conflict over KRG's petroleum development is the nature of the investment vehicle it provides to IOCs. The KRG offers lucrative production sharing contracts (PSCs) instead of the fee-based technical service contracts (TSCs) offered in the south. To Baghdad, the generous PSCs represent irresponsible stewardship over Iraq's natural resources; to Erbil, PSCs are necessary to attract IOCs and accelerate the exploration and development of long-neglected Kurdistan. Indeed, the KRG's PSCs are a large incentive for developers to land production deals in Kurdistan and explains why Exxon (and now Chevron, Total and Gazprom[80]) started negotiating deals with the KRG, risking the ire of Baghdad and losing existing TSCs in the south.

Under the terms of Baghdad's TSC, "remuneration fees" are paid for "incremental production", or barrels of oil (or oil equivalent) produced above a specified baseline rate.[81] Remuneration fees in Baghdad's TSCs are designed such that a declining fee per barrel is paid to the contractor as cumulative revenues exceed cumulative costs (the "R-factor"; see **Figure 7**).

FIGURE 7: REMUNERATION FEES UNDER BAGHDAD'S TSCS (FEE PER BARREL VS. R-FACTOR)



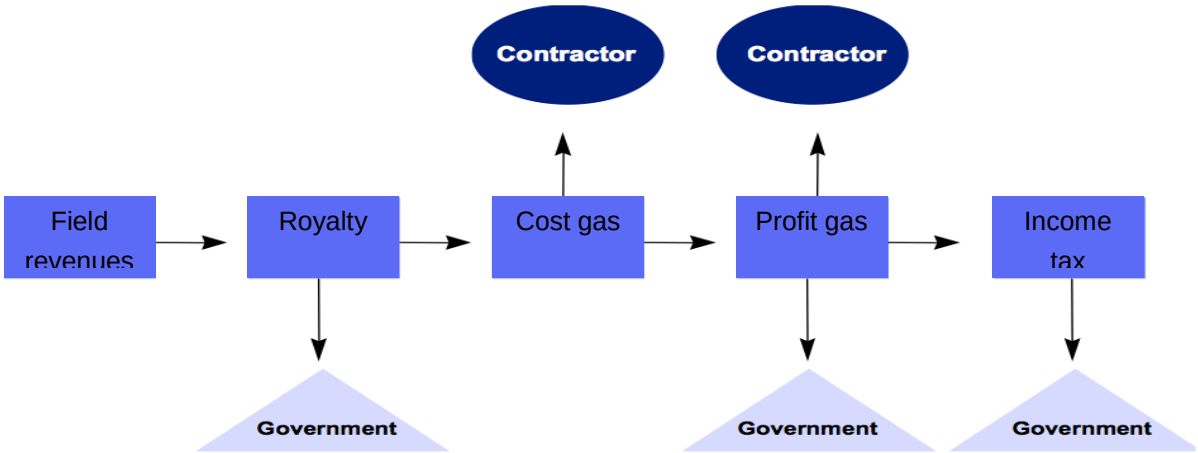
Source: A Southern Oil Company TSC, authors' visualization

[79] Dargin, 2008.
[80] Reuters, "Oil's big players rais the stakes in Iraqi Kurdistan," 2012.
[81] Liezenga & Fletcher, 2010; South Oil Company TSC obtained by authors.

The incentive to produce more oil declines as companies recoup their costs and, more importantly, the flat fee structure (e.g., $2.00 per barrel), while it may create revenue certainty for contractors, permits no upside for contractors if oil prices rise because the absolute fees are decoupled from the market.

In sharp contrast to the contracts issued by Baghdad, the KRG's PSCs charge a royalty based on the volume of oil or gas produced and the proportion of profits shared, not a flat fee per barrel, is adjusted based on the contractor's R-factor (see **Figure 8** for general configuration; **Figure 18** depicts KRG-Dana Gas's PSC).

FIGURE 8: FLOW OF NATURAL GAS REVENUES UNDER A PSC

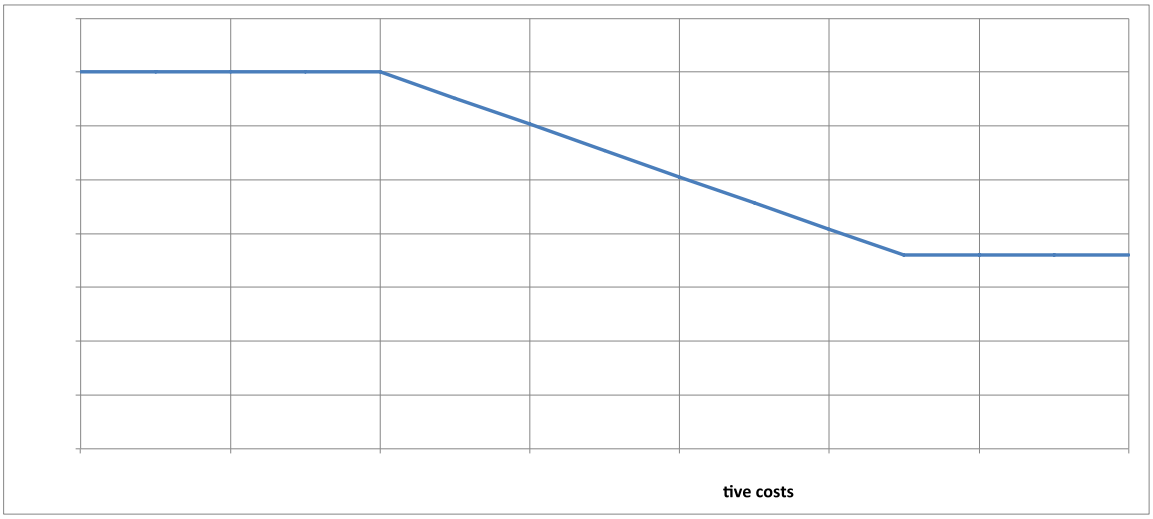


Source: Authors (modified from diagram found in UBS, 2004)

The share of profits typically decreases over time starting when the contractor has recouped all of its cumulative costs (R = 1). In Heritage Oil's PSC (published on the KRG's website), Heritage's share of natural gas profits starts at 35% until Heritage's cumulative revenues exceed its cumulative costs (R > 1), then decreases linearly to 18% when it has earned cumulative revenues equal to 2.75 times its cumulative costs (R = 2.75; see **Figure 9**).[82]

[82] KRG-Heritage PSC, p59, online at KRG.org.

FIGURE 9: HERITAGE OIL'S PROFIT SHARING PROFILE FOR NATURAL GAS UNDER THE KRG'S PSC (SHARE OF PROFITS PETROLEUM VS. R-FACTOR)



Source: Heritage Oil-KRG PSC, authors' visualization

With higher pay-offs when cumulative revenues are less than cumulative costs (R < 1), both TSCs and PSCs are designed to allows contractors to recoup costs quickly at first until break-even. However, the PSC is a far more profitable arrangement that incentivizes rapid and efficient development. Dana Gas, for example, has the right to produce gas for resale within Kurdistan to produce electricity for Kurdish residents. Under its PSC, it also has the right to sell any gas in excess of the volume mandated by the KRG contracts (300 MMcfpd), as well as gas by-products. According to the Crisis Group, these by-products have been "trucked … to the oil pipeline at the nearby NOC-managed Jambour oil field, which connects to the Kirkuk-Ceyhan pipeline. Because adding condensate to oil improves the latter's quality, it has high value."[83] Dana Gas gets to capture much of this value under the PSC.

The large gap in return on investment (ROI) between the contracts in the north and in the south have applied pressure on Baghdad to revise the terms of its contracts, particularly after Exxon and Total voiced interest in the more lucrative PSC's with the KRG. In fact, for its fourth bid round for oil and gas exploration in twelve blocks around the country (currently scheduled for the beginning of summer 2012), Baghdad has introduced changes to its contracts to make them more attractive and reward greater risk-taking by IOCs. Significantly, IOCs would have a 100% stake in the projects and state-owned companies would have none (versus 75% for IOCs before).[84]

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[83] Crisis Group, 2009.
[84] Natural Gas Asia, 2012.

However, despite the new changes to Baghdad's TSCs, the underlying remuneration fee structure is still far less attractive than profit sharing.

As discussed previously, another concern is that the KRG's contracts might be subject to renegotiation because of how much more profitable they are compared to Baghdad's contracts. Worse, by offering more lucrative terms to attract developers, the KRG may even be (unwittingly) increasing the renegotiation risk. In *The Natural Resources Trap*, Harvard Kennedy School Professor of Global Energy Policy William Hogan and his co-authors describe how sovereign governments often enter into a "natural resources trap" that can doom contracts to renegotiation:

> *extractive industries are vulnerable to [renegotiation]… because of the timing and nature of investments and payoffs. Typically, many years separate the first capital investment in a project from the first production of a resource, and most investment takes place before any revenue flows. Typically the MNC [multi-national corporation] shoulders the costs for investments. The investment is sunk because it is specific to each field or mine. … Furthermore, it can be argued that, once the investment is made, there will be little distortion with respect to the production possibilities if firms are expropriated or taxed more heavily. All this exposes the projects to mounting populist pressures to capture more of the revenue stream ex post than as provided under the ex ante arrangements, particularly when commodity prices go up, making the properties or concessions in the hands of MNC more valuable. … A contract is set up that seems to work, but as conditions evolve the interests of the parties change and the HC [host country] seems more inclined to expropriate for an immediate gain. But, of course, this outcome is anticipated, and this means that the initial contract should already have taken into account that this will happen. … Because MNCs anticipate expropriation, they will offer a contract [or only accept a contract] that compensates them for the risk. But this forces the HC to expropriate; if they do not firms will be rewarded with a windfall gain that may be politically intolerable. It is a double trap, because lack of credibility not only creates a contract that in itself is more vulnerable, but also because it forces even those governments that would prefer to operate in a stable and law-abiding context to fall in the vicious cycle with the rest.*[85]

Note that, because the KRG is contending with Baghdad over natural resource sovereignty, the above dynamics, and ensuing risks, could be greatly exacerbated in the case of Kurdish gas.

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[85] Hogan, Sturzenegger, & Tai, 2010.

4.4 KURDISTAN'S MARCH FORWARD

As discussed above, the KRG has been actively pursuing oil and gas projects independent of Baghdad, only consulting with the federal government in cases where (in the KRG's eyes) unilateral action would violate the Constitution.[86]

To be sure, not all of the KRG's natural resource production is opposed by Baghdad. For example, Dana Gas's production of natural gas from the Khor Mor field was acceptable because it agreement with the KRG preceded the 2007 draft hydrocarbon law. Still, Baghdad was infuriated when OMV and MOL (both members of the Nabucco Consortium) bought stakes in Dana Gas and Crescent Petroleum's gas development projects, announcing, with the KRG's support, that they hoped to export 3 Bcfpd to Turkey and Europe via the proposed Nabucco pipeline by mid-decade.[87]

Minister Hawrami has compared Kurdistan's natural resource growth plan to that of the North Sea,[88] where small companies were financially incentivized to take risk and explore rapidly, and larger companies arrived later to bring production to scale and improve the sophistication of the oil and gas industry.[89] Accordingly, the KRG signed early contracts with small companies like Genel Enerji[90] (now looking to be a major player in Kurdistan, though Exxon's entrance interrupted its plans by raising target company valuations[91]), then signed contracts with larger players like Hunt and Marathon to lead exploration and accelerate natural resource development in Kurdistan, and is finally gaining traction with larger companies like Exxon and Total. Small companies are no longer able to find a footing in the KRG because the KRG is looking to the majors to accelerate exploration and production.[92]

This resource development plan has also aligned with IOCs' approach to risk. Initially, as an article in *The Telegraph* describes:

> *Heritage was one of the first foreign oil companies to enter Kurdistan, along with AIM-listed Gulf Keystone Petroleum and Turkey's Genel. The area has typically been avoided by the energy majors, despite its stable security, because its independence as an oil province has been disputed by the Iraqi state.*[93]

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[86] Hawrami, 2012.
[87] Crisis Group, 2009.
[88] Where Dr. Hawrami had experience early in his career.
[89] Hawrami, 2012; Hammer, 2010.
[90] The Turkish firm founded by Mehmet Sepil and acquired by Tony Hayward's investment vehicle, Vellares, to form Genel Energy.
[91] Reuters, "Exxon spoils Genel's plans," 2012.
[92] Interviews with KRG officials and contractors.
[93] Mason, 2011.

For small companies with no relationship with the rest of Iraq, the potential for high returns in Kurdistan was worth the risk; larger companies opted to wait and see how these smaller players would fare and how Erbil and Baghdad would interact. Now that natural resource wealth has been firmly established and observers have seen a stable and secure Kurdistan over the last several years, larger players are clamoring to enter Kurdistan, betting that the national political dispute will be resolved. For its part, the KRG appears to be betting that Baghdad's need for revenue generated by the KRG's contracts will prevent Baghdad from forcibly interfering with the KRG's production deals.

Baghdad takes a very different view of Erbil's activities. There is broad "cross-sectarian and cross-party opposition" in the south to the KRG's unilateral resource contracts, particularly around the amount of profits the KRG is passing on to producers and the increased autonomy it is wielding.[94]

The more self-sufficiency Kurds achieve and the larger interest they can attract from the oil majors and the international community (e.g., forging close ties with Europe over the Nabucco Pipeline), the more autonomy the Kurds might demand. There is a real suspicion in the south that the Kurds are laying the economic groundwork for their ultimate independence.

4.5 Potential Markets for Kurdish Natural Gas

According to the KRG, the priorities for Kurdish natural gas production are as follows:[95]

1) To supply KRG and Iraqi demand (i.e., generate power and support industry)
2) To export natural gas to neighboring Turkey
3) To export natural gas beyond Turkey, particularly Europe

The KRG is adamant that it intends to help solve Iraq's chronic electricity shortage with Kurdish gas. Its aim is to export any leftovers, provided that it can reach an export agreement with the central government.[96]

4.5.1 The Domestic Market

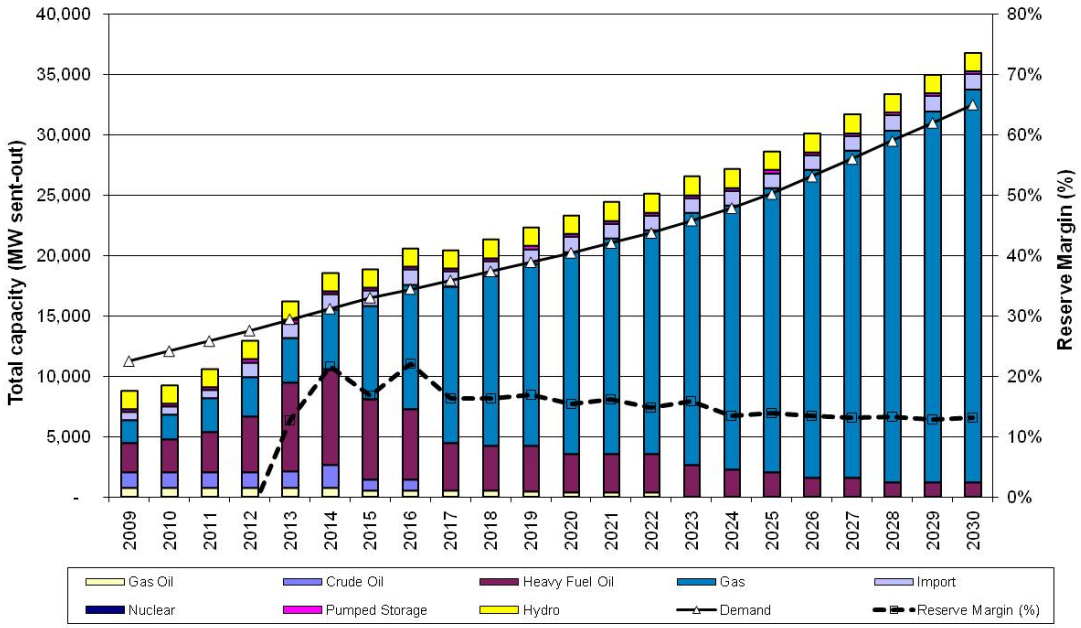
As mentioned earlier in this report, Iraq's electricity situation is an existential issue: many residents live on five hours a day or less of electricity during the hottest days of the summer. In the summer of 2010, the shortage was so dire that riots erupted in Nasiriyah and Basra and the

[94] Blanchard, 2009.
[95] Hawrami, 2012.
[96] KRG, 2011.

Electricity Minister was forced to resign.[97] Kurdistan, however, has seen a major improvement in its electricity supply and reliability thanks to the natural gas supplied by Dana Gas's operation near Erbil.

According to the current Master Electricity Plans for Iraq (excluding Kurdistan[98]), Iraqi electricity demand will exceed its *planned* capacity until 2013 (that is, if it fails to meet its planned target, demand will exceed supply for even longer; see **Figure 10**). The central government's goal is to both increase supply and shift the electricity generation feedstock from expensive fuel oil to natural gas, ultimately aiming to satisfy all of Iraq's demand with domestic natural gas.

FIGURE10: IRAQ ELECTRICITY MASTERPLAN—CAPACITY AND DEMAND



Source: Republic of Iraq, "Iraq Electricity Masterplan," Final Report, Vol. I, December 2010, p15.

To support its top priority of supplying domestic demand, the KRG has plans to pursue gas-fired power plant contracts in the provinces of Dohuk, Erbil and Suleimaniya.[99] In addition to 2,000

[97] Reuters, 2010.
[98] Iraq's master electricity plans were done separately (one for the KRG and the other for the central government), another indication of the level of autonomy with which the KRG operates.
[99] KRG, 2011.

MW planned for these provinces, the KRG also aims to develop 5,000 MW for the KRG and the neighboring provinces of Nineveh, Kirkuk and Salahadin.[100]

As Iraq's *Electricity Masterplan* states, the priority is to generate electricity for the Iraqi people and to prevent the possibility that export commitments would leave the Iraqi people short on gas requirements for electricity demand, as other gas exporting countries have experienced.[101]

The KRG shares the same goal: "We are all working to the same end," Minister Hawrami explained last year at an oil and gas conference in Erbil, "which is to make our oil and gas work for all the people of Iraq, without exception."[102] Currently, however, due to the political dispute over natural resource control and revenue sharing, Kurdish gas development is only benefiting Kurdistan.

4.5.2 The Turkish Market

Turkey, the world's 17th largest economy[103] and rapidly developing market just across Kurdistan's border to the north, is the next obvious market to consider for Kurdish natural gas. Turkey's natural gas demand is met almost entirely by imports (98% is imported)[104] and its imports overwhelmingly come from Russia (roughly 70%). Both Ankara and Erbil believe that Kurdish gas is the best option for reducing Turkey's dependency on Russian imports and creating a more liquid natural gas market. According to Aydin Selcen, the Turkish general consul in Erbil, "The most commercial alternative seems to be the [KRG]."[105] Turkey is an ideal partner for Baghdad and Erbil: it could guarantee large volumes in its gas contracts, has good credit, is eager to participate in the development and revival of Iraq, and may even be willing to pay a premium to diversify away from Russian and Iranian gas (the former because of how large a share it constitutes of Turkey's natural gas; the latter because of its failure to deliver contracted amounts of gas to Turkey[106]).

As Turkey's economy continues to modernize and urbanize, it will become increasingly energy-intensive. Electricity demand is projected to increase 7% per year (over five times its population growth rate of under 1.5%) for most of this decade and exceed planned capacity by 2017.[107] Thanks to Russia, Turkey's usage of natural gas has increased rapidly, and its import dependence

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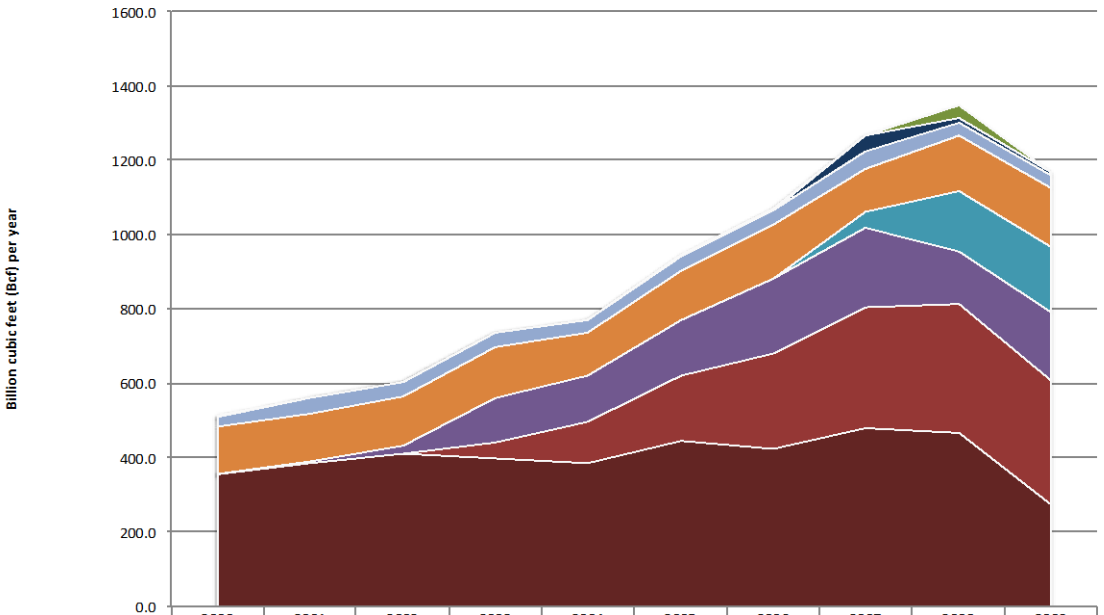
[100] KRG, 2011.
[101] Republic of Iraq, 2010.
[102] KRG, 2011.
[103] World Bank, 2011
[104] ISPAT, 2010.
[105] Blas, 2011a.
[106] Kardas, 2012.
[107] ISPAT, 2010.

on Russia could rise to 80% within the next several years.[108] (**Figure 11** shows Turkey's historical gas import volumes.)

FIGURE 11: TURKEY'S NATURAL GAS IMPORTS BY SOURCE COUNTRY (BCF PER YEAR)



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
TPAO	5.3					4.8	3.1	1.4	31.6	
Spot (LNG)								39.4	11.8	9.1
Nigeria (LNG)	24.9	42.3	40.2	39.1	35.9	35.8	38.8	49.3	35.9	31.9
Algeria (LNG)	126.9	128.0	131.4	133.9	112.3	134.7	148.6	114.9	149.0	158.4
Azerbaijan								44.4	161.7	175.1
Iran		4.0	23.3	122.2	123.5	150.0	197.5	213.7	145.2	185.4
Russia (Blue Stream)				43.5	112.4	172.4	256.9	324.3	346.2	336.3
Russia (Western line)	355.9	385.8	408.6	396.4	385.4	446.2	424.9	478.8	464.4	271.1

Source: Republic of Turkey, "Ministry of Energy and Natural Resources Strategic Plan (2010-2014)," p26, online at http://www.enerji.gov.tr/yayinlar_raporlar_EN/ETKB_2010_2014_Stratejik_Plani_EN.pdf, author's analysis

According to IBS Research, an energy economics consultancy based in Istanbul, natural gas demand in Turkey is forecast to grow by 3.8% per year to 2020 to reach 1.9 Tcf and then by 2.7% per year to reach 2.5 Tcf in 2030[109]; IBS estimates that Turkish demand for natural gas will exceed supply around 2020 and as early as 2018.[110] Some observers believe that Turkish consumption alone could prove to be a sufficient export target for Kurdish gas, and both the Turks and Kurds recognize that there is a tight window of opportunity to negotiate natural gas

[108] Statement by Stephen Larrabbee. Brookings Insitution, "Turkey, Russia and Regional Energy Strategies" (Washington, D.C., 15 July 2009).
[109] 53.8 BSm^3 and 70.0 BSm^3, respectively.
[110] Tonge, 2012.

export contracts as Russian and Iranian natural gas contracts come up for renewal over the next few years.[111]

Some in Turkey, including EnerCo Enerji, the second largest importer of natural gas in Turkey after BOTAS (the state-owned pipeline company) are keen to create a natural gas hub in Turkey.[112] Just as there is a Henry Hub natural gas price, M. Fatih Baltacı, the CEO and Founder of EnerCo Enerji, believes there should be an "Anatolian Hub" for natural gas.[113] The main arguments for it, according to EnerCo Enerji, are that Turkey's export and import capacity (and, therefore, security of supply) would be increased, it would earn significant transaction revenues, and it would weaken natural gas prices as a political instrument.[114] Most importantly, by becoming a gas hub, Turkey could solidify its influence in both the East and the West, a critical objective of its foreign policy under Turkey's Foreign Minister Ahmet Davutoglu.

4.5.3 EUROPE

Europe has long proclaimed its need to diversify its energy sources and especially reduce its dependence on Russian gas, which is used to meet one-third of European demand[115] (see Even if the Nabucco pipeline is built, Russia has strategically been extending its pipeline network to create what EnerCo's Baltacı has described as a potential uniform "price frontier" for Russian gas in Europe precisely along the route that Nabucco would follow (see **Figure 13**). The fact that Russia can maintain a uniform price for its gas along the same route as the Nabucco Pipeline means that from a pure geography and transit cost perspective, Russian gas will always beat Nabucco gas in price: the further up into Europe Nabucco gas travels—or, indeed, other Southern Corridor gas piped in from the Caspian or the Middle East—the higher the transit cost and the less competitive it becomes against Russian gas. The South Stream's route would complete this price frontier strategy.

Figure for Russian gas lines feeding into Europe). Europe's natural gas demand will increase 40% over the next two decades,[116] and its imports, totaling 11.7 Tcf in 2010 (74% from pipelines and 26% from LNG), are projected to rise to 80% of its total natural gas needs by 2030.[117] The major questions it faces are: what alternative source of natural gas can Europeans import, and what price are they willing to pay for it?

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[111] Tonge, 2012; Baltacı, 2012; Hawrami, 2012; other interviews.
[112] Baltacı, 2012.
[113] Baltacı, 2012.
[114] EnerCo Enerji, 2011.
[115] Ratner, Belkin, Nichol, & Woehrel, 2012.
[116] Engdahl, 2010.
[117] Ratner, Belkin, Nichol, & Woehrel, 2012.

4.5.4 The "Southern Corridor" Pipelines

The major initiative of the European Commission (EC) is to bring gas from the Caspian, Middle East, Central Asia, and North Africa to Europe via a "Southern Corridor" (also known as the "New Silk Road").[118]

Initially, there were high hopes for a Nabucco Pipeline to bring Caspian gas from Turkey's eastern border to Austria (see Figur). In 2009, the European Commission stated that gas transit through Turkey and the "swift implementation of Nabucco" are of "utmost importance" to Europe.[119] The Nabucco Pipeline[120] is the decade-in-planning project by Nabucco Gas Pipeline International GmbH, a consortium of six national gas companies from Turkey, Bulgaria, Romania, Hungary, Austria, and (the only country through which Nabucco would not pass) Germany.[121]

The aspirations of the Nabucco project were initially to carry roughly 1.1 Tcf (31 Bcm) of Caspian and potentially Middle Eastern gas to the heart of Europe in Austria. However, having so far failed to secure enough gas to make the project viable, a new proposal being considered for Nabucco roughly halves the capacity and starts from Turkey's western border.[122]

Figure 12: The proposed Nabucco Pipeline

Source: http://en.wikipedia.org/wiki/File:2010Nabuccopipelinemap.jpg (accessed 1/28/2012)

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[118] European Commisison, 2008.
[119] European Commission, 2009.
[120] The pipeline is named after the Verdi opera that the consortium's representatives saw during a visit to Vienna.
[121] Nabucco Gas Pipeline website, http://www.nabucco-pipeline.com/portal/page/portal/en/company_main/shareholders_link.
[122] Torello & Hromadko, 2012.

Several major factors explain why Nabucco has stalled and are relevant to the Southern Corridor in general. First, questions have been raised about whether the pipeline's capacity can be filled with Caspian gas: the Shah Deniz II field in the Caspian would only fill one-third (roughly 350 Bcf) of Nabucco's capacity and so far the prospects of piping gas from Iraq or Central Asia are slim.[123] Second, other pipeline projects are already underway that directly compete with Nabucco and are being supported by Turkey. The notable recent competitor to Nabucco is the Trans-Anatolian Pipeline, or TANAP, that Turkey's BOTAS is proposing to transport Azeri gas across Turkey. Other competitor pipelines include the South East Europe Pipeline, the Norway's Trans Adriatic Pipeline, the Interconnector Turkey-Greece-Italy (ITGI), and Russia's South Stream pipeline, which was explicitly designed to compete against Nabucco with twice its capacity (see Figure **Figure 14** and **Figure 17** for Southern Corridor competitors). Third, and relatedly, members of the consortium have demonstrated weak commitment to the project. Turkey's TANAP project is the obvious example; another is Germany's RWE's recent downplaying of Nabucco due to its heightened aversion to financial risk after its nuclear reactors were shut down (the Merkel government's response to Japan's Fukushima disaster).[124]

Even if the Nabucco pipeline is built, Russia has strategically been extending its pipeline network to create what EnerCo's Baltacı has described as a potential uniform "price frontier" for Russian gas in Europe precisely along the route that Nabucco would follow (see **Figure 13**).[125] The fact that Russia can maintain a uniform price for its gas along the same route as the Nabucco Pipeline means that from a pure geography and transit cost perspective, Russian gas will always beat Nabucco gas in price: the further up into Europe Nabucco gas travels—or, indeed, other Southern Corridor gas piped in from the Caspian or the Middle East—the higher the transit cost and the less competitive it becomes against Russian gas. The South Stream's route would complete this price frontier strategy.

[123] Torello & Hromadko, 2012.
[124] Torello & Hromadko, 2012.
[125] Baltacı 2012.

FIGURE13: MAJOR RUSSIAN GAS PIPELINES TO EUROPE

Source: http://en.wikipedia.org/wiki/File:Major_russian_gas_pipelines_to_europe.png (accessed 1/28/12)

FIGURE14: SOUTHERN CORRIDOR GAS TRANSIT OPTIONS

Source: Euractiv, 2010, http://www.euractiv.com/sites/all/euractiv/files/Southern_gas_corridor_0.gif

4.5.4.1 Liquefied Natural Gas

Exporting LNG is a costly alternative to building a pipeline, but because Nabucco has been stalled for so long, it is an alternative that is looking more attractive to the KRG. The KRG could negotiate LNG export deals via the Turkish port of Ceyhan, potentially supplying more distant areas of Europe.

4.5.5 A note on security

Any planning for pipelines or transmission lines that go into Turkey must consider the region's security situation. The recent bombing of innocent cigarette dealers along a mountain road on the Kurdistan-Turkey border by the Turkish military is evidence of the ongoing conflict in southeastern Turkey between the Turkish military and the Kurdistan Worker's Party (PKK). Any deal to export natural gas or electricity to Turkey would come with the risk that infrastructure would be susceptible to terrorist attacks.

4.6 Geopolitical Context

Although domestic politics is currently preventing Kurdistan from exporting its natural gas to Turkey and Europe, doing so comes with many geopolitical advantages for all of the actors that would be involved.

4.6.1 Iraq

Baghdad would likely be suspicious of closer ties between Turkey and Kurdistan. Statements like the following from KRG officials only exacerbate Baghdad's fears: "we have the right to be independent, but if that doesn't work out, then I'd rather be with Turkey than Iraq, because Iraq is undemocratic."[126] Instead of letting the KRG forge closer ties with Turkey and Europe, Baghdad's interest is likely to do so itself. The longer Iraq waits to make export arrangements for its natural gas, the more likely Russia and other countries might beat Iraq to Turkish and European contracts. From this point of view, it seems to be in both Erbil and Baghdad's interest to develop and export Kurdish natural gas as soon as possible; the fact that they are not indicates how important the sovereignty question is.

4.6.2 Turkey

Turkey is actively cultivating better relations with the KRG, as evidenced in the opening of a consulate in Erbil and high-level visits between the leaders (and even in the increased number of flights from Istanbul and Ankara to Erbil). However, Turkey is keenly aware that overly close

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[126] A KRG minister quoted in Crisis Group, 2009.

relations with the KRG will strain ties between Ankara and Baghdad. As a Turkish official explains, "An economic confederation with the Kurds of Iraq will be possible in the future, but it would have to be a *de facto*, not a *de jure* arrangement. We want Iraq to remain unified. Iraq is like a barometer of the ethnic and sectarian balance in the region. But economic incentives are possible. Via agreement with Baghdad, we can make our border with the Kurdish areas flexible and create an economic zone."[127] Turkey also likely views a stable and united Iraq as the best buffer against Iran, with whom it has a rocky relationship. For example, Turkey's opening of a consulate in Basra in southern Iraq is viewed as a countering move to Iran's influence.[128] This summer, Iraqis rioted at the gates of that consulate, protesting Turkey's interference with Iraq's internal affairs (citing among other things Turkey's protection of Iraq's Vice President in exile, Tareq al-Hashimi).[129] Therefore, although it would benefit from importing Kurdish gas, Turkey may be wary of further exacerbating its rocky relationship with Baghdad.

4.6.3 Europe

Europe's main foreign policy interest regarding Iraq is to diversify its energy sources and weaken Russia's bargaining position. Europe is investigating the Caspian and northern Africa for sources of natural gas as well, and recent shale gas discoveries (e.g., in the U.S. and Poland) create a potential LNG source from the U.S. and may allow Europe to start developing significant volumes of its own natural gas. Beyond securing its energy supply, Kurdish gas represents an opportunity to create a corridor of mutual interest from the Middle East to central Europe that could generate great dividends in other areas like diplomacy and trade (hence the Southern Corridor's other name: the "New Silk Road").

4.6.4 The United States

The U.S. supports the position promoted by the Iraqi Constitution that Iraq's hydrocarbon resources belong to all the people of Iraq and hydrocarbon revenues should be shared fairly throughout the country. The U.S. also recognizes that Iraq would benefit from advancing its development of hydrocarbon resources and that such development necessitates more active involvement of IOCs. However, having only just withdrawn troops from Iraq and seen the country's politics start to fracture, the U.S.'s immediate interest is political stability in the country. For that reason, the State Department explicitly discouraged (unsuccessfully) Exxon from signing a PSC with the KRG. Provided that political stability is not sacrificed, the U.S. would support natural gas development in Kurdistan because it recognizes the enormous potential of Kurdish natural gas to benefit Iraq, the region and even Europe.

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[127] Crisis Group, 2009.
[128] Crisis Group, 2009.
[129] Al Arabiya News, 2012.

5 A FINANCIAL MODEL

The objective of our financial model is to assess the investment returns for natural gas development in Kurdistan under a set of specific assumptions to see if they would justify the added political uncertainty and market risk present in Kurdistan. We look at two different scenarios to analyze the returns of a potential natural gas project: one producing natural gas for domestic electricity generation and another exporting natural gas to the Turkish border. Although many natural gas finds are "associated," or combined in the same well, with other natural resource finds, our analysis looks at natural gas-only wells. This is a more conservative approach: if any given well also had oil or higher value "condensates," or liquids, which are far easier to lift, transport and market, the value of these wells would be even higher and make their development more attractive.

5.1 SCENARIO 1: DOMESTIC ELECTRICITY GENERATION

5.1.1 ASSUMPTIONS

For this model scenario we make the following assumptions:

1. This well has only natural gas and no other high-value fossil fuels.
2. An inflation rate of 3%.
3. The output of the natural gas well will be used to power a 1,000 MW combined cycle generation facility.[130]
4. The combined cycle generation facility will use generators with a 7.0 heat rate (in MMBtu/MWh).[131] We used the GE MS6001B, one of the most versatile and widely used combined cycle turbine generators, as a benchmark for the thermal efficiency of our combined cycle heat rate.
5. All the necessary feedstock[132] for this domestic generation would be paid for upon delivery and at a base rate of $.056/kWh.[133] This base rate was then assumed to grow at the above assumed inflation rate.
6. Production Royalty for natural gas used for domestic electricity generation would be 0%[134].
7. Variable lifting costs[135] are assumed to be $1.80/MMBtu, the approximate average for Middle East natural gas,[136] and to grow at inflation.

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[130] In a single cycle generator, the heat from a fuel source is converted to mechanical then electrical energy only once; in a combined cycle generator, the "waste heat" of the first process is used in a second process, making the system more efficient.
[131] A measure of thermal efficiency for fossil fuel based power generation, representing how many MMBtu of fossil fuel energy is required to produce 1 MWh of electric power.
[132] In this case natural gas as the fuel input for the combined cycle power generator.
[133] Gas Fuels – Kurdistan's Power Politics
[134] Production Sharing Contract, Miran Block, Heritage, Article 24.

8. Variable pipeline transportation costs are assumed to be $1.75/MMBtu,[137] which includes compression and maintenance, and to grow at inflation.
9. Overhead is assumed to be 2% of revenues.
10. Income Taxes equal 40%.[138]
11. The distance from the wellhead to power generation facility will be 100 miles.[139]
12. Pipeline diameter is 16 inches, for a medium size pipe appropriate for short distance transportation from field to generation.[140]
13. Annual pipeline maintenance is assumed to be $5 million per year and to grow at inflation.
14. Capital expenditure depreciation is based on 25 years.[141]

5.1.2 CALCULATIONS

Annual revenue is calculated first by calculating annual production of the sample electricity generation plant in MWh per year and then multiplying it by the $.056/kWh assumption of the value of the natural gas feedstock in Kurdistan. This yields an annual dollar revenue figure. For example a plant with a 1,000 MW capacity could potentially produce 8,760,000 MWh annually. At $.056/kWh this equals $490.6 million.

The implied price of natural gas is calculated by first calculating how much natural gas would be needed at the assumed heat rate to generate the needed amount of electricity. For example, a combined-cycle plant with generation capacity of 1,000 MW and an efficiency of 7.0 MMBtu per MWh would need 7,000 MMBtu of natural gas per hour as a feedstock. Running at full-capacity for an entire year would need 61.3 million MMBtus of feedstock for generation. To imply a natural gas price we divide the $490 million revenue figure by the annual natural gas needed, implying a natural gas price of $8.00 per MMBtu.

"Netback Revenue" is revenue to the natural gas producer net of operating expenses and royalties. In addition to royalties, these operating expenses include lifting and transportation

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[135] Lifting costs is the term used for the cost of extraction of the fossil fuels in a well. These can include many things such as pumping, electricity, water, and labor.
[136] U.S. Energy Information Administration, http://www.eia.gov/tools/faqs/faq.cfm?id=367&t=8, accessed Feb. 2012, converted from $/boe.
[137] 22nd World Gas Conference, *The Challenges of Further Cost Reductions for New Supply Options*, June 1-5, 2003, converted from $/m^3.
[138] Production Sharing Contract, Miran Block, Heritage, Article 31.
[139] Approximate distance using Google maps from Miran site to Erbil.
[140] http://www.naturalgas.org/nat, accessed Feb. 2012.
[141] Used Dana Gas 2010 Annual report as a benchmark for Middle East natural gas projects.

costs. With the above assumptions, netback revenue is to be approximately $3.50 per MMBtu, which is line with the author's interviews held with KRG officials.[142]

After calculating netback revenues we subtract non-operating expenses such as pipeline maintenance and overhead expenses to calculate Earnings Before Interest Depreciation & Amortization ("EBITDA"). After EBITDA we subtract depreciation, using a 25-year straight-line depreciation method,[143] and income taxes to arrive at Earnings Before Interest After Tax (EBIAT).

Finally we subtract annual capital expenditures (CAPEX) and add back depreciation to calculate Free Cash Flow, which we can then use to find an Internal Rate of Return (IRR) for the project. (See Appendix 8.3 for a sample calculation using our financial model.)

5.2 Scenario 2: Export to Turkish Border

5.2.1 Assumptions

For this model we make the following assumptions:

1. This well has only natural gas and no other high value fossil fuels.
2. An inflation rate of 3%.
3. Export volume is consistent over time.
4. The Turkish border is 500 miles from the well development site, which in turn will increase the number of pipeline miles that need to be built in order to export.
5. Production Royalty for natural gas used for export would be 10%.[144]
6. Variable lifting costs assumed to be $1.80/MMBtu, the approximate average for Middle East natural gas[145] and to grow at inflation.
15. Variable pipeline transportation costs assumed to be $1.75/MMBtu,[146] which includes compression and maintenance, and to grow at inflation.
7. Overhead is assumed to be 2% of revenues.
8. Income Taxes are exempted due to the profit sharing agreement.[147]
9. Pipeline diameter is 32 inches, as a larger pipe for export would need to be built to accommodate larger export volumes.[148]

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[142] Hawrami, 2012.
[143] Straight-line depreciation assumes that an asset's value declines linearly toward its salvage value over the course of its useful life.
[144] Production Sharing Contract, Miran Block, Heritage, Article 24.
[145] U.S. Energy Information Administration, http://www.eia.gov/tools/faqs/faq.cfm?id=367&t=8, accessed Feb. 2012, converted from $/boe.
[146] 22nd World Gas Conference, *The Challenges of Further Cost Reductions for New Supply Options*, June 1-5, 2003, converted from $/m^3.
[147] Production Sharing Contract, Miran Block, Heritage, Article 31.
[148] http://www.naturalgas.org/nat, accessed Feb. 2012.

10. Pipeline per inch-mile cost[149] is assumed to be $100,000 which is a more conservative estimate for the larger pipe for export.
11. Annual pipeline maintenance is assumed to be $25 million per year and to grow at inflation.
12. Capital expenditure depreciation is based on 25 years.[150]

5.2.2 CALCULATIONS

Annual revenue is calculated first by taking the assumed natural gas price at the border multiplied by the assumed annual production. This yields an annual dollar revenue figure. For example, a price of $8 per MMBtu with 640 million MMBtus of annual production generates $5,120 million of field revenues.

Next, royalty due to the government is subtracted from field revenues. As defined, the royalty due is 10% of total MMBtus produced not 10% of total field revenues received. For example if 600 million MMBtus are produced than 60 of those are due to the government.

Next, production expenses are calculated which includes lifting and transportation costs. Lifting costs are incurred on the full amount of natural gas extracted from the well. However, because the contractor is not responsible for the transportation costs on the royalty gas, transportation costs are only incurred on the available natural gas after the royalty due. These costs are then totaled as total operating expenses. Per the PSC, cost recovery for these expenses is capped at 50% of total field revenues. This has two important implications. First, the contractor is taking the price risk of natural gas. Because the contractor's lifting and transportation costs are relatively stable over time, if natural gas prices for export gas drops, then the contractor would potentially not be able to recover its full variable costs. Second, the 50% price cap aligns the incentives of the contractor and the government to keep lifting and transportation costs as low is possible enabling a larger percentage to be considered "profit petroleum."

"Profit petroleum" is then calculated by taking available revenues after royalty and subtracting the allowable cost recovery of the contractor. This yields the profit petroleum that is shared between the contractor and the government. The percent share received by the contractor is on a decreasing sliding scale from 35% to 18%. The contractor receives the 35% share until it has recovered its upfront development and exploration costs. There after it receives a decreasing percentage until it has recovered 2.75 times its costs. After this point, it receives only an 18% share going forward.

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[149] Cost of a pipeline is commonly expressed in per inch-mile, which means how many dollars does the pipe cost per inch of diameter for every mile of pipe.
[150] Used Dana Gas 2010 Annual report as a benchmark for Middle East natural gas projects.

Finally, a few minor charges such as charges for an environmental fund ($300K per year), technical and logistical assistance (a $1M one-time charge), and pipeline maintenance is then subtracted before calculating EBITDA. There is not income tax in this scenario as the profit sharing itself can be thought of as a tax by the government which has already been taken into account.

Finally we subtract annual capital expenditures (CAPEX) and add back depreciation to calculate Free Cash Flow, which is used to determine the Internal Rate of Return (IRR) for the project.

6 ANALYSIS

We were able to use our assumptions above to test several scenarios for natural gas development in Kurdistan. Although typical on-shore well development costs can be as low as $2/MMBtu, we did not feel it realistic to model a large Kurdish natural gas find on this variable cost basis because of the large market risk inherent in being able to sell these large volumes of natural gas at the assumed prices. Instead we modeled the two scenarios described in detail below, Scenario 1: Domestic Electricity Generation, and Scenario 2: Export to Turkish border.

6.1 Scenario 1: Domestic Electricity Generation

For our domestic electricity generation scenario, we held revenue fixed and looked at rates of return while conducting a sensitivity analysis on pipeline per inch-mile cost and on total well development CAPEX. We chose a range of $20,000 to $120,000 for the per-inch mile cost of the pipeline based on U.S. pipeline benchmarks.[151] For example, a pipeline of 100 miles with a 16-inch diameter would cost $160 million at a pipeline cost of $100,000 per inch-mile.

This analysis shows that several hundred million dollars could be spent on well and pipeline development CAPEX and the project would still be highly profitable (well over 20% in most cases) even with the significant market risk Kurdish gas faces. Moreover, these costs are well above the traditional development cost of U.S. benchmarks giving a significant investor margin of safety to compensate for political risk, market volume risk and price uncertainty.

[151] Natural Gas Pipeline and Storage Infrastructure Projections Through 2030, pg. 47 estimated $30-100K

Pipeline CAPEX (in $ per inch-mile, for 16" diameter)	Well Development CAPEX (in $ millions)									
	200	250	300	350	400	450	500	550	600	650
$20,000	57.4%	48.0%	41.4%	36.6%	32.8%	29.8%	27.4%	25.3%	23.6%	22.1%
$30,000	54.0%	45.7%	39.7%	35.3%	31.8%	29.0%	26.7%	24.7%	23.1%	21.7%
$40,000	51.0%	43.6%	38.2%	34.1%	30.8%	28.2%	26.0%	24.2%	22.6%	21.3%
$50,000	48.3%	41.7%	36.7%	32.9%	29.9%	27.5%	25.4%	23.7%	22.2%	20.9%
$60,000	45.9%	39.9%	35.4%	31.9%	29.1%	26.8%	24.8%	23.2%	21.7%	20.5%
$70,000	43.8%	38.3%	34.2%	30.9%	28.3%	26.1%	24.3%	22.7%	21.3%	20.1%
$80,000	41.9%	36.9%	33.1%	30.0%	27.6%	25.5%	23.7%	22.2%	20.9%	19.7%
$90,000	40.1%	35.6%	32.0%	29.2%	26.8%	24.9%	23.2%	21.8%	20.5%	19.4%
$100,000	38.5%	34.3%	31.1%	28.4%	26.2%	24.3%	22.7%	21.4%	20.1%	19.1%
$110,000	37.1%	33.2%	30.1%	27.6%	25.6%	23.8%	22.3%	21.0%	19.8%	18.8%
$120,000	35.7%	32.2%	29.3%	26.9%	25.0%	23.3%	21.8%	20.6%	19.4%	18.5%

Pipeline CAPEX (in $ millions)	Well Development CAPEX (in $ millions)									
	200	250	300	350	400	450	500	550	600	650
$32	57.4%	48.0%	41.4%	36.6%	32.8%	29.8%	27.4%	25.3%	23.6%	22.1%
$48	54.0%	45.7%	39.7%	35.3%	31.8%	29.0%	26.7%	24.7%	23.1%	21.7%
$64	51.0%	43.6%	38.2%	34.1%	30.8%	28.2%	26.0%	24.2%	22.6%	21.3%
$80	48.3%	41.7%	36.7%	32.9%	29.9%	27.5%	25.4%	23.7%	22.2%	20.9%
$96	45.9%	39.9%	35.4%	31.9%	29.1%	26.8%	24.8%	23.2%	21.7%	20.5%
$112	43.8%	38.3%	34.2%	30.9%	28.3%	26.1%	24.3%	22.7%	21.3%	20.1%
$128	41.9%	36.9%	33.1%	30.0%	27.6%	25.5%	23.7%	22.2%	20.9%	19.7%
$144	40.1%	35.6%	32.0%	29.2%	26.8%	24.9%	23.2%	21.8%	20.5%	19.4%
$160	38.5%	34.3%	31.1%	28.4%	26.2%	24.3%	22.7%	21.4%	20.1%	19.1%
$176	37.1%	33.2%	30.1%	27.6%	25.6%	23.8%	22.3%	21.0%	19.8%	18.8%
$192	35.7%	32.2%	29.3%	26.9%	25.0%	23.3%	21.8%	20.6%	19.4%	18.5%

6.2 Scenario 2: Export to Turkish Border

For the scenario exporting gas to the Turkish border, we made a few simplifying assumptions that were different than our domestic electricity generation scenario. First, we assumed that development capex was $2 per MMBtu. Second, we used a conservative high-end estimate for the per inch-mile cost of the pipeline CAPEX of $100,000. We then conducted a sensitivity analysis, varying price per MMBtu of natural gas at the Turkish border and export volume in order to see the potential rates of return (IRRs) that could be generated for a given price at the border.

Natural Gas Price (in $/MMBtu)	Annual Volume (in million MMBtus)									
	200	250	300	350	400	450	500	550	600	650
$6.00	2.4%	3.9%	5.0%	6.0%	6.9%	7.6%	8.2%	8.8%	9.3%	9.8%
$6.50	5.8%	7.7%	9.3%	10.7%	11.9%	12.9%	13.9%	14.7%	15.5%	16.2%
$7.00	9.2%	11.5%	13.5%	15.3%	16.9%	18.3%	19.5%	20.7%	21.8%	22.8%
$7.50	11.1%	13.7%	15.9%	17.8%	19.5%	21.1%	22.5%	23.8%	25.1%	26.2%
$8.00	12.9%	15.7%	18.1%	20.2%	22.1%	23.9%	25.5%	27.0%	28.3%	29.6%
$8.50	14.6%	17.6%	20.3%	22.6%	24.7%	26.6%	28.4%	**30.0%**	**31.5%**	**32.9%**
$9.00	16.3%	19.5%	22.4%	24.9%	27.2%	29.3%	**31.3%**	**33.1%**	**34.7%**	**36.3%**
$9.50	17.9%	21.4%	24.5%	27.2%	29.8%	**32.1%**	**34.2%**	**36.1%**	**37.9%**	**39.6%**
$10.00	19.5%	23.3%	26.6%	29.5%	**32.3%**	**34.7%**	**37.0%**	**39.2%**	**41.1%**	**43.0%**
$10.50	21.1%	25.1%	28.6%	**31.8%**	**34.7%**	**37.4%**	**39.9%**	**42.2%**	**44.3%**	**46.3%**
$11.00	22.7%	26.9%	**30.7%**	**34.1%**	**37.2%**	**40.1%**	**42.8%**	**45.2%**	**47.5%**	**49.6%**

What this analysis clearly shows is that export returns are very sensitive to both total volume and natural gas price. As can been seen above, if we assume a target project return IRR of 30% needed by the developers to pursue one of these projects (to compensate for the risks they perceive), then no gas price under $8/MMBtu is feasible. In light of the profit sharing contract, this has important implications because it shows that even though the developer will receive 35% of the profit gas until they meet their cost recovery, they are still significantly exposed to low returns if there are low natural gas prices. On the other hand, the developer's upside in a high natural gas price environment is also relatively capped because their share of "profit petroleum" will quickly decrease to 18%, which is already after the royalty, if there are excess profits.

In addition, export volumes significantly enhance returns. This puts several pressures on the developers. First, this implies a pressure to sign long-term contracts at prices and volumes that will be able to make development worthwhile. Second, if long-term contracts are not secured, the projects would be subject to the high risk of natural gas price volatility. Finally, signing long-term contracts will create significant pressure to meet delivery, or otherwise breech the contract; however, due to the political and security instability in Kurdistan this might be a risk that developers are unwilling to take. This might also cause potential importers to be wary of signing long-term contracts to begin with, because of the perceived delivery uncertainty, further exacerbating the pressures.

7 DISCUSSION

As discussed throughout the report, the return on investment opportunity is very large for Kurdish natural gas; however, the risks associated with natural gas development and export remain high. While oil and gas majors Exxon and Total and the oil and gas companies already in Kurdistan appear to have made favorable assessments of the risk-reward profiles, significant risks still appear to be obstacles to investment in Kurdistan as demonstrated that many firms are still hesitant to enter the region.

Providing specific recommendations on how to mitigate these risks is beyond the scope of this report, but it is well worth summarizing the major risks and their implications for stakeholders in Iraq and Kurdistan's development:

- *Export Risk*. The risk that the KRG will not find a way to export its natural gas is one of the main detractors of Kurdish natural gas development. Without an export pathway, developers have, at best, an internal market to sell to. At worst, they cannot find a reliable buyer for the volumes they can produce.

- *Price Risk.* As our qualitative discussion and quantitative sensitivity analysis show, the price of natural gas is the key determinant in project returns. Since it is unclear what price can be reliably achieved for Kurdish natural gas and what, if any, premium would be paid by Turkey or Europe to diversify their natural gas imports away from Russia, price risk is significant for any natural gas development project in Kurdistan.

- *Political Risk.* As we discussed above, the legal risk of signing contracts with the KRG does not appear to be the main issue concerning oil and gas companies; rather, the risk that the political process might subject the contracts to renegotiation in the future is the real risk. Furthermore, if returns for these projects become excessive, officials from either Erbil or Baghdad could demand higher royalty payments than they do today or in the worst case expropriate the projects entirely. Political risk also affects gas prices within Iraq, given the subsidies that support low domestic oil and gas prices.

- *Timing Risk.* For export contracts, there is a risk that Kurdish gas will not be ready in time to sign contracts with Turkey and Europe. This may, in turn, make it more difficult to sign long-term export contracts to begin with.

- *Volume Risk.* Upfront costs for development can be very large, necessitating selling large volumes consistently over a long time. Domestic Kurdish and Iraqi markets are unlikely to be able to support significant volumes, at least in the near term. There is therefore significant risk that the necessary volumes to make these projects feasible will not be

available to the project, in particular because there is no current export option for Kurdistan.

- *Security Risk.* The security risk in Kurdistan is far better than in southern Iraq; however, the ongoing conflict between the PKK and Turkish authorities may pose a future threat to export infrastructure for natural gas to Turkey. In addition, the poor security situation in the south poses and obstacle to transporting natural gas to other areas within Iraq, limiting commercialization options.

The vast quantities of natural gas in Kurdistan can make a substantial impact on local and national economic development; however, to take advantage of these resources, foreign and private sector investment is critical. To the extent that Erbil and Baghdad can reduce the risks above, natural gas development in Kurdistan is an extremely attractive investment.

8 APPENDICES

8.1 ABBREVIATIONS

BTC	Baku-Tibilisi Pipeline
EIA	US Energy and Information Administration
IGC	Italy-Greece Connector
IOC	International Oil and Gas Company
ITO	Independent Transmission Operator
KRG	Kurdistan Regional Government
LNG	Liquefied Natural Gas
MNC	Mutli-National Corporation
MOC	Multi-national Oil Company
NOC	National Oil Company
PSC	Production-Sharing Contract
ROI	Return on investment
SOC	South Oil Company of the Republic of Iraq
SOMO	Oil Marketing Company of the Republic of Iraq
TSC	Technical Service Contract

8.2 UNITS

Note: in energy units, the "M" is the Roman numeral for 1,000, and "MM" denotes one million (1,000 x 1,000).

Energy

kcal	kilo calories: one thousand calories
	Btu British thermal units (the energy required to raise the temperature of 1 pound of water by 1°F)
MBtu	thousand British thermal units

MMBtu	million British thermal units

Gas

cf (ft^3)	cubic feet
Mcf	thousand cubic feet
MMcf	million cubic feet
MMcfpd	million cubic feet per day
Bcf	billion cubic feet
Tcf	trillion cubic feet
cm (m^3)	cubic meters (35.3 cf)
Tcm	trillion cubic meters
Bcm	billion cubic meters
Cm^3	Contract cubic meters: Gas at 20□C, Gross calorific value of 9,000 kcal/m^3
Sm^3	Standard cubic meters: Gas at 15□C, Gross calorific value of 9,155 kcal/m^3

Oil

bbl	barrel of oil
boe	barrel of oil equivalent (used to describe the energy contained in volumes of other fuels like natural gas: e.g., 1 boe of natural gas is roughly 5,800 cf)
bpd	barrels per day
MMbpd	million barrels per day

Electricity

W	Watt = 1 Joule/second, a measure of power, or energy over time
Wh	Watt-hour = 1 Watt x 1 hour, a measure of energy used
kW	kilowatt = 1 thousand W
MW	Megawatt = 1 million W
GW	Gigawatt = 1 billion W

Conversions

Note: conversion from volume to energy depends on the qualities of the fuel, which vary from field to field and even between reservoirs of the same field. The thumb rules below are commonly used estimates. A convenient natural gas calculator is available at http://www.natgas.info/html/natgasunitscalculator.html.

Natural gas energy density: 1,000 Btu/cf, or 1 MMBtu/Mcf

Oil energy density: 5.4 to 5.8 MMBtu/bbl

Oil equivalent volume of natural gas: 1 boe/5,800 cf

Heat rates – amount of thermal energy required to produce electrical energy

Combined-cycle plant heat rate: 7.0 MMBtu per MWh

8.3 Sample Financial Model

Production and Cash Flow Projections ($ millions except as noted)															
	Year														
x	**Assumptions**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
	inflation rate	**3%**													
	Power Capacity in MW	**-**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**
	Annual Electricty Production (in MWh)		**8,760,000**	**8,760,000**	**8,760,000**	**8,760,000**	**8,760,000**	**8,760,000**	**8,760,000**	**8,760,000**	**8,760,000**	**8,760,000**	**8,760,000**	**8,760,000**	**8,760,000**
	Electricity Price $/kWh (to Generator)		**$0.032**	**0.033**	**0.034**	**0.035**	**0.036**	**0.037**	**0.038**	**0.039**	**0.041**	**0.042**	**0.043**	**0.044**	**0.046**
	Electricity Price $/kWh (for Feedstock)		**$0.056**	**0.058**	**0.059**	**0.061**	**0.063**	**0.065**	**0.067**	**0.069**	**0.071**	**0.073**	**0.075**	**0.078**	**0.080**
	Estimated Heat Rate (MMBTU/MWh)	**7.00**													
	MMBTU per hour	-	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000
	Hours per day (assuming baseload)	24													
	Annual Gas Production (in million MMBTUs)		61.3	61.3	61.3	61.3	61.3	61.3	61.3	61.3	61.3	61.3	61.3	61.3	61.3
	Annual Gas Production (in MMcf)	-	59.7	59.7	59.7	59.7	59.7	59.7	59.7	59.7	59.7	59.7	59.7	59.7	59.7
	Production per day (in MMcf)		0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	Production Tax Rate (or Royalty)	**0.0%**													
	Variable Lifting Costs (per mmBTU)	**$1.80**	$1.85	$1.91	$1.97	$2.03	$2.09	$2.15	$2.21	$2.28	$2.35	$2.42	$2.49	$2.57	$2.64
	Transportation Costs (per mmBTU)	**$2.50**	$2.58	$2.65	$2.73	$2.81	$2.90	$2.99	$3.07	$3.17	$3.26	$3.36	$3.46	$3.56	$3.67
	Overhead % of Revenues	**2.0%**													
	Income Taxes	**0.0%**													
	Discount rate	**10.0%**													
	Pipeline CAPEX (in $ per inch-mile, for 16" diameter)	**$100,000**													
	Pipeline diameter (in inches)	**32**													
	Pipeline miles	**500**													
	Pipeline CAPEX (in $ millions)	1,600													
	Well Development (in $ per mmBTU)	**$2.00**													
	Well Development CAPEX (in $ millions)	**122.64**													
	% of Revenue for Nat Gas Cost Recovery	**50%**													
	Depreciation Years	**25**													

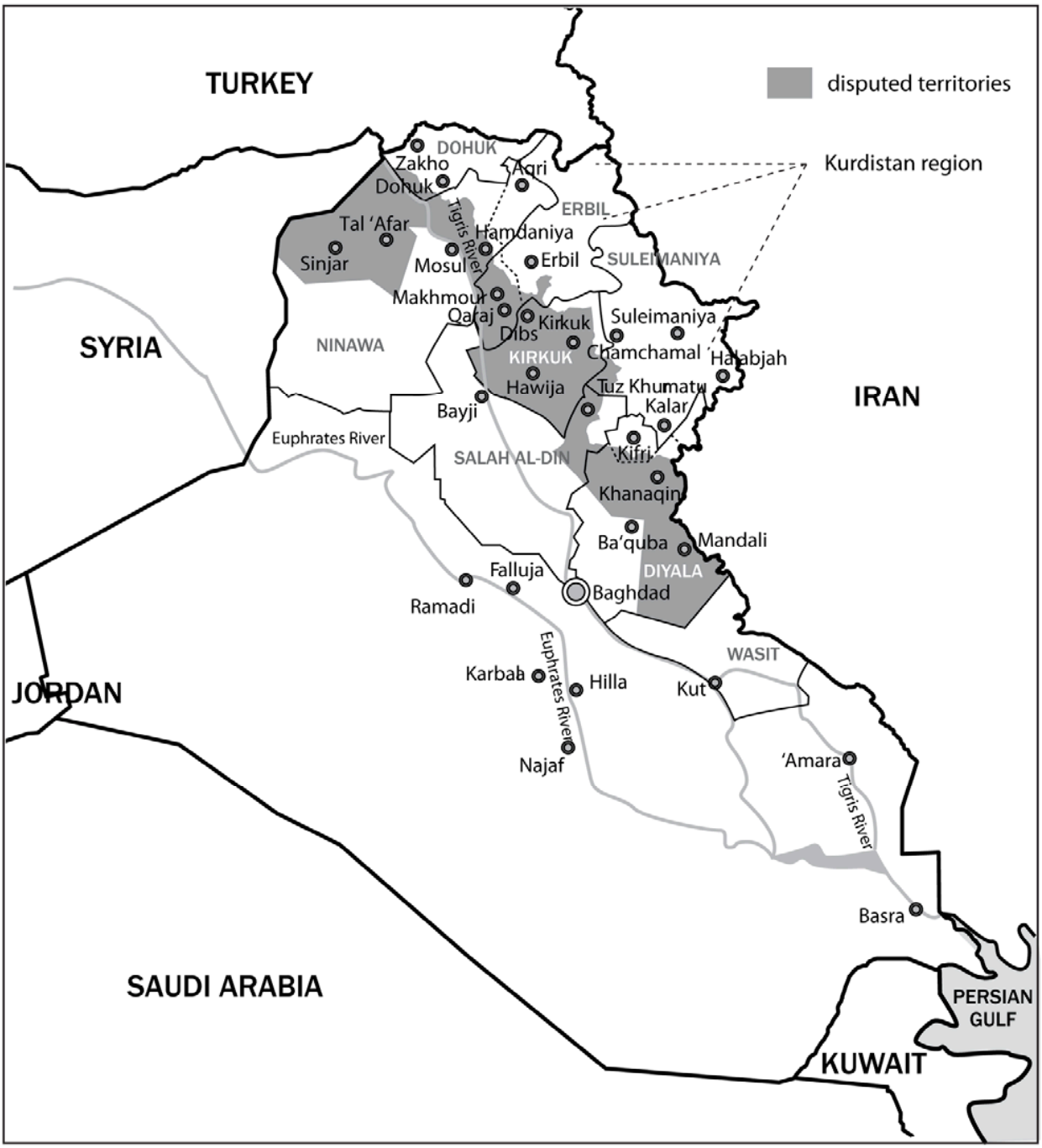
x	**Cash Flow Projections (in $ millions)**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
	Annual Electricity Revenue to Generator	**$0.0**	**$0.0**	**$0.0**	**$0.0**	**$0.0**	**$0.0**	**$0.0**	**$0.0**	**$0.0**	**$0.0**	**$0.0**	**$0.0**	**$0.0**	**$0.0**
	Annual cost of feedstock	**$0.0**	**$0.1**	**$0.1**	**$0.1**	**$0.1**	**$0.1**	**$0.1**	**$0.1**	**$0.1**	**$0.1**	**$0.1**	**$0.1**	**$0.1**	**$0.1**
	Implied Price of Gas ($/MMBTU)		***$8.00***	***$8.24***	***$8.49***	***$8.74***	***$9.00***	***$9.27***	***$9.55***	***$9.84***	***$10.13***	***$10.44***	***$10.75***	***$11.07***	***$11.41***
	Annual Production:														
	Gas (million MMBTU)		700.0	700.0	700.0	700.0	700.0	700.0	700.0	700.0	700.0	700.0	700.0	700.0	700.0
	Cash Flows														
	Field Revenues	-	5,600.0	5,768.0	5,941.0	6,119.3	6,302.8	6,491.9	6,686.7	6,887.3	7,093.9	7,306.7	7,525.9	7,751.7	7,984.3
	Royalty	-	(560.0)	(576.8)	(594.1)	(611.9)	(630.3)	(649.2)	(668.7)	(688.7)	(709.4)	(730.7)	(752.6)	(775.2)	(798.4)
	Available Natural Gas Revenues	**-**	**5,040.0**	**5,191.2**	**5,346.9**	**5,507.3**	**5,672.6**	**5,842.7**	**6,018.0**	**6,198.6**	**6,384.5**	**6,576.1**	**6,773.3**	**6,976.5**	**7,185.8**
	Available Natural Gas (in million MMBtus)		630.0	630.0	630.0	630.0	630.0	630.0	630.0	630.0	630.0	630.0	630.0	630.0	630.0
	Expenses														
	Unrecovered Costs Carry Forward														
	Lifting	-	(1,297.8)	(1,336.7)	(1,376.8)	(1,418.1)	(1,460.7)	(1,504.5)	(1,549.6)	(1,596.1)	(1,644.0)	(1,693.3)	(1,744.1)	(1,796.5)	(1,850.4)
	Transportation	-	(1,135.6)	(1,169.6)	(1,204.7)	(1,240.9)	(1,278.1)	(1,316.4)	(1,355.9)	(1,396.6)	(1,438.5)	(1,481.7)	(1,526.1)	(1,571.9)	(1,619.1)
	Total Operating Expenses	**-**	**(2,433.4)**	**(2,506.4)**	**(2,581.6)**	**(2,659.0)**	**(2,738.8)**	**(2,820.9)**	**(2,905.6)**	**(2,992.7)**	**(3,082.5)**	**(3,175.0)**	**(3,270.3)**	**(3,368.4)**	**(3,469.4)**
	OpEx in Million MMBtus		304.2	304.2	304.2	304.2	304.2	304.2	304.2	304.2	304.2	304.2	304.2	304.2	304.2
	Cost % of Available Nat Gas		43.5%	43.5%	43.5%	43.5%	43.5%	43.5%	43.5%	43.5%	43.5%	43.5%	43.5%	43.5%	43.5%
	Netback Revenue	**-**	**2,606.6**	**2,684.8**	**2,765.4**	**2,848.3**	**2,933.8**	**3,021.8**	**3,112.4**	**3,205.8**	**3,302.0**	**3,401.1**	**3,503.1**	**3,608.2**	**3,716.4**
	in $/MMBTU		*3.72*	*3.84*	*3.95*	*4.07*	*4.19*	*4.32*	*4.45*	*4.58*	*4.72*	*4.86*	*5.00*	*5.15*	*5.31*
	Developer Cost Recovery	-	2,433.4	2,506.4	2,581.6	2,659.0	2,738.8	2,820.9	2,905.6	2,992.7	3,082.5	3,175.0	3,270.3	3,368.4	3,469.4
	Unrecovered Costs		-	-	-	-	-	-	-	-	-	-	-	-	-
	Profit Petroleuem		2,606.6	2,684.8	2,765.4	2,848.3	2,933.8	3,021.8	3,112.4	3,205.8	3,302.0	3,401.1	3,503.1	3,608.2	3,716.4
	Profit Petroleuem (in million MMBtus)		325.8	325.8	325.8	325.8	325.8	325.8	325.8	325.8	325.8	325.8	325.8	325.8	325.8
	Profit Share to Contractor	*35.00%*	*35.00%*	*35.00%*	*35.00%*	*35.00%*	*35.00%*	*35.00%*	*35.00%*	*35.00%*	*35.00%*	*35.00%*	*35.00%*	*35.00%*	*35.00%*
	Contractor Profit	0.0	912.3	939.7	967.9	996.9	1,026.8	1,057.6	1,089.4	1,122.0	1,155.7	1,190.4	1,226.1	1,262.9	1,300.7
	Government Profit	0.0	1,694.3	1,745.1	1,797.5	1,851.4	1,907.0	1,964.2	2,023.1	2,083.8	2,146.3	2,210.7	2,277.0	2,345.3	2,415.7
	Environment Fund	**(0.3)**	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)
	Technical and Logisitcal Assistance	**(1.0)**	-	-	-	-	-	-	-	-	-	-	-	-	-
	Pipeline Maintence Expense		**(25.0)**	(25.8)	(26.5)	(27.3)	(28.1)	(29.0)	(29.9)	(30.7)	(31.7)	(32.6)	(33.6)	(34.6)	(35.6)
	Overhead		(52.1)	(53.7)	(55.3)	(57.0)	(58.7)	(60.4)	(62.2)	(64.1)	(66.0)	(68.0)	(70.1)	(72.2)	(74.3)
	EBITDA	**(1.3)**	**834.9**	**859.9**	**885.7**	**912.3**	**939.7**	**967.9**	**997.0**	**1,026.9**	**1,057.7**	**1,089.4**	**1,122.1**	**1,155.8**	**1,190.5**
	Depreciation	-	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0
	EBIT	**(1.3)**	**714.9**	**739.9**	**765.7**	**792.3**	**819.7**	**847.9**	**877.0**	**906.9**	**937.7**	**969.4**	**1,002.1**	**1,035.8**	**1,070.5**
	Income taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	EBIAT	**(1.3)**	**714.9**	**739.9**	**765.7**	**792.3**	**819.7**	**847.9**	**877.0**	**906.9**	**937.7**	**969.4**	**1,002.1**	**1,035.8**	**1,070.5**
	Cumulative Revenue	-	912.3	1,852.0	2,819.9	3,816.8	4,843.6	5,901.3	6,990.6	8,112.6	9,268.3	10,458.7	11,684.8	12,947.7	14,248.4
	Cumulative Costs	3,000.0	5,458.7	7,990.8	10,598.9	13,285.2	16,052.2	18,902.1	21,837.5	24,861.0	27,975.2	31,182.8	34,486.7	37,889.6	41,394.7
	R-Factor	0.100	0.17	0.23	0.27	0.29	0.30	0.31	0.32	0.33	0.33	0.34	0.34	0.34	0.34
	Capital expenditures	3,000.0	0.3	-	-	-	-	-	-	-	-	-	-	-	-
	Depreciation	-	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0
	Cash flow	(3,001.3)	834.6	859.9	885.7	912.3	939.7	967.9	997.0	1,026.9	1,057.7	1,089.4	1,122.1	1,155.8	1,190.5
	Discount Factor	1.00	0.91	0.83	0.75	0.68	0.62	0.56	0.51	0.47	0.42	0.39	0.35	0.32	0.29
	Present Value	(3,001.3)	758.7	710.7	665.5	623.1	583.5	546.4	511.6	479.0	448.6	420.0	393.3	368.3	344.8
	NPV	**$6,621**													
	IRR	***30.7%***													
x	Depreciation Schedule														
	Beg of Year PPE	0.0	3,000.0	2,880.0	2,760.0	2,640.0	2,520.0	2,400.0	2,280.0	2,160.0	2,040.0	1,920.0	1,800.0	1,680.0	1,560.0
	Capital Expenditures	3,000.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-
	Depreciation	0.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0
	End of Year PPE	3,000.0	2,880.0	2,760.0	2,640.0	2,520.0	2,400.0	2,280.0	2,160.0	2,040.0	1,920.0	1,800.0	1,680.0	1,560.0	1,440.0

8.4 Other Figures

Figure15: Iraqi Governorates

Source: http://en.wikipedia.org/wiki/File:Iraqi_Governorates.svg

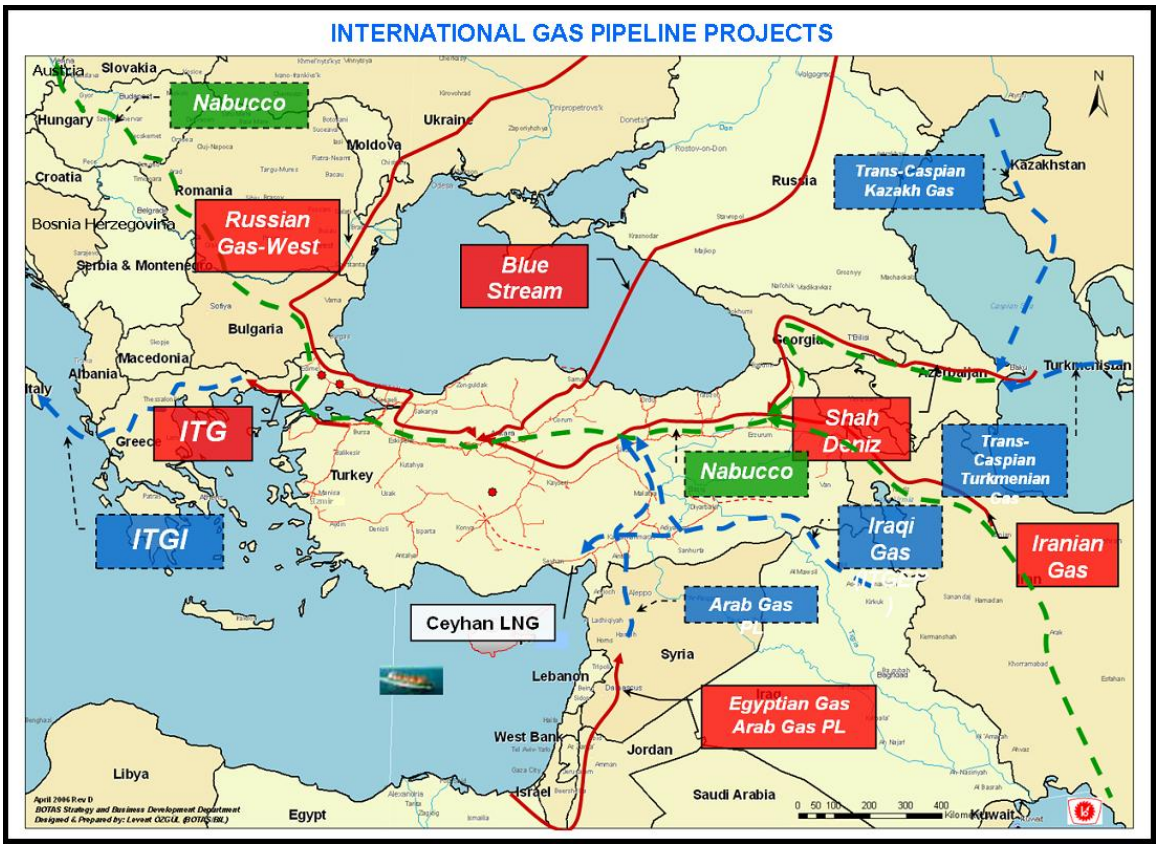
FIGURE 16: DISPUTED TERRITORIES CLAIMED BY THE KRG



This map has been produced by the International Crisis Group. It is a modified version of a similar map appearing in Crisis Group Middle East Report N°80, *Oil for Soil: Toward a Grand Bargain on Iraq and the Kurds* (28 October 2008). Only the northern boundary of the disputed territories has been adjusted to add more detail.

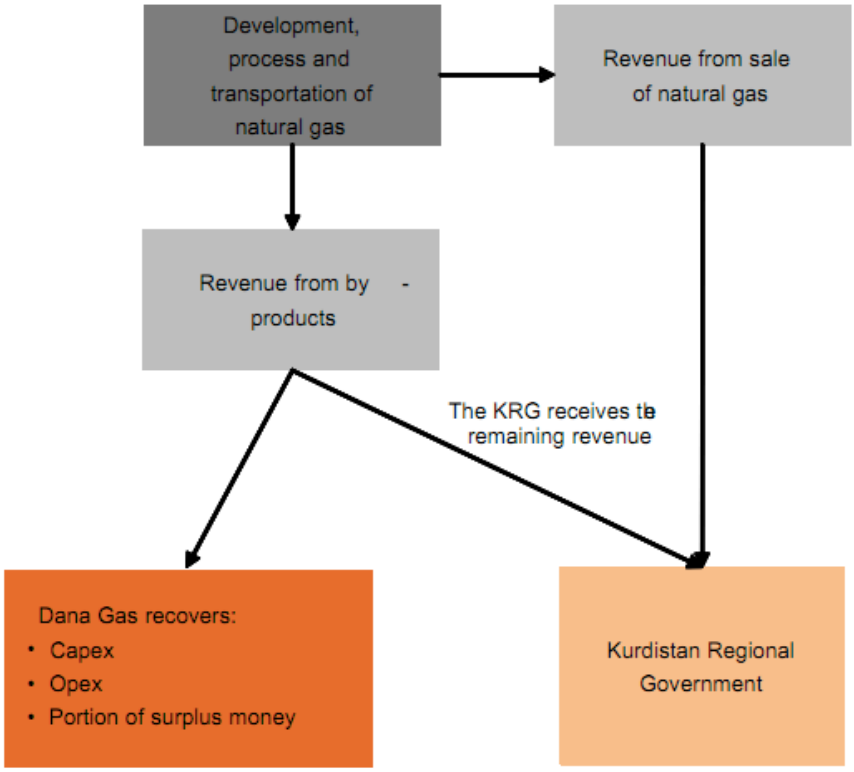
Source: "Iraq and the Kurds: Trouble Along the Trigger Line," International Crisis Group, 7/8/09, http://www.crisisgroup.org/en/regions/middle-east-north-africa/iraq-iran-gulf/iraq/088-iraq-and-the-kurds-trouble-along-the-trigger-line.aspx

FIGURE17: INTERNATIONAL GAS PIPELINE PROJECTS THROUGH TURKEY



Source: BOTAS, http://www.botas.gov.tr/images/icerik/harita/BotasProjeE.jpg (accessed 1/28/12)

FIGURE 18: KRG-DANA GAS PROFIT-SHARING



Source: Dana Gas, available online at http://www.rasmala.com/equity_report/Dana_Gas_20Jan11.pdf

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