

Article

# Oil in Syria between Terrorism and Dictatorship

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**Abstract:** The sale of oil and gas is one of the most important components of the Syrian economy. Unfortunately, since the discovery of these resources, the Syrian people have not benefited from the revenues earned. This study deals with the development of oil and gas production and the geographical distribution of fields, as well as production control, deterioration of production, refining and selling mechanisms, and the resulting health and environmental impacts following Islamic State's (IS) control of the majority of oilfields in Syria. Since summer 2015, IS controls 80% of the fields with a production of 65,000 barrels per day (b/d); the Assad regime controls 8% of fields with 10,000 b/d; and Kurdish forces dominate the remaining 12% with 25,000 b/d. IS depends on oil as a major source of financing for its military and civilian activities, and has also managed to set up an extensive network of middlemen in neighbouring territories and countries, with the aim of trading crude oil for cash and other resources. IS produces and exports within its areas of control and sells part of the oil to the Assad regime, and another portion to the liberated areas, as well as to Iraq and Turkey.

**Keywords:** Syria; oil-selling; Islamic State; Kurdish forces; Assad regime

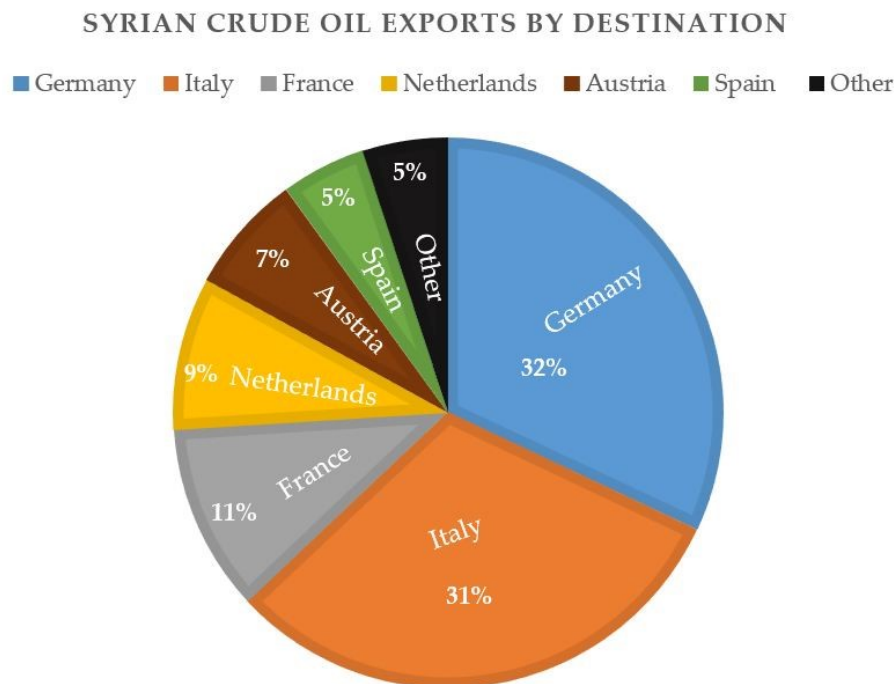
## 1. Introduction

Although not a large oil producer or exporter on the world market, Syria produced pre-war approximately 400,000 barrels per day (b/d) of crude oil from its oilfields in the eastern part of the country, near the Iraqi border, while exporting approximately 150,000 b/d of crude oil, virtually all over Europe [1]. Estimated net crude oil exports were 109,000 bbl/d in 2010, the vast majority of which went to the Organisation for Economic Co-Operation and Development (OECD)'s European countries. Germany, Italy, France, and the Netherlands received over 80% of Syria's crude oil exports. According to the European Commission, European Union (EU) countries imported 1.35% of their petroleum from Syria in 2010 (Figure 1). Although exports from Syria represented a small share of the EU's overall oil needs, these exports accounted for 30% (or \$4.1 billion) of Syrian government revenues in 2010 [2].

However, most of this production has not been exploited to the benefit of the Syrian people. Since its discovery in 1968 until 2001, the retail value of oil was not included in the general budget, and billions of dollars disappeared under the pretext of military build-up against Israel [3].

Since the outbreak of the Syrian civil war in 2011, oil and gas production declined because of massive economic sanctions and conflicts in the country. At present, the oil and gas fields are divided between the players of the Syrian conflict. The Syrian government, Kurdish forces, and Islamic State (IS) all control portions of the fields and are locked in conflict with each other. All of these factions have been using oil to serve their own agendas and ambitions, far removed from the will of the common people. While Assad's government uses it as a "weapon" to kill opposing Syrians, namely as fuel for military equipment, in addition to civilian purposes, IS uses it to finance its terrorist operations and the foundation of their state. Kurdish forces use oil to establish their authority and military operations. Thus, oil is not used in favour of the Syrian people; on the contrary, it is used against their interests.

The opposition groups (rebels) do not have any oil resources, though they buy it from the Islamic State and the Assad regime, for both military and civilian purposes.



**Figure 1.** Syria crude oil exports by destination, 2010 [2].

IS controls a variety of public resources and infrastructure in parts of Iraq and Syria, enabling it to assemble a “diverse financial portfolio” [1]. Unfortunately, most of the oilfields in Syria at present are under IS control. Senior US officials have described IS as one of the best-funded terrorist organizations, financed in different ways:

- Selling of crude oil and oil products to the Assad regime, rebels, and the world market through Turkey;
- Donations from financially strong individuals, mainly from countries in the Arabian Peninsula;
- Bank looting and extortion;
- Ransom money from the kidnapping of journalists and other people from Western countries;
- Returns from the sale of abducted women and girls;
- Trade in stolen cultural goods.

The revenue from the sale of crude oil continues to be its major source of income, although the coalition conducted airstrikes in Syria, targeting oil refineries under the control of IS militants. This paper thus aims to study the trends of oil and gas production, the geographical distribution of Syrian oilfields and their control by the active forces in the sector, in addition to examining the refining, selling and smuggling mechanisms, especially by the IS, and the health and environmental impacts from the extraction, refining and transportation of oil.

This study was conducted using data available from journals and the internet, including websites, social networks, and online video-sharing platforms. This information was later extended through field visits to some of the points of sale and areas of smuggling, and interviews with academicians, oil smugglers, sellers and brokers, including sympathizers and sometimes even assumed IS members. All the interviews were collected in 2014 and 2015.

## 2. History of Oil and Gas Exploration—The Distribution of Oil and Gas Fields

Syria, located in the northern part of the Arabian plate, has oil reserves of 2.5 thousand million barrels (tmb), which corresponds to 0.15% of world reserves. In addition, the country had 10.6 trillion cubic feet (TCF) of natural gas in 2014, corresponding to 0.15% of the total world reserves [4].

Syrian oil exploration first began in 1930 during the French mandate by the Iraq Petroleum Company (a consortium of Shell, Exxon-Mobil, Total, and Gulbekian). However, it did not emerge as an oil producer until May 1968, when the first barrel of oil arrived at Tartus port. The first petroleum shows have been realized in Jebissa and Ghouna (NE part of Syria) during the late 1930s and '40s by the Iraq Petroleum Company (IPC) in association with the state-owned petroleum company (later to be known as Syrian Petroleum Company SPC). It relinquished its concession in 1951 and never made a commercial discovery. The first major discovery, the Karatchok field near the border with Iraq and Turkey (Figure 2), was made in 1956 by the independent US-based Menhall Company, followed by the discovery of the Suwaidiyah field in 1959 by the German company Concordia. Subsequently, the discovery of the Rumailan field by the Syrian Petroleum Company was followed by the nationalization of all oil operations in 1962 [5].

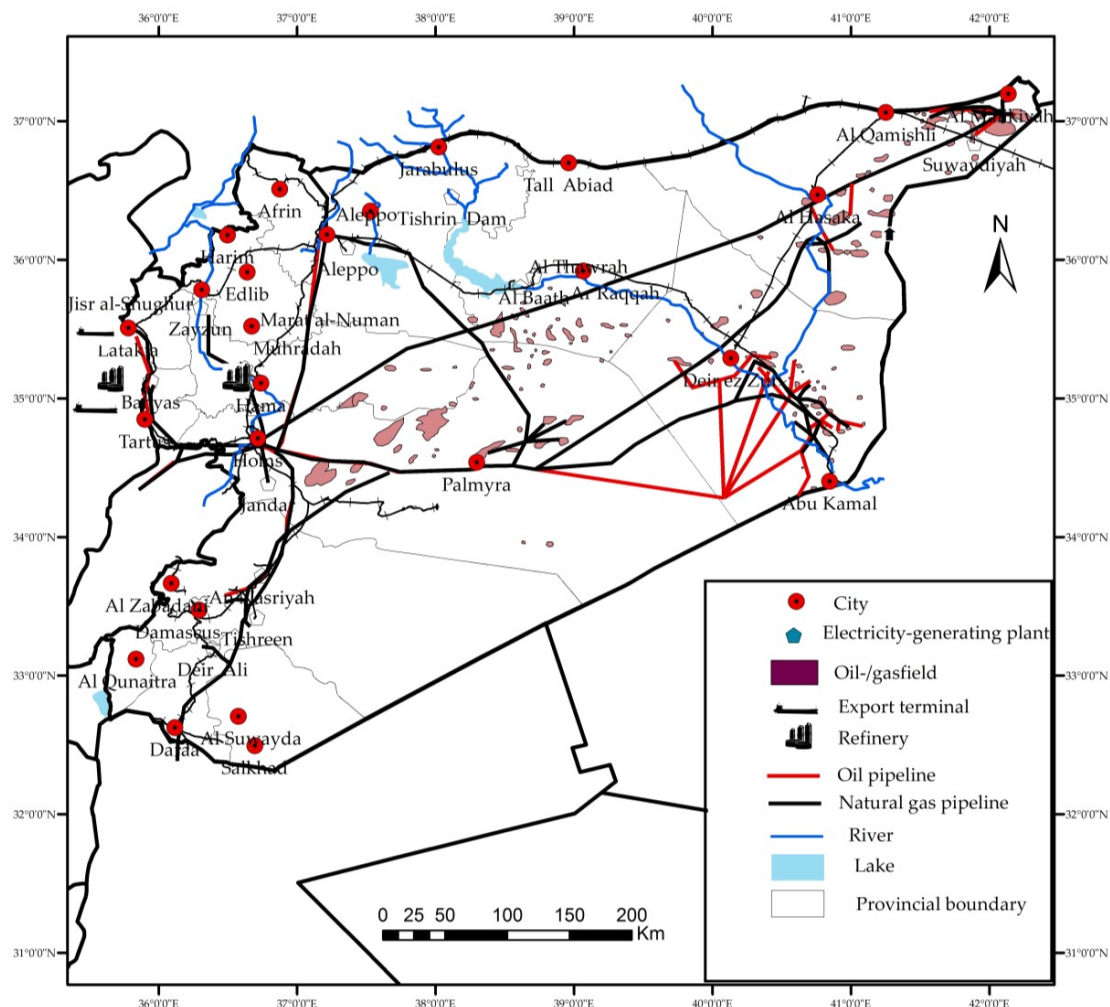


Figure 2. Geographical distribution of oil and natural gas deposits, refineries and pipelines.

In 1974, the Syrian government began to award production-sharing contracts to foreign operators. In the mid-1980s, significant discoveries were made in the Euphrates Graben, which is located in the eastern part of the country. Figure 2 shows the oil and gas fields in Syria in the late 1990s. One of the

most important oilfields in the Euphrates Graben is the Omar field, which is the largest field in the portfolio of Al Furat Petroleum Company (AFPC), and it is located in the northeast of the country, 45 kilometres southeast of Deir ez Zor. The field was discovered in 1987. Originally, the field at its peak produced some 80,000 b/d, but production declined rapidly due to the lack of any pressure support. The Omar field was mismanaged by overproduction in early 1990, thereby damaging the field and leading to a drop in production to 16,000 b/d by 1991. From 1991 onwards, water injection was used at the site, and a plateau production level of 60,000–70,000 b/d was reached between 1994 and 1997. As of 2008, the production rate has declined to 20,000 b/d [6]. Since 2004, various sets of international sanctions have been imposed on the Syrian regime by the US and the EU, with implications for the country's extractives industries [7].

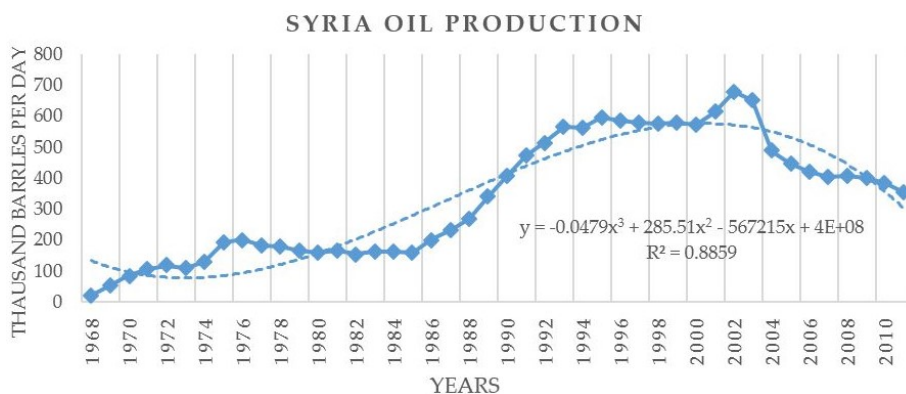
Another field in the Euphrates region, Thayyem, was discovered in 1984. The discovery motivated the establishment of the AFPC. Though Thayyem is the AFPC's main field, it is a mature field and production levels have been declining since 1991. Like other AFPC fields, Thayyem produces a light grade of oil with low sulfur content [7].

Other Syrian oilfields include Maleh, Qahar, Sijan, Azraq, and Tanak. Jafra was discovered in late 1991 and is located near Deir ez Zor, operated by Total Final. The fields had a production of around 60,000 b/d in 2010. In December 2011, Total announced it was suspending operations in Syria in line with recently tightened sanctions by the EU which indirectly target its local partner, the Deir Ez Zor Petroleum Corporation [7]. Crude oils produced from oilfields are transported through the Syrian pipeline to the two refineries in Homs and Baniyas, in addition to the Tartus Port, for exports [5,8].

About 58% of Syrian gas is non-associated, while gas cap reserves and associated gas (with oil) respectively account for 26% and 16%. Some two-thirds of the country's non-associated gas reserves are located in the Syrian Petroleum Company's concession area, containing the Palmyra fields in the centre of the country. The Cherrife and Ash Shaer fields, also in central Syria, are other large sources of non-associated gas, with more than 30 billion cubic meters (bcm) of reserves. In June 1999, a new natural gas field, North al-Faydh, was discovered by SPC. The field reportedly has a production potential of 35 million cubic feet per day (Mmcf/d). Gas cap reserves are mainly located in the northeastern part of Syria, as are the majority of the country's associated gas reserves, which can be found in the Deir ez Zor region as well as around the Rumailan and Suwaidiyeh fields. The gas produced had been fluctuating between 5 and 6 bcm/year for a decade and increased to 7.8 bcm in 2010 [9].

### 3. Trend of Oil Production (1968–2011)

Over the last 50 years, oil has been important as a foreign exchange earner and contributor to the budget. Oil was discovered in Syria in the early 1950s, but the sector developed slowly (Hasan and Dridi, 2008), and sizeable production did not begin until 1968 (albeit with the relatively small amount of 21,000 b/d) (see also Figure 3).



**Figure 3.** Syria's oil production, based on data of the *BP Statistical Review of World Energy* [3].

The general long-term trend of Syria’s physical production and consumption, as per the available data from the BP Statistical Review [4], is depicted in Figure 1. However, oil production increased rapidly in the following years to peak at 200,000 b/d in 1976. Oil production stabilized in the range of 16,000 b/d to 185,000 b/d in 1985. Following stagnation in production, the sector was reopened to foreign investments under production-sharing agreements with the Syrian Petroleum company (SPC). This led to discoveries of new fields and significantly increased oil production, which reached 31,577,000 b/d in 1996 [10].

However, oil production has been declining since then by 4% annually due to technological problems coupled with depletion of reserves (especially Jebisseh and Omar); serving to open up the sector to attract large investments [7]; and output levels falling to just 376,000 b/d [11]. This period nevertheless saw a slight boom in production to 622,000 b/d in 2002 [6].

In 2011, Syria’s proven gas reserves were estimated to be 258 bcm, a level that has remained constant over the past two decades. According to BP [4], Syria produced about 8 bcm of gas in 2010. Production rose by 11.6% per year between 1970 and 2010 (see also Figure 4). During the late 2000s, the natural gas sector attracted huge investments, and production rose sharply in 2010 and 2011 due to the start-up of two major projects in central Syria: the Al-Shaer field developed by Ebla Gas Company, in which Canada’s Suncor was the operating partner; and the Jihar scheme developed by Hayan Petroleum, operated by Croatia’s INA. These two schemes helped to raise total gas output to 8 bcm in 2010 and to 8.7 bcm in 2011, from an average of 5.5 bcm in the previous five years. The gas was mainly used for generating electricity, and feeding new combined-cycle power stations [12]. The steep drop over the last four years reflects the disruptions wrought by civil war and international sanctions, in addition to depletion.

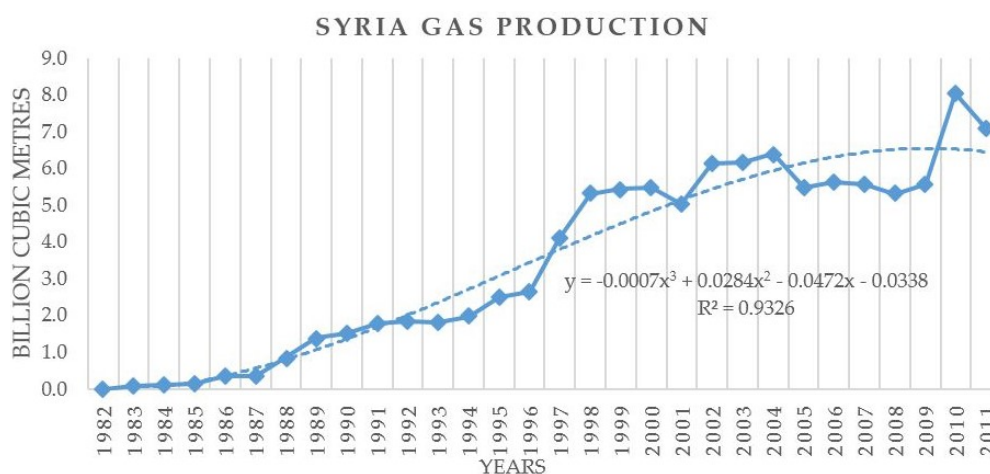


Figure 4. Syria’s gas production (1982–2011) based on data of the BP Statistical Review of World Energy [3].

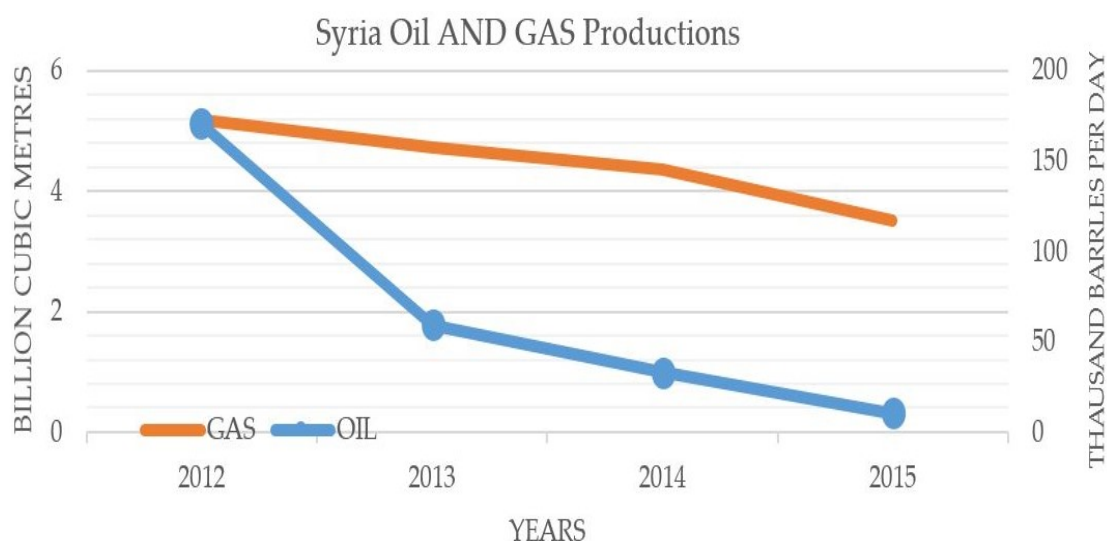
#### 4. Deterioration of Production during the on-Going Civil War (2011–2015)

Average Syrian oil production from 2006 to 2010 was approximately 400,000 barrels per day (b/d), but declined steadily after that period. Military conflict combined with economic sanctions considerably slowed down average production, which had dropped from 380,000 b/d in March 2011 to 117,000 b/d in March 2013, a nearly 70% decline from pre-conflict levels. The latest estimates by USA’s EIA indicate that Syrian production of crude oil and condensates has fallen to barely 25,000 b/d, including production outside the control of the Syrian government, whereas the oil minister in the Syrian government said that production fell to 9837 b/d during the first quarter of 2015 [13]. This is a drop of roughly 97% since the conflict began in March 2011. According to government officials, the majority of Syria’s oilfields are no longer under the control of forces supporting the Assad regime.

The natural gas system has suffered relatively little damage compared to the oil sector [1]. During the course of 2012, the Syrian army recognized that it had to prioritize its resources. This meant

concentrating forces in areas with larger populations in the western part of the country, and protecting its natural gas fields, which are critical for generating electricity [12]. Syria produced 8 bcm natural gas in 2010. Following the start of the military conflict and international sanctions against Syria, Total suspended operations in the country since December 2011. Production since then dipped to 5.3 bcm in 2012, 4.7 bcm in 2013, and 4.4 bcm in 2014 [4]. It is estimated that production of Syrian natural gas declined by about 45% from 2011 to 2014 (See also Figure 5).

Syria has two state-owned refineries in Homs and Banias. According to the Oil & Gas Journal [14], the combined nameplate capacity of the two refineries at the beginning of 2015 was slightly less than 240,000 b/d, a total capacity that met only three-fourths of Syria's pre-conflict demand for refined products. With damage to pipelines and other infrastructure around the refineries, particularly in Homs, Syrian officials claimed that the country's actual refining capacity now is closer to 50% of its pre-war nameplate capacity [15,16].



**Figure 5.** Syria's oil and gas production (2012–2015) based on data of the BP Statistical Review of World Energy [4] and U.S. Energy Information administration (EIA) [16].

## 5. Geographical Distribution of the Control of Syrian Oil and Gas Fields by Forces

The status of the oilfields in east and northeast Syria has been in a state of flux since the summer of 2012. The situation is complicated by the existence of several organized military forces in the region: the Syrian Army, the Syria Free Army, IS, the Alnusra Front, and Kurdish forces, as well as other groups fighting the Syrian government. By the end of 2014, Syrian oil and gas fields were controlled by three forces: IS, Kurdish forces, and the government (see also Figure 6).

IS gained control of the majority of oilfields as well as several gas fields in Syria. According to a map issued by the Ministry of Communications, Transport, and Industry in the Syrian Interim Government, Transport Department GIS Office in 2015 [17], IS controls 80% of the oil and gas fields in the country, Kurdish forces dominate 12%, and the Syrian regime retains control over only about 8% after more than four years of ongoing civil war in Syria.

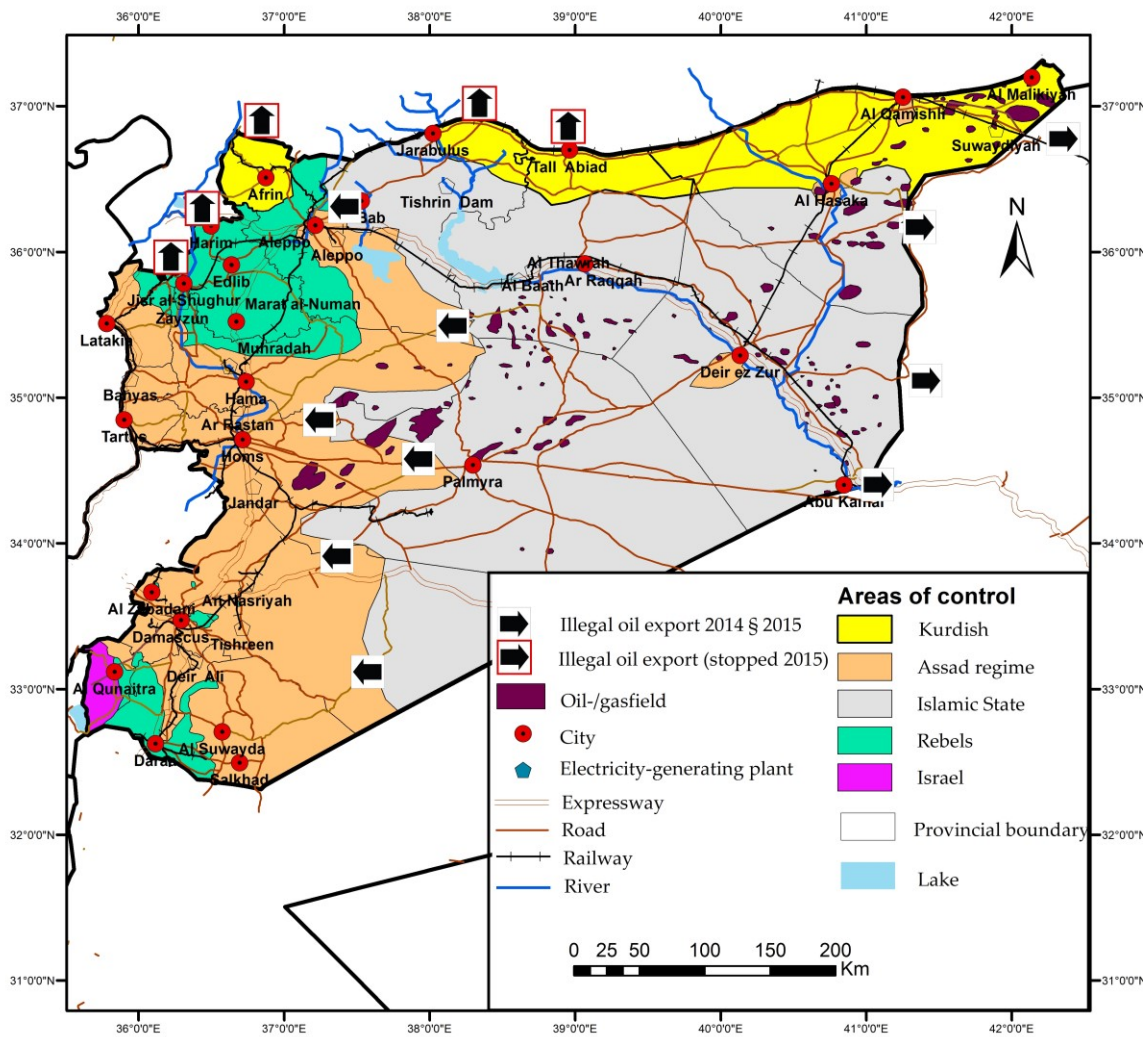


Figure 6. Geographical distribution of the control of Syrian oil and gas fields by forces and illegal export.

5.1. Oil and Gas under the Control of IS

IS controls the main oilfields in Deir ez Zor province, such as Ward, Tank, Taim, Jafra, and Omar, which is one of the biggest fields with the best quality of extracted oil in Syria [3,18]. In the province of Hasaka, IS controls the oilfields in southern Hasaka such as Margada, Al Jubaissah, Gouna Tishreen, and Al Hol. In Raqqa province, the militants control all the small oilfields found in the area. IS also recently seized control of a number of oil and gas fields in central Syria (Homs province), such as Arak Shahr, Sokhna, and Aldzl. In addition to these fields, the group also wrested control of Kuniko gas plant (20 km east of the city of Deir ez Zor), Al Kharrata oil station (20 km southwest of Deir ez Zor), Derro oil station (40 km northwest of Deir ez Zor), and the stations T1 and T2, which lie along the Iraqi oil line in Syria [19]. Most of these oilfields were previously assets in the portfolio of the Al-Furat Petroleum Company, a Royal Dutch Shell affiliate (Table 1). The crude oil produced in these oilfields is still of fairly good quality because of low sulfur concentration, which makes it very easy to process [20].

**Table 1.** Oil production (b/d) under control of IS in summer 2015 [3,18,21–23].

Province	Field	Production (b/d)
Deir ez Zor	Omar	15,000
	Tank	7000
	Jafra	3000
	Al Kharrata	1000
	Derro	500
	Ward, Ahmer, Akash, and Ratka	7000
	Atallah	500
	Tayyani, Maleh, Sijan, and Azraq	12,000
	Thayyem	700
	Other fields	1000
	Hasaka	Margada
	Al Jubaissah	3500
	Gouna	1000
	Tishreen	2000
Raqq	Wahab, Habbari, Deilla, and Fadeh	2000
Homs	Jazal–Heil	2500
		61,700

In fact, IS presently controls about one-third of Syria and 80% of the oil and gas fields in the country. Before the conflict in 2011, the oilfields now controlled by IS were producing about 250,000 b/d (65% of Syria's oil production). Recognizing the importance of energy assets as a reliable and sustainable revenue source, IS seeks to operate local oil infrastructure, underlining its desire to capture and utilize existing assets and expertise rather than destroy them. At present, there is no reliable data regarding oil production in IS-held areas. According to estimates, the total output of Syrian oilfields under IS control is between 50,000 b/d and 150,000 b/d. The Syrian government [18] estimated total oil production to be about 50,000 b/d in mid-2014, Butter [12] estimated that IS-controlled oilfields have the capacity to produce some 60,000 b/d, while Lister [24] approximated a production of 70,000 b/d, and Hammadeh and Albkri [3] put it at 90,000 b/d. According to *Foreign Policy* magazine [25], before the onset of US airstrikes in summer 2014, IS was estimated to be producing more than 80,000 b/d and selling it in the black market for about \$1 million to \$3 million per day.

Based on data collected from activists in IS-held areas, oil production fell from 250,000 b/d in 2011 to some 62,000 b/d after the start of conflict. This is about 25% of production in comparison to the pre-conflict output of these fields in 2011. However, IS cannot effectively manage these assets due to lack of resources and technical capacities [20]. At the same time, it should be remembered that international companies have ceased work in Syria [3,20], and some oil and gas wells lie close to frontlines between the IS and Assad government or between the IS and Kurds. In addition, US airstrikes have targeted oil facilities in Syria because of their importance to IS financing. It has been estimated that US airstrikes destroyed about 50% of IS's refining capacity by early October 2014 [20].

IS produced about 62,000 b/d of oil in 2015. It produced about 40,000 b/d from mature fields in Deir ez Zor in the Euphrates valley that had been earlier developed by the Syrian government in the 1980s and 1990s [7]. Other producers included Total (19,000 b/d), which operated in the fields in Margada, Al Jubaissah, Gouna, and Tishreen in Hasakeh province. The remainder produced about 3000 b/d from some oilfields in Raqqa and Homs provinces [3,7] (see also Table 1 and Figure 6). However, in spring 2016, the products of oil probably fell by half (30,000 b/d) because of Russian, American and Kurdish attacks. IS depends on pre-existing equipment to extract oil from the fields controlled by it and relies on primitive methods for refining the extracts. IS uses the incineration method, whereby crude oil is extracted from wells without freeing it from water and gas. It is then transferred to dirt digs for workers to wait for water to settle down at the bottom and gas to evaporate from the surface [22]. The oil is then placed in reservoirs, where it is burned directly in order to derive diesel, gas, and gasoline (see also Figure 7). Workers can differentiate these items by changes in colour



and smell. Also, local investors bring in Chinese- and Turkish-made makeshift refineries via Turkey, some of which process 500–1000 b/d [18,19,22,23].



**Figure 7.** The primitive metal kilns to refine crude oil from Manbij (province Aleppo) into a pit where it will be distilled.

When the international coalition began its operations against IS, though it targeted refineries in outfit-controlled areas, it generally avoided strikes on oil wells because of the potential impact on civilians and also because it seeks to preserve key oil infrastructure for the post-conflict period, causing IS to resort to selling unrefined crude oil. For this reason, the citizens were forced to establish incinerators and primitive refineries. OMORAN [26] estimates that there are more than 3500 primitive refineries in areas held by IS and rebels.

#### The Sale of Oil and Gas and Smuggling by IS

Operating in large swathes of territory in eastern Syria and western and northern Iraq allows the IS to control numerous oilfields from which it continues to extract oil for its own use, its own refining, and for onward sale to or swap in local and regional markets [27]. One of the biggest streams of revenue for the outfit is the illegal sale of oil obtained from the oilfields controlled by the organization in both Syria and Iraq. However, selling oil is technically difficult for the IS because it lacks traditional export facilities or access to the open market [1]. As a result, IS sells oil at a much lower price than prevailing global rates. It has been reported that IS oil might have been selling for as little as \$16 per barrel at a time when Brent, a world price reference for crude oil, was selling at \$65 per barrel. The fall in world oil prices is likely to have further reduced the net price received by IS leaders for the oil they sell.

Gas, unlike oil, requires sophisticated equipment and special pipelines to be transferred. Most of Syria's gas infrastructure is oriented to delivering gas westward, where most of the specialized processing and electricity generation plants lie in areas under the control of pro-Assad forces [28].

IS mostly benefits from using the crude oil and oil products it controls or by earning revenues by selling these resources to local customers. IS tends to sell oil to some traders in the eastern parts of Syria. Whoever declares loyalty to the militant group gets an advantage for purchase. In order to win the loyalty of certain tribes, IS has offered the resources of some small oil wells to them. The organization also produces oil derivatives that are needed for self-use, such as fuel for its military and civilian vehicles, municipal garages, sanitation, agriculture, Islamic police vehicles and mobile Sharia'a courts. The production of such derivatives is done in on-field refineries. According to sources [21,22],

45% of the refined fuel is used by IS vehicles and tanks. The remaining portion of IS's oil revenue comes from sales via middlemen and smugglers, who trade and transport the illicit petroleum and petrol products for onward sale or swap in local and regional markets. In oilfields in eastern and northeastern Syria, trucks (Figure 8) line up daily to load cheap crude sold by IS militants. Therefore, IS markets its produce within its own areas of control as well as sells part of the oil to the liberated areas, the Assad regime, and Kurdish-dominated areas in Syria and Iraq. In addition, another portion is smuggled to Turkey and Iran and then to the world market. Recent reports suggest that about 30,000 b/d of Iraqi and Syria oil were being smuggled in the middle of 2014. Since October 2014, the governments of Turkey and Iraq's Kurdistan Region have also reportedly cracked down on the IS's crude oil racket [22,23].



**Figure 8.** Tanker trucks for transport to fuel stations and customers.

The IS controls one processing plant located south of Deir ez Zor known as “Conoco”, named after the American company that built it. The plant is said to be still functioning despite US air strikes in its vicinity since September 2014, albeit at a significantly reduced level due to damage and lack of routine operational maintenance. IS is believed to use the plant to extract liquefied petroleum gas (LPG) from the propane/butane cut of natural gas in order to supply cooking gas canisters for household purposes in areas under its control. However, the main production of the plant is dry gas, which was used to fuel the regime-controlled Jandar power station south of Homs, and the supply of dry gas appears to continue at least for now.

IS continues to supply gas from the eastern fields to regime power plants either for money or in exchange for electricity. This sort of deal has allowed uninterrupted operation of the Euphrates dam near Raqqa that is held by IS but maintained with technical assistance from the regime [29].

Gas, unlike oil, requires sophisticated equipment and special pipelines to be transferred. Most of the country's gas infrastructure is oriented towards delivering gas westward, where most of the specialized processing and electricity generation plants are controlled by the Assad regime. Well over two months before capturing Palmyra, the IS captured the nearby gas fields at Hail—the largest in the Palmyra area—and Arak on 1 March 2015, triggering power cuts in Damascus. Arak, which came online in 1995, also contains a gathering plant that links the main gas flow from the Palmyra area to a central station in Homs, which in turn is connected to Baniyas on the Mediterranean coast. Regime forces have subsequently regained these fields, but IS took conclusive control of them on 21 May, along with the T3 pumping station to the east of Palmyra, which used to carry oil from Iraq *en route* to the export terminal at Tartous on the Syrian coast [30].

The following are the main groups and countries that sell IS oil and gas:

*Assad regime:* The Assad regime and IS, despite fighting each other, still exchange services and indulge in bargains. In a manner of speaking, the Assad regime is a business partner of IS, and this

makes sense in terms of making more money. The organization cuts deals with local traders, buyers, and even businessmen who support the Assad regime, and some of its oil finds its way back to government buyers through a series of middlemen [31].

Crude oil, gasoline, and gas are smuggled into areas controlled by the Syrian government. Crude oil heads to the Homs refinery, gas to power plants, and gasoline directly reaches consumers in government-dominated areas through traders. The Assad regime currently imports from IS almost all of the crude oil and oil derivatives, accounting for approximately 10,000–12,000 b/d [13]. IS has continued the practice of guarding some pipelines transporting crude pumped by Kurds in their fields in northeast Syria to a government-run refinery in Homs in exchange for protection money and premium gasoline.

However, diesel is not smuggled directly to consumers because it sells for the cheapest price in Syrian government areas. A litre of gasoline from the locally refined crude sells for around \$0.50, a third of the price of good-quality gasoline sold in government-held areas.

The Telegraph [32] published a detailed report on a gas facility jointly run by the regime and IS that supplies government-held areas. IS continues to supply gas from the eastern fields to the regime's power plants in return for money or electricity.

For example, Mr Haswani's company, HESCO, operates a gas plant in Tabqa, a town in central Syria that was captured by IS August 2014. Officials believe this installation was being run jointly by IS and personnel from the regime. IS continues to supply the regime with gas to run electric power stations, including the Jandar power station in Homs which is supplied with gas from the Kuniko gas field in exchange for a monthly sum paid through intermediaries [8]. This is the sort of deal that has allowed the uninterrupted operation of the Euphrates dam near Raqqa that is held by the IS but maintained with technical assistance from the regime.

*Rebel areas:* The rebel areas do not contain any oil wells. Moreover, the Syrian regime did not allow the delivery of petroleum products to the population in these areas. Only small amounts of very highly priced diesel and gasoline reach these people via mediators such as traders and warlords, leading to an acute fuel crisis. As a result, the population has only oil derivatives coming from IS. The only way to transport crude oil and its derivatives to consumers in rebel areas is through tankers or large cargo vehicles. These vehicles carry oil to the rebel areas and sell the fuel to oil brokers and traders for cash payments. This fuel is then sold to wholesalers and retailers in oil-trading hubs across several towns in rebel-held parts of northwestern and eastern Syria. Prices for diesel range from \$80 to \$90 per barrel, and gasoline sells for \$120 to \$130 per barrel, nearly three times the price of crude oil. The rebel areas currently consume almost all of the oil derivatives, accounting for approximately 6000–8000 b/d [21].

*Turkey:* Diesel smuggling is a thriving sector in Turkey, and truck drivers have been involved in the racket for a long time. The smuggled diesel is mainly used as fuel for trucks or for heating. However, gasoline is not smuggled because it is of poor quality. This phenomenon has escalated with the deterioration of the political situations in Iraq and Syria. The price of a litre of diesel coming from Syria is about \$0.50 to \$0.70. The price of diesel fuel in Turkey is about \$2.70, and so there are huge profits in oil smuggling [3]. The trucks transport the diesel from primitive refineries to border areas with Turkey that are controlled by IS, Kurds, and rebels. During field trips by the authors to the Syrian-Turkish border in February 2014, it was revealed that smuggling occurs in two ways. In the first of these, diesel is filled in plastic cans (capacity of 30 litres each), which are then transferred to the Turkish side of the border by workers, or loaded on horses or mules. Alternatively, diesel is carried across rivers on rafts or pumped through underground pipes, before the fuel finds its way to markets across southern Turkey. All this happens in connivance with border patrols, who exploit their privileged status to benefit from the racket. On the Turkish side, several minibuses and cars wait along small dirt tracks and then carry the smuggled diesel to different points on the border.

The most important crossings for the smugglers are Harem district along the Orontes River (Harm), Otmh and Azaz in rebel-held areas, Tell Abied and Jarabulus in IS-dominated areas, and Afrien, Amuda Nusaybin in Kurdish areas albeit to a lesser degree. However, the IS recently lost the

Tell Abied crossing, an important conduit for the smuggling of oil and fighters with the IS having established numerous tunnels crossing into the Turkish side.

Reports suggest that about 25,000 barrels of oil were smuggled daily in mid-2014. Following international pressure, the Turkish government has been pursuing multi-layered crackdowns on oil smuggling since October 2014. This has significantly disrupted the illicit trade, and some claim that oil sales now might have declined by 98%. The purchase of this oil has obviously been condemned by the international community, with the United Nations warning that the purchase of oil from IS violates international sanctions against the group.

*Iraq and Iran:* IS sells crude oil and diesel to brokers and mediators in Iraq and Kurdistan, with the organization going about replacing gasoline. It sends crude oil to buyers, to oil refineries in northern Iraq, and to foreign buyers such as Turkey.

### 5.2. Oil and Gas under the Control of Kurds

Hasakah province, which is densely populated by Kurds, is the richest area in Syria in terms of oil resources. The Rumailan, Souedieh, and Karatchuk oilfields in the province produce a heavy grade of oil and gas. In addition, there are 1322 oil wells and 25 gas wells. The fields are connected by pipelines to Syria's Homs refinery.

In 2012, the central government in Syria lost effective control of the country's oilfields, which are located close to the border with Iraq and east of Homs. Rumailan fields used to produce about 170,000 barrels per day. These fields are currently out of the government's control and run by the Kurdish units, which extract oil and sell part of [33]. The Kurdish Supreme Committee (Desteya Bilind a Kurd (DBK)) was established by the Democratic Union Party (PYD) and the Kurdish National Council (KNC) as the governing body of Rojava in July 2012. The board comprises an equal number of PYD and KNC members. In November 2013, the PYD announced an interim government in Syria's Kurdish regions, divided into three non-contiguous autonomous areas or cantons: Afrin, Jazira, and Kobani [34].

The interim government in Syria's Kurdish-dominated regions (Rojava) managed to take over the oilfields in the area under their control, but the pipelines going from the fields in Jazire to the refineries were sabotaged, forcing the closure of 1300 wells in Rumailan. Later, Rojava decided to take matters into its own hands and cooperate with the Syrian government, restarting extraction at 150 wells and creating around 20 makeshift refineries. On its part, the Syrian government helped to get wells back into operation by providing raw materials such as oil for turbines, spare parts and also by continuing to pay the salaries of a handful of former government employees who have gone back to work in Rumailan [16,34]. In November 2013, the Movement for a Democratic Syria (TEV-DEM), which includes Kurdish civil society organizations and political parties, founded a company called Distribution of Al Jazeera Fuel, known as KSC. The company was established to exercise the same specialties that were carried out by the former state-owned company Sadcob after the latter stopped working with oil wells before permanently stopping production on 8 March 2013 [33,34]. The company was finally able to bring several refineries to Zero Cr/Tel Adas areas near Al Malikiyah in Syria's far northeast. The company is now working to bring in more advanced electric refineries to enhance production [3,35]. The Kurdish operation in Rumailan produced around 15,000 b/d in mid-2014 [34,36] and the Swedish gas plant produced 2140 tcm per day in 2013 from the field in Souedieh [37]. At present, gas production has reached more than 25,000 b/d. About half the oil goes to Iraq and then to Turkey, while the other half is consumed in Syria, both in Rojava territories and the Assad regime.

### 5.3. Oil and Gas under the Control of Assad Regime

The Assad regime's control has declined to only about 8% of oilfields and 55% of gas fields after more than four years of ongoing war in Syria. The Syrian government's control is limited to the oil and gas fields located in the provinces of Homs and Hama with some oil wells in Deir ez Zor province. The Assad regime now retains control over only Ar Rasm, Bilas Sharifah, al-Sha'ir, Elba, and Jazal.

In these fields, crude oil production decreased by 60% to 10,000 b/d and natural gas production by 40% to stand at 10 million cubic meters per day (3.56 bcm) in 2015 (shortly prior to the fall of Palmyra) from 25,000 b/d and 5 bcm in 2011. The decrease in crude oil and natural gas production is attributed to the suspension of activities by international oil companies, such as CNPC, Gulfsands, Shell, and Total, because of sanctions and the destruction of Syria's oil infrastructure [3,16]. Gas production is also expected to decrease by more than 45% after IS snatched control of Palmyra and gas fields such as Arak, Al Hail, Najib Zubyyat, and Sukhnah.

Palmyra offers IS greater opportunity to reap disproportionate rewards—compared to its limited investment in manpower for combat—and acquire strategic leverage. In 2013, over 90% of Syria's natural gas production was used to generate electricity, according to government sources [30]. The Assad regime still retains the Homs and Baniyas refineries. The combined capacity of Syria's two refineries has fallen to roughly half its pre-conflict output, resulting in supply shortage for refined petroleum products. It is likely that Iran and Algeria would continue to supply crude oil and refined products to Syria. Oil theft is also a problem, with Syrian officials claiming that hundreds of barrels of crude oil are being stolen and shipped to neighbouring countries each day [16].

With the exception of co-production between the Kurds and Assad regime, the Syrian government produced less than 10,000 b/d of crude oil in the first quarter of 2015 and 3.56 bcm of natural gas in 2014. The production of crude oil dipped by 97% to 164,000 b/d in 2012 from 327,000 b/d in 2011. Sources confirmed that 95% of the refined fuel is consumed by the regime for its vehicles and tanks [4,16].

## 6. Environmental and Social Impacts of Oil Refineries and Transportation

Oil extraction, primitive oil refineries, and transportation of fuel in tanks or pipelines lead to heavy pollution in the region and pose major health hazards for human communities living near the refineries as well as for marine and terrestrial ecosystems in the areas where they are located. Oil is extracted, refined, and transported without any precautions, protection and preventative measures. During oil extraction, neither Kurdish units nor militant factions pay attention to these preventive measures. This means that oil extraction sites and surrounding areas are exposed to all kinds of contamination risks, including radiation.

Though there is no statistical data on the volume of pollution, it can be easily seen. Small-scale refining enterprises are set up in unstudied areas in terms of proximity to surface water, traffic or agricultural lands, potentially causing traffic accidents and damaging crops and water. These refineries emit smoke and fumes into the air, leading to further pollution and causing the formation of a black cloud over the eastern region of Syria, which will have disastrous results for the area's residents, water sources, and agricultural land, leading to their inevitable desertion. One alarming concern is the high concentration of oil, heavy metals, and benzene in the waters of River Euphrates and the surrounding soil (see also Figure 9). Regulations on work safety, emission standards, and environmental protection are absent. The primitive oil refineries were set up by individuals who did not possess the knowledge or understanding of the risks of working in such refineries. They deal with burning materials that evaporate automatically in the sun and cause health problems such as skin allergies, and even serious diseases like cancer and ailments of the respiratory system. In addition, explosions and fires have claimed the lives of dozens of those in charge of refining the oil [3].

Moreover, coalition airstrikes against IS-run oil refineries have increased the problem of pollution. The targeting of Syrian refineries may aggravate the indirect harm to the local communities and environment in oil-producing areas by encouraging the setting up of difficult-to-detect but high-polluting micro-refineries. The hazard to civilians and the environment varies depending on local environmental conditions, land use, and population density. Soil, surface water and groundwater contamination is likely, as is air pollution from persistent fires.



**Figure 9.** Soil and air pollution from oil refining.

## 7. Conclusions

Since the discovery of oil in Syria, it has been more of a burden than a support to the Syrian people. It was used from the 1970s to the beginning 2000s to buy and assemble weapons by the Assad regime. These weapons have subsequently been used against the Syrian people since the first cry of freedom in 2011.

The control over Syria's oil and the black market trade of oil products has been a key element of this internal conflict. The black market network of traders is supported by smuggling networks that move oil internally and internationally, where many of the illicit micro-refineries are found. A war economy has emerged in which groups such as the IS and the Kurdish Force in the east and northeast have established autonomous economic spheres. Both are dependent on oil and gas resources as one of their main sources of funding.

The US-led coalition achieved a decrease in oil production, but the military actions also caused a significant localized contamination—a risk to civilians as well as the environment. Unfortunately, the IS turned to diversifying its income sources through an increase in the looting of cultural heritage artifacts. Additionally, the IS changed certain punishments for disobeying IS rules from imprisonment to fines to generate more income. The dictatorship of Assad has created the current state of terrorism by torture, abuse, injustice and complete lack of freedom. He created the chaos that allowed the IS to rise in Syria. A form of collaboration between Assad and IS as he buys their illegally exploited oil and gas also exists.

If the international community plans to stand up to terrorist organizations, then they have to confront the dictatorship in Syria. The campaign of terror has to stop, and not just with Assad: a cycle of ruthless organizations and dictators who will use the same method as the present regime when the people demand freedom and dignity will continue.

In order to put an end to terrorism, dictatorship in Syria must be stopped. Injustice and tyranny breed terrorism not only in the countries of their existence, but also the world over. Only the permanent removal of dictatorship and terrorism will allow the Syrian people to invest its natural and human resources in a peaceful and orderly manner to achieve development instead of war.

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