Country Report: **Iran**
Subject: **Energy Sector**

(1) Iran's Energy Sector in Context

The Islamic Republic of Iran dates from the 1979 Islamic revolution, which removed the autocratic Shah of Iran, and imposed a theocratic Shiite-Islamic government with some quasi-democratic elements (led by a president) that are still ultimately answerable to the Supreme Leader, who is an unelected theocrat. Protests leading up to this governmental change had already severely disrupted the Iranian oil sector by 1978. In November 1978, a strike by 37,000 oil and gas workers reduced production from 6 million barrels per day to about 1.5 million barrels. Foreign workers (including skilled oil workers) also fled the country at this time. As far as the implications for the energy sector are concerned, Iran's revolutionary government expelled foreign oil companies from the country and the National Iranian Oil Company appropriated their assets and cancelled all contracts.

Soon after the deposition of the Shah, Iraq, seeking to take advantage of the instability of its neighbor invaded Iran, and the long, bloody Iran-Iraq war started which would continue until 1988. The war was enormously expensive in terms of loss of human life and economic waste, causing significant damage to the oil and gas infrastructure of both countries. For Iraq, the war was the first serious supply shock to Iraqi production (see Country Report: Iraq) and for Iran, it prevented a resurgence of production which had collapsed in the face of the 1979 Revolution, effectively retarding the gains of the previous 10 years. The chart below shows Iranian production from 1970 through the revolution and war years, and into the first decade of the 21st century.

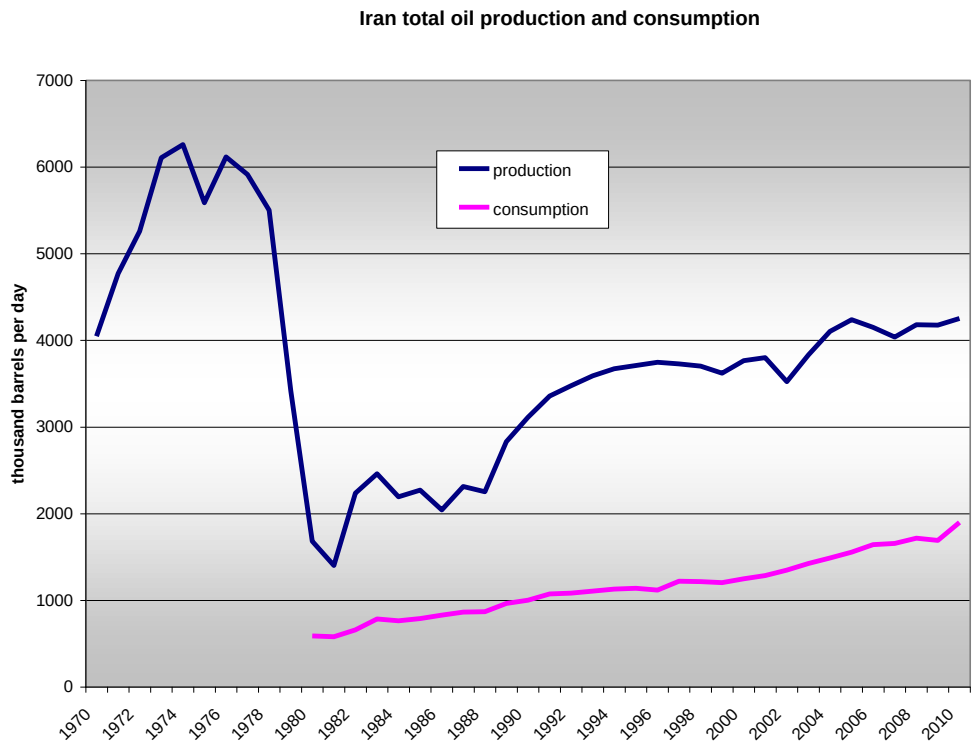


Chart 1: Iran's Oil Production and Consumption since 1970

The revolution and early phase of the war resulted in a drop of 3.9 million barrels per day of crude oil production from Iran from 1978 to 1981. Much of this lost production was offset initially by increases in output from other OPEC members[1], particularly from Iran's Persian Gulf neighbors. With the start of the Iran-Iraq war however other Persian Gulf countries reduced output as well (for reasons initially related to the war but also unrelated reasons as the supply picture evolved in the 80s). OPEC crude oil prices increased to unprecedented levels on the back of the revolution in Iran. By 1981, OPEC production had declined to 22.8 million barrels per day, 7.0 million barrels per day below its level for 1978. At this time however, OPEC cuts were being enforced voluntary given the huge increase in volumes stemming from the North Sea, Alaska, Mexico and elsewhere (see Report: MENA Energy Overview for a discussion of the overall supply picture and OPECs role in it). This phenomenon became known as the 80's oil glut.

During wartime, the oil industry in many border areas was damaged (particularly those installations located in Khuzestan province), and Iran also suffered from an inability to obtain replacement parts on U.S.-made equipment. Additionally, Iran's export terminals suffered. The so-called "Tanker War" started when Iraq attacked the oil terminal and oil tankers at Kharg

[1] At the time, the other countries in addition to the Islamic Republic of Iran were Iraq, Kuwait, Saudi Arabia and Venezuela who had founded the cartel in 1960. These countries were later joined by Qatar (1961), Indonesia (1962), Libya (1962), the United Arab Emirates (1967), Algeria (1969), Nigeria (1971), Ecuador (1973), Gabon (1975).

Island in early 1984 (see section 2.4.1 for a discussion of Iranian export terminals). Lloyd's of London, a British insurance provider, estimated that the Tanker War damaged 546 commercial vessels and killed about 430 civilian sailors. The main Iraqi air effort had by 1986 shifted to the destruction of Iranian war-fighting capability – primarily centered on the destruction of Persian Gulf oil fields, tankers, and Kharg Island. Hostilities between the two countries finally ended 2 years later with a ceasefire in August 1988. Iran's crude oil production, which had peaked at about 6 million barrels per day (MMbbl/d) in 1976 had plunged to 2.3 MMbbl/d by wars end.

After the war, the NIOC made new investments and repairs in an effort to restore production levels and regain the country's spot as OPEC's second-largest producer. The company was able to substantially increase crude oil production, but only to levels still well short of the high reached in the 1970s. By the mid-1990s, production hovered at around 3.6 MMbbl/d.

The fact that Iran did not allow foreign investment in the oil sector until 1998 (see section 2), and the almost constant pressure of sanctions since the American Embassy hostage situation served to inhibit growth. Despite seeming breakthroughs with regard to engagement with the outside world and hence with foreign energy companies today the theocratic regime, whose position was solidified in those war years, is again under strict sanction for alleged attempts to construct a nuclear weapon disturbing the regional balance of power and the global security situation at large. It remains to be seen what will happen with nuclear talks and hence what production path Iran's enormous hydrocarbon reserve base will follow. These considerations are explored in this report with the nuclear talks discussed in depth in section 4.

(2) Oil and Gas: Upstream

As alluded to in the introduction, Iran is a massive player in global energy markets but its present production capacity is well short of potential. Iran holds 155 billion barrels of oil in reserve as of 2012 according to the Oil & Gas Journal. This places Iran ahead of Iraq (number 3) and behind Saudi Arabia (number 1) for the 2nd largest conventional reserve holdings in the world. According to FGE, approximately 70% of Iran's crude oil reserves are located onshore and the remainder offshore, mostly in the Persian Gulf. Roughly 85% of Iran's onshore reserves are located in the Luristan-Khuzestan basin in the southwest near the Iraqi border, according to the Arab Oil and Gas Journal.

(2.1) Sector Organization

The state-owned National Iranian Oil Company (NIOC) is responsible for all upstream oil and natural gas projects. The Iranian constitution prohibits foreign or private ownership of natural resources. However, international oil companies (IOCs) can participate in the exploration and development phases through 'buyback contracts' (discussed further in section 2.3).

The energy sector is overseen by the Supreme Energy Council, which was established in July 2001 and is chaired by the president of Iran. The council is composed of the Ministers of Petroleum, Economy, Trade, Agriculture, and Mines and Industry, among others. Under the supervision of the Ministry of Petroleum, state-owned companies dominate the activities in the oil and natural gas upstream and downstream sectors, along with Iran's petrochemical industry. The three key state-owned enterprises are the National Iranian Oil Company (NIOC), the National Iranian Gas Company (NIGC), and the National Petrochemical Company (NPC).

The state-owned NIOC, under the supervision of the Ministry of Petroleum, is responsible for all projects, encompassing both production and export infrastructure in the oil sector. The National Iranian South Oil Company (NISOC), a subsidiary of NIOC, accounts for 80% of oil production covering the provinces of Khuzestan, Bushehr, Fars, and Kohkiluyeh and Boyer Ahmad. Nominally, NIOC also controls the refining and domestic distribution networks, by way of its subsidiary, the National Iranian Oil Refining and Distribution Company (NIORDC). The National Iranian Gas Company (NIGC) is in charge of Iran's natural gas downstream activities, including gas processing plants, pipelines, and city natural gas networks. The NIGC operates through several subsidiaries, including: Iran Gas Engineering and Development Company (IGEDC), Iran Gas Transmission Company (IGTC), Iran Gas Storage Company (IGSC), and Iran Gas Distribution Company (IGDC). NIGC holds a trading company that sells natural gas plant liquids called the Iran Gas Commercial Company (IGCC). Another subsidiary, the National Iranian Gas Exports Company (NIGEC), is in charge of new pipeline and liquefied natural gas (LNG) projects. The National Iranian Petrochemical Company (NPC) operates several petrochemical complexes through its subsidiaries. In 2011-12, NPC accounted for almost 90% of Iran’s total petrochemical production of 46-47 million tons and almost the same share of Iran's petrochemical exports of 18-19 million tons. NPC exports petrochemicals through its wholly-owned subsidiary Iran Petrochemical Commercial Company (IPCC).

(2.2) Major Oil Fields

Iran’s main oil fields are located near the southern part of the border with Iraq and along the northern part of the Persian Gulf (Khuzestan and Bushehr provinces), including in the shallow waters offshore.

Iran’s largest onshore oilfields are:

- Ahwaz-Asmari (700,000 bbl/d)
- Marun (520,000 bbl/d)
- Gachsaran (560,000 bbl/d)

With other major onshore fields:

- Agha Jari (200,000 bbl/d)
- Karanj-Parsi (200,000 bbl/d)
- Rag-e-Safid (180,000 bbl/d)
- Bangestan (245,000 bbl/d current production, with plans to increase to 550,000 bbl/d)
- Bibi Hakimeh (130,000 bbl/d)
- Pazanan (70,000 bbl/d)

And offshore capacity:

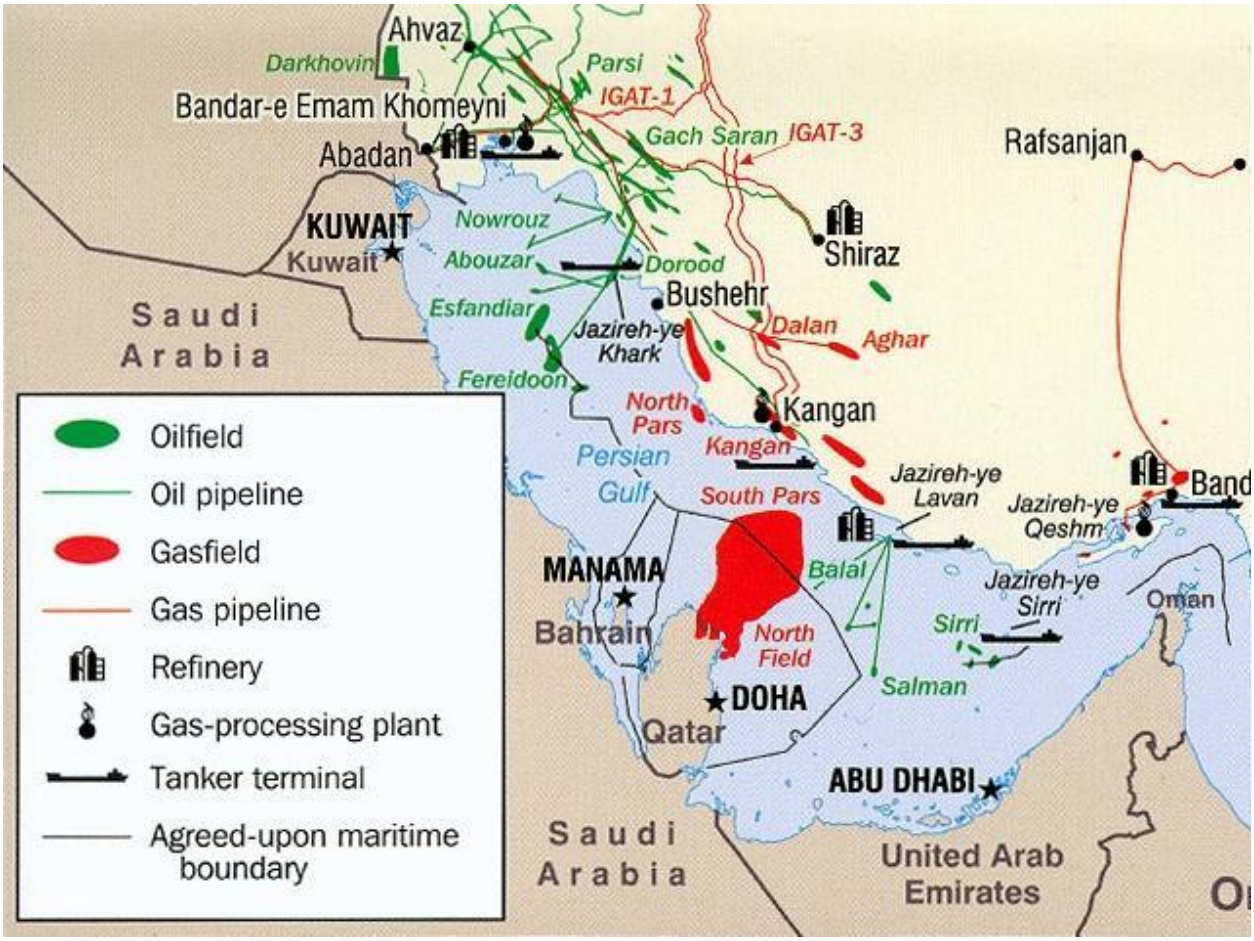
- Nowrouz (60,000 bbl/d)
- Abuzar (175,000 bbl/d)
- Dorood (130,000 bbl/d)
- Salman (130,000 bbl/d)
- Lavan (100,000 bbl/d)
- Sirri (95,000 bbl/d)

Iran also produces crude condensate in the South Pars gas field discussed in section 2.3.1. Two of Iran's major untapped fields include:

- Azadegan (600,000 bbl/d as outlined in contracts)
- Yadavaran (300,000 bbl/d as outlined in contracts)

The Azadegan field (near the border with Iraq) was Iran's biggest oil find in 30 years when announced in 1999. It contains 6 to 7 billion barrels of recoverable crude oil reserves, but its geologic complexity makes extraction difficult and demining and clearing of unexploded ordinance is an added cost. Yadavaran is the other major promising new find with 3.2 billion barrels of recoverable oil reserves and 2.7 tcf of recoverable gas reserves. The status of these projects is covered in the next section.

Iran's crude oil is generally medium in sulfur content and in the 28° to 36° API gravity range. Two crude streams, Iran Heavy and Iran Light, account for more than 80% of the country's crude oil production capacity. The fact that historically the country has had little or no real spare capacity is one of the reasons that the country has tended to be a "price hawk" in OPEC meetings, not supporting expansion of overall OPEC production rather insisting on lower levels of production. Iran's OPEC quota is 3.36 mbbl/d and has sometimes had difficulty moving heavy, sour crudes at competitive prices, competing with light crudes of Persian Gulf neighbors.



Map 1: Select Oil and Gas Infrastructure including Major Oil and Gas Fields (Source: NIOC)

(2.3) Foreign Company Involvement in Iran's Upstream & Technology Access

It was recognized by the government of President Khatami in 1997 that foreign investment could help increase production and also assist with the development of the natural gas sector (more on Iran's natural gas in section 2.4). However, because the post-revolution constitution prohibits foreign concessions (or any foreign or private ownership of natural resources, and all production-sharing agreements (PSAs) are prohibited), a special type of investment vehicle was created called a 'buy-back agreement.' The buyback scheme can be defined as a risk service contract, under which the contractor is paid back by being allocated a portion of oil or gas produced as a result of providing services[2]. Hence, there is no formal share in the oil or gas field. Under these terms, over $40 billion was invested in the hydrocarbons sector between 1997 and 2004.

[2] Buyback is based upon a defined scope of work, a capital cost ceiling, a fixed remuneration fee and a defined cost recovery period. When buyback is used for both exploration and development, the specifications of the field to be developed are unknown at the time of contracting and therefore agreement on the scope of work, duration of development operations, ceiling for capital costs, fixed remuneration fee, and duration of cost recovery need to be deferred to the time when a commercial field is discovered.

The amount of investment and technology transfer that came in when some of the top European majors and independents made investments in this period was limited however in terms of scope, concentrated largely in the South Pars gas and condensate projects. From the mid-2000s this foreign investment, particularly by U.S. and European companies, has been curtailed, as concerns over problems with the U.S. government have created reluctance, and, more recently, certain U.S., European Union and UNSC sanctions have come into effect. Moreover, risk perceptions of Iran have increased, and the buy-back scheme has not always been globally competitive for attracting investment despite a modification in 2007 to make it more financially attractive.

Implications of sanctions for foreign operation are significant and directly affect the technological capabilities that can be brought to bear on Iranian fields. According to the IEA's recent Medium Term Oil Market Report, US and EU sanctions have had an immediate market impact on crude exports (detailed in section 4) , but they are also putting a stranglehold on Iran's oil production capacity in the medium term. The NIOC's finances have been severely strained, limiting the company's ability to fund even routine field maintenance work, infrastructure repairs and planned projects. Under-investment in exploration and production and the unavailability (in part due to sanctions) of the latest enhanced oil recovery (EOR) techniques (standard on large fields in most places in the world) may mean that decline rates are set to accelerate. Information on Iran's oil fields is very limited given the lack of foreign participants in the sector but estimates for field decline rates range from 8% to 12% in recent years. More than half of Iran's crude oil production is from fields discovered more than 70 years ago and are costly to operate in later stages. Iran started producing crude oil in significant quantities by the late 1940s from Agha Jari and Gachsaran, and these and other old fields are in desperate need of EOR methods and rehabilitation with new technology.

The pressure applied by sanctions has in turn seen the Oil Ministry increase pressure on the few foreign companies still operating in the country. The country's only remaining major foreign partners, CNPC (China's national oil company) and Sinopec, are under increasing pressure to fast-track stalled projects designed to increase capacity. The oil ministry has cancelled CNPC's contract for the massive 600 kbbl/d South Azadegan project in April 2014. CNPC signed the USD 2.5 billion contract three years ago and planned to develop the field in two parts, with Phase I scheduled to bring on 320 kbbl/d by mid-2014 and phase II scheduled to bring on 280 kbbl/d by 2017. To date, only 7 of around 160 planned wells have been drilled. CNPC retains its contract to develop the North Azadegan project however. Phase I is underway and expected to be completed by 2015-16 (75,000 bbl/d). Phase II expected to be completed by 2020 (75,000 bbl/d). Dramatically smaller volumes then those planned for the southern portion of the field. China's Sinopec is also falling behind at the Yadavaran field, with only limited progress despite an initial planned 2012 start-up. Sinopec, along with an NIOC subsidiary was awarded the contract for the 300 kbbl/d project. Current production is just 25 kbbl/d versus the plan to have output at 85

kbbl/d by 2012. There is no timeline to increase output further, which could likely lead to a cancellation of Sinopec's contract. The Chinese companies report that sanctions have caused chronic delays in bringing much needed equipment and technology into the country, with payment issues also being a major problem.

Increasing domestic needs and cuts in exports because of increased domestic consumption indicate fewer funds available for investment. NIOC claims that each barrel of new crude oil capacity costs between $7,000 and $7,500 to develop, but many analysts believe that the true figure is significantly higher. Bringing online the large new discoveries, particularly the important Azadegan (5.2 billion recoverable barrels) and Yadavaran (3 billion recoverable barrels) fields, will remain costly. Planned expansion of capacity at existing fields also continues to be delayed by lack of technology and equipment. Development at the offshore Foroozan field has been postponed again, to end 2014 at earliest now. At 60 kb/d of capacity, Foroozan was initially slated to be on stream in 2008. NIOC has pushed back the date with only small incremental volumes expected to start in late 2014. Smaller developments such as the 35 kb/d South Pars (condensate layer) has been pushed back to 1Q15 from 2013.

However, and as will be discussed in section 4.2, the reappointment of Oil Minister Bijan Namdar Zanganeh under Rouhani has attracted a lot of confidence from the analyst community in regard to attracting foreign capital and technological expertise to Iran's oil sector. What's more, the Iranian Oil Ministry is currently preparing a new upstream contract model to attract IOCs. It is expected that EOR projects for Iran's largest fields Ahwaz-Asmari, Marun, Gachsaran and Agha Jari will be the first on offer. The success of this however will depend on the outcome of the nuclear negotiations.

(2.4) Iran: A Sleeping Gas Giant

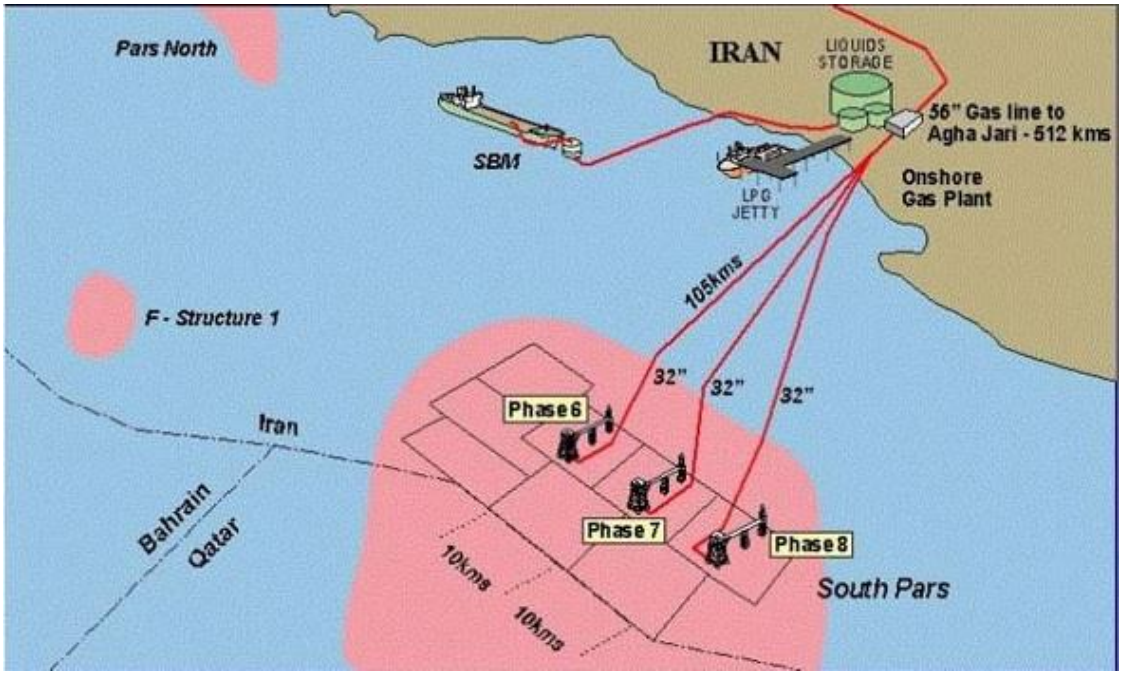
Iran is very comparable to its neighbor Iraq in terms of the underdevelopment of its enormous hydrocarbon deposits due to consistent rows with the international community – and this is especially true of Iran's gas fields. Iran's gas deposits are enormous, with reserve holdings being the second largest in the world, second only to Russia. According to Oil & Gas Journal, as of January 2014, Iran's estimated proved natural gas reserves were 1,193 Tcf, some 17% of the world's proved natural gas reserves and more than one-third of OPEC's reserves. The National Iranian Gas Company (NIGC) operates Iran's gas fields, although, particularly in South Pars, the presence of foreign companies has been considerable though sanctions have put much foreign company involvement on hold.

(2.4.1) South Pars Gas Field

One of the main reasons for Iran's enormous reserve figures is that part of the world's largest natural gas field (shared with Qatar in the Persian Gulf) falls partially in Iranian waters. This field is called the North Field by the Qataris (see Country Report: Qatar) with the Iranian section called South Pars (see Map 1). About 3,700 square km of 97,000 are in Iranian waters. Including both sections, the field is estimated to have reserves of nearly 51 tcm of gas. The estimates for the Iranian section are 14.2 tcm of gas in place and around 10.1 tcm of recoverable gas, which accounts for 36% of Iran's total proven gas reserves.

The Iranian section also holds 18 billion barrels of condensate (oil) in place of which some 9 billion barrels are believed to be recoverable. An issue for Iran in the medium to long term is whether the intensive development of the Qatari sector will hasten the day when South Pars developments begin to see the effects of overall reservoir depletion. This has already caused tensions between Qatar and Iran, and was one of the reasons why Qatar declared a moratorium in 2005 on new projects in the North Field that is expected to last until at least 2015, while reservoir studies are carried out.

South Pars, given its size, has a very large number of projects (28 'phases'), many of which have foreign participation through the buy-back scheme (see section 2.3 for definition). Iran has been increasingly looking toward Asian companies to invest, as Western companies have become hesitant to invest for reasons of political risk and sanctions. Overall, the 28 phases are forecast to produce at peak nearly 800 million cubic meters (mcm) per day. Each phase is producing or planned to produce approximately 40,000 bbl/d of condensates, for a total of 1.18 mbbl/d.



Map 2: South Pars Phases 6,7 & 8 for Reinjection at Agha Jari (Source: Statoil)

Phase	Foreign Company Presence	Expected Start Year	Gas Capacity (Bcf/d)
1*	Petronas	2004	1
2*	Total, Petronas, Gazprom	2002	2
3*	Total, Petronas, Gazprom	2002	2
4*	Eni	2004	2
5*	Eni	2004	2
6*	Statoil	2009	3.9
7*	Statoil	2009	3.9
8*	Statoil	2009	3.9
9*	-	2011	2
10*	-	2011	2
11	-	2020 +	2
12	PDVSA	2014	3
13	-	2020 +	2
14	-	2017	2
15	-	2015	2
16	-	2015	2
17	-	2016	2
18	-	2016	2
19	-	2018	2
20	-	2017	2
21	-	2017	2
22	-	2016	2
23	-	2016	2
24	-	2016	2

Table 1: Foreign Participation in South Pars. '' denotes already producing, '–' denotes no foreign presence.*

Currently, Phases 1 through 10 are producing. Phases 2 and 3 (part of the same development contract) is producing above target, at a combined 79 mcm/d. Gas from Phases 6 through 8 is used in large part for injection in the Agha Jari oilfield (see section 2.2). Many of the future phases are planned to be part of liquefied natural gas (LNG) export schemes or even piped gas exports to Turkey. Total (France) of Phases 2 and 3, Eni (Italy) of Phases 4 and 5, Statoil (Norway) of Phases 6-8 have suspended operations in South Pars. Most of the rest of the companies are Iranian, though some South Korean companies were involved in the construction phase of Phases 9 and 10, and Petronas and Gazprom are active in phases 1, 2 and3. In response to the exodus of Western companies, Iran has looked toward eastern firms, such as state-owned Indian Oil Corp., China's Sinopec and Russia's Gazprom, to take a greater role in Iranian natural gas upstream development. However, activity from these sources has also been on the decline because of pervasive sanctions imposed on technology and financial transactions, similar to what was described in section 2.3 for oil production.

(2.4.2) Gas Fields other than South Pars

Iran has other important natural gas fields besides South Pars. As mentioned, South Pars is only responsible for a minority (36%) of Iran's total proven gas reserves. Most of these fields are located onshore northeast of South Pars, but the three largest fields after South Pars are offshore as well (but wholly in Iranian territorial waters) – Kish, North Pars, and Golshan. These three fields alone have at least 3.45 tcm of proven reserves using a conservative estimate, with much higher figures for gas in place. Major onshore fields include Nar, Tabnak, Kangan, and Khangiran.

Total reserve figures are: Kish (70 tcf), North Pars (50 tcf), Lavan (66 tcf), Golshan (39 tcf), Forouz B (25 tcf), Ferdowsi (11 tcf) and Khayyam (7.3 tcf). These fields are currently not producing with many analysts not expecting production from these fields until 2020.

(2.4.3) Current Role in Global Gas

Gross natural gas production totaled almost 8.2 tcf in 2012, increasing 3% from the previous year. The South Pars field accounted for almost 40% of Iran's gross natural gas production. Of the 8.2 tcf produced, most of it was marketed (6.54 tcf), and the remainder was re-injected into oil wells to enhance oil recovery (1 tcf) or vented and flared (0.62 tcf). According to Cedigaz, Iran flared the second-largest amount of natural gas in the world in 2012, after Russia. In 2012, Iran exported 326 bcf and imported 188 bcf of dry natural gas (net exports of138 bcf), both via pipelines – accounting for less than 1% of global natural gas trade in 2012

Iran exports natural gas to Turkey, Armenia, and Azerbaijan. Almost 90% of Iranian exports went to Turkey in 2012 (see Country Report: Turkey, for a discussion of Turkey’s extensive pipeline system). In 2011, Iran received almost 30% of Turkmenistan's gas exports, but the share dropped to under 15% in 2012 (due to sanctions pressuring financial transactions). Nonetheless, more than 90% of Iran's natural gas imports still came from Turkmenistan in 2012, and the remainder was from Azerbaijan (as Iran exports natural gas to the isolated Azerbaijani exclave of Nakhchivan via the Salmas-Nakhchivan pipeline in exchange for Azerbaijani exports to Iran's northern provinces via the Astara-Kazi-Magomed pipeline).

Despite sanctions, Iran's natural gas production has grown, and output is likely to continue to increase in the coming years. FGE projects that Iran's gross natural gas production will increase to 10.6 Tcf in 2020, but that growth will depend on the pace of development of the South Pars field (which as discussed, is under significant pressure from financial and technological sanctions).

Iran does not have the infrastructure in place to export or import liquefied natural gas (LNG).

(2.5) Downstream Oil Sector

There is an extensive domestic network to take the crude to export terminals and refineries. Iran's gas export capacity however is relatively trivial (see previous section). Crude oil is exported via Persian Gulf island terminals to tankers that pass through the Strait of Hormuz.

(2.5.1) Oil export Terminals

The Kharg, Lavan, and Sirri Islands, located in the Persian Gulf, handle almost all of Iran's crude oil exports.

(i) *Kharg Island*: The largest and main export terminal in Iran accounts for roughly 90% of Iran's exports. Kharg's loading system has a capacity of **5 million bbl/d**. The terminal processes all onshore production (the Iranian Heavy and Iranian Light Blends) and offshore production from the Froozan field (the Froozan Blend). Its storage capacity is expected to increase to 28 million barrels of oil in 2014. Kharg island was the focus of attack by Saddam's airforce in the so called 'Tanker Wars' in the Iran-Iraq war.

(ii) *Lavan Island*: Bearing the name of the offshore fields, the terminal handles exports of the Lavan blend (light sweet). Lavan facilities have the capacity to process **200,000 bbl/d** of crude oil. Lavan has a two-berth jetty, which can accommodate vessels up to 250,000 deadweight tons. Lavan's storage capacity is 5.5 million barrels.

(ii) *Sirri Island*: The Sirri terminal processes crude from the Sirri offshore field complex, and includes a loading platform equipped with four loading arms that can load tankers from 80,000 to 330,000 deadweight tons. Its storage capacity is 4.5 million barrels.

In addition to crude oil (see section 4.1 for figures on Iranian crude oil exports under sanction), Iran also exports petroleum products. According to FGE, Iran exported about 240,000 bbl/d of petroleum products in 2013, most of which was fuel oil and LPG sent to Asian markets. Iran's petroleum product exports declined by roughly 40% in 2013 compared with the 2011 level – indicative of the adverse effects of sanctions.

The export terminals Bandar Mahshahr and Abadan (also known as Bandar Imam Khomeini), are near the Abadan refinery (Iran's 2nd largest) and are used to export refined products from the Abadan refinery. Bandar Abbas, located near the northern end of the Strait of Hormuz, is Iran's main fuel oil export terminal. Condensate from the South Pars natural gas field is exported from the Assaluyeh terminal.

Map 3: The Strait of Hormuz

The Strait of Hormuz is the world's most important oil chokepoint because of its daily oil flow of 17 million barrels (average in 2013), constituting about 30% of all seaborne-traded oil. The vast majority of Iran's exports flow through this route. Iran has a hand in controlling the strait, which at its narrowest point is 21 miles wide, leading many to be wary of the supply security risks, likely being a prominent factor in the presence of the U.S. 5th fleet in the surrounding waters.

(2.5.2) Refinery Capacity and Domestic Consumption

Iran is the second-largest oil-consuming country in the Middle East, second to Saudi Arabia. Iranian domestic oil consumption is mainly diesel, gasoline, and fuel oil. Total oil consumption averaged approximately 1.75 million bbl/d in 2013. As of September 2013, Iran's total crude oil distillation capacity was nearly 2.0 million bbl/d, about 140,000 bbl/d more than the previous year, according to FGE (see table below). Most of that increase came from expansion projects that were recently completed at the Arak and Lavan refineries.

The downstream sector is run by the National Iranian Oil Products Refining and Distribution Company (NIOPRDC). The nine refineries, at Abadan, Arak (Shazand), Bandar Abbas, Isfahan, Kermanshah, Lavan, Shiraz, Tabriz and Tehran, have a combined crude oil throughput capacity of 1.7 mbbl/d under optimal conditions.

Refinery	Crude Distillation Capacity (bbl/d)
Abadan	360,000
Isfahan	370,000
Bandar Abbas	345,000
Tehran	250,000
Arak	250,000
Borzuyeh	120,000
Tabriz	110,000
Shiraz	50,000
Kermanshah	25,000
Lavan Island	50,000
BooAli Sina	34,000
Booshehr	10,000
Aras	5,000
Total	**1,979,000**

Table 1: Oil Refineries in Iran (Source: Facts Global Energy, 2013)

Iran also extracts petroleum products at natural gas processing plants (naphtha and liquefied petroleum gas). A small amount of crude oil, approximately 4,000 bbl/d, is directly burned for power generation. In refinery capacity too, the effects of sanctions are felt as Iran finds itself in the highly perverse situation of being the 2nd largest oil reserve holder on the planet and yet imports petroleum products. In 2013, FGE estimates that Iran imported almost 17,000 bbl/d of petroleum products, of which roughly 85% was gasoline. Over the past several years, Iran's gasoline import dependence has decreased significantly however as a result of increased domestic refining capacity and subsidy cuts. Iran plans to increase gasoline production capacity at the Isfahan and Bandar Abbas refineries by the end of 2014.

Iran's energy prices are heavily subsidized, particularly gasoline prices. At the end of 2010, the government initiated the first phase of the subsidy reform, decreasing the subsidies on energy prices to discourage waste. Phase II of the subsidy reform was initiated in early 2014. According to FGE, gasoline prices have risen by 43% to 75%. As a result, gasoline consumption is expected to decline in the near term, cutting imports.

(3) Electricity

In 2012, Iran generated approximately 221 billion kilowatthours (Bkwh) of electricity, of which almost 95% was from fossil-fuel sources, according to Business Monitor International (BMI). Natural gas is the largest source of fuel for electricity generation in Iran, accounting for almost 70% of total generation. Oil, hydropower, coal, and non-hydro renewables made up the remaining fuel sources used to generate electricity in Iran, with marginal generation from a nuclear power plant that came online in 2011 but did not start commercial production until 2013. Iran's first nuclear power plant at Bushehr became operational in 2011 after many years of delay. Construction at the power plant originally began in the mid-1970s, but was repeatedly delayed

by the Iranian Revolution, the Iran-Iraq war, and more recently by problems associated with the Russian consortium that was awarded the construction contract. The Iranian government took control over the management of the plant in late 2013, around the same time the nuclear power plant began commercially producing power at its full capacity of 1,000 megawatts (MW), according to BMI. Two additional units are planned at Bushehr (see Map 4), each with a planned capacity of 1,000 MW, according to the World Nuclear Association. Iran's government plans to construct additional nuclear power plants, the next of which is likely to be a station near Darkhovin with a generation capacity of 360 MW, although initial plans included capacity of more than 1,000 MW. Iran, along with the UAE (see Country Report: UAE), other MENA country with concrete plans to develop power generation capacity from nuclear fuel. The discussion surrounding weaponization is discussed in section 4.

Under the Ministry of Energy, the two state-owned companies that run the sector and operate most of the power plants are the Iran Power Generation Transmission & Distribution Co. (Tavanir) and Tehran Regional Electricity Co. (TREC).

(3.1) Coal Utilization

Iran has a relatively small, but significant coal mining industry, unlike the other countries of the region, which do not have coal mining industries, except for a very small one in Egypt (see Country Report: Egypt) and a relatively significant sector in Turkey (see Country Report: Turkey). It is estimated that Iran produced about 1.7 million tons of coal in the most recent Iranian year. There are three large producers that produce the overwhelming majority of the Islamic Republic’s coal: Kerman Coal Mines Company, Eastern Alborz Coal Mines Company, and the Central Alborz Coal Company. Most of Iran’s coal has been used for industrial/metallurgical purposes, though a coal-fired power plant is under construction.

(4) Crude Oil and Nuclear: Iran's Energy Sector Holdup in the Face of Nuclear Program

Barring the possible aerial bombardment from American or Israeli air forces in select locations, and the greater backlash that could unleash, Iran does not share the internal security risks of its energy giant neighbor Iraq. However, sanctions related to financial and material support for terrorist activities abroad and the serious international security concern related to Iran's nuclear weapons program has critically affected Iranian energy – with persistent effects in the medium term.

While attention is still attracted by Iranian support for Hezbollah, Hamas and Shia militias in Iraq, diplomatic efforts are currently fixated on Iran's nuclear program. Iran is a signatory to the 1968 nuclear Non-Proliferation Treaty, but has been accused of uranium enrichment which can be used for civilian purposes, but also to build nuclear bomb. Iran has cleared the biggest hurdle to creating a nuclear bomb in learning to make the fissile material that fuels the massive blast. At Iranian facilities, centrifuges were discovered in operation spinning at supersonic speeds to separate the explosive uranium-235 isotope from uranium ore. The machines refine the metal to low enrichment levels to make fuel for nuclear power plants but they can also make higher-grade material for bombs.

As a consequence, in 2006, the UN Security Council passed Resolution 1696 and imposed sanctions after Iran refused to suspend its enrichment program. The United Nations Security Council has adopted six resolutions since 2006 requiring Iran to stop enriching uranium and co-operate with the IAEA. Skeptics aren't satisfied by IAEA verification however. They point to the example of Iran's two main uranium enrichment plants – a hardened bunker in Natanz and a mountainside chamber in Fordo — that Iran acknowledged only after they were exposed by people outside the country (see map below). In response IAEA is seeking deeper probing programs.

The US and EU have imposed their own sanctions on Iranian oil exports and banks. The EU imposed its own restrictions on trade in equipment which could be used for uranium enrichment and put in place an asset freeze on a list of individuals and organizations that, it believed, were helping advance the country's nuclear program. It also banned the individuals from entering EU member states. In January 2012, the EU froze assets belonging to the Central Bank of Iran, and banned all trade in gold and other precious metals with the bank and other public bodies. Six months later, an EU ban on the import, purchase and transport of Iranian crude oil came into force. The 27 member states had until then accounted for about 20% of Iran's oil exports. European companies were also stopped from insuring Iranian oil shipments, having previously underwritten 90% of them. In March 2012, Swift, the Brussels-based body that handles global banking transactions, cut Iranian banks from its system, making it almost impossible for money to flow in and out of Iran via official channels. In October 2012, the EU banned any transactions

with Iranian banks and financial institutions, as well as the import, purchase and transportation of natural gas from Iran, the construction of oil tankers for Iran, and the flagging and classification of Iranian tankers and cargo vessels. In February 2012 the US froze all property of the Central Bank of Iran and other Iranian financial institutions, as well as that of the Iranian government, within the United States.

The American view is that sanctions should target Iran's energy sector that provides about 80% of government revenues, and try to isolate Iran from the international financial system. Additional sanctions implemented in February 2013 effectively bar Iran from repatriating earnings from its oil exports, depriving Tehran of much needed hard currency. As with all other sanctions, countries that violate the new requirements risk being expelled from the US financial system, among other penalties.

The Islamic republic has repeatedly questioned the legal basis of demands to suspend work, and before it made any concessions, Iran wanted what it calls its “right” to enrich uranium recognized. Evidence the heavy sanctions in place however, have begun to dissuade the calculus of the Iranian leadership were realized in November 2013 when world powers agreed to a temporary accord setting limits on the Islamic Republic’s nuclear program in exchange for about $7 billion in relief from sanctions. The Joint Plan of Action (JPOA) was established between Iran and the five permanent members of the United Nations Security Council (the United States, United Kingdom, France, Russia, and China) plus Germany (P5+1).

Under the JPOA, Iran agreed to scale back or freeze some of its nuclear activities during negotiations in exchange for some sanctions relief. The JPOA aims to reach a long-term comprehensive plan that ensures that Iran's nuclear program is peaceful, which may lead to the lifting of international sanctions. Under the first extension, Iran agreed to maintain caps on the amount of material it produces during the negotiations. The International Atomic Energy Agency, which is tasked with verifying that enrichment is used strictly for peaceful purposes, has tracked Iran’s build-up of 5-percent and 20 percent-enriched uranium. The stockpile of higher-grade material, which is the bigger concern because it could be further purified into weapons grade at short notice, has been reduced by half through diluting it to no more than 5 percent enrichment. Iran also agreed to improve cooperation with monitors and halt advanced centrifuge installation, agreeing also not to use installed centrifuges not yet in operation. It pledged to stop work on its Arak heavy water reactor, which, if it became operational, could produce plutonium and give the country a second path to nuclear weapons.

In the map below, the red circle number 1 concerns the (concealed and fortified) enrichment complexes at Natanz and Fordo, and the red circle number 2 concerns the heavy water reactor Arak that could produce plutonium – potential weapons material – as a byproduct. Curbing activity at Natanz, Fordo and Arak has been by many accounts viewed as a success in the interim agreement.

Map 4: Outline of Nuclear Projects in Iran

(4.1) Effects of Sanctions on Iranian Energy & the November 24th Talk Outcomes

The sanctions detailed in the previous section are some of the world's most comprehensive and the implications for oil exports have been severe. Production has fallen from an average of 3.7 mbbl/d in 2010 and just over 3.6 mbbl/d in 2011 to an average of 2.68 mbbl/d in 2013, as can be seen in the graph below.

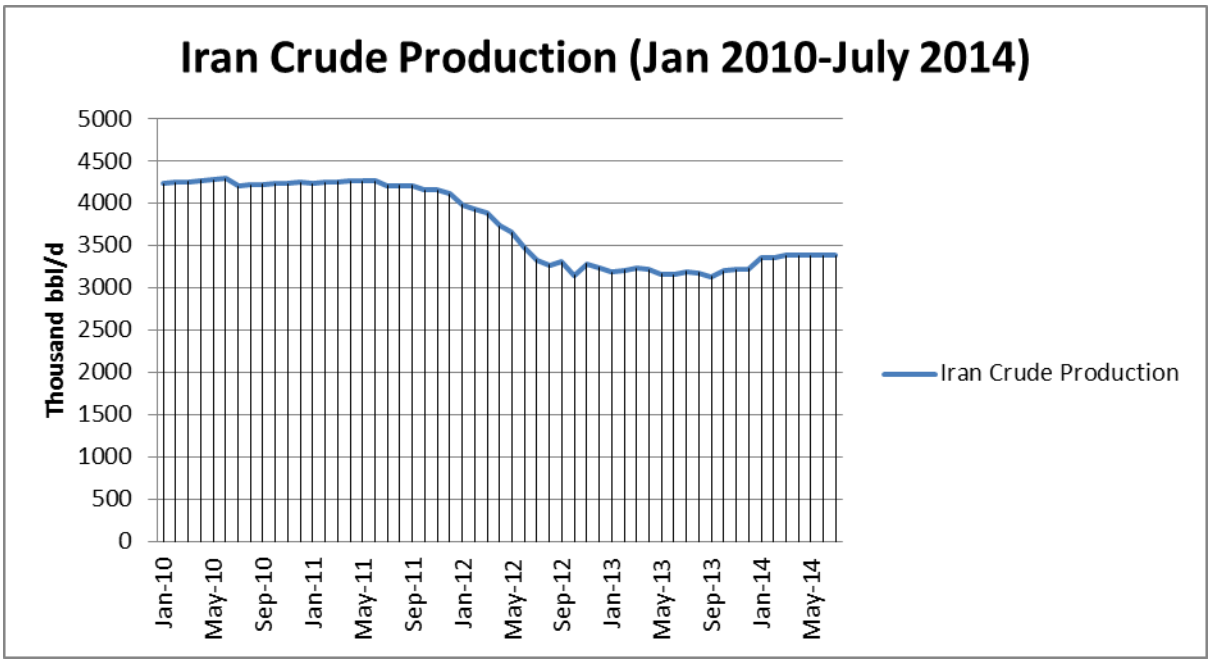


Chart 2: Iran Crude Production since January 2010. Source: EIA

As for medium term consequences the IEA in 2014 expects that Iran's oil production capacity is expected to remain largely unchanged out to 2020, growing perhaps by 50,000 bbl/d to 3.11 mbbl/d – capacity growth well below what some had hoped for Iran had the nuclear issue not reached the critical stages which it is currently in.

Envoys representing Iran and a group of world powers agreed on November 24th, 2014 to extend nuclear talks until June 30th 2015 after failing to overcome differences at negotiations in Vienna. Many had hoped that the breakthrough deal would have emerged at this time. The extension will keep in place the terms of the JOPA interim agreement that was struck a year ago and USD 700 million in Iranian assets will be unfrozen per month. Western officials said they were aiming to secure an agreement on the substance of a final accord by March 2015 but that more time would be needed to reach a consensus on the all-important technical details. Iranian President Hassan Rouhani has said the gap between the sides had narrowed at the latest round of talks in Vienna. But he made clear that Tehran was taking a firm line at the talks. "There is no question the nuclear technology and facilities of the Islamic Republic of Iran will remain active and today the

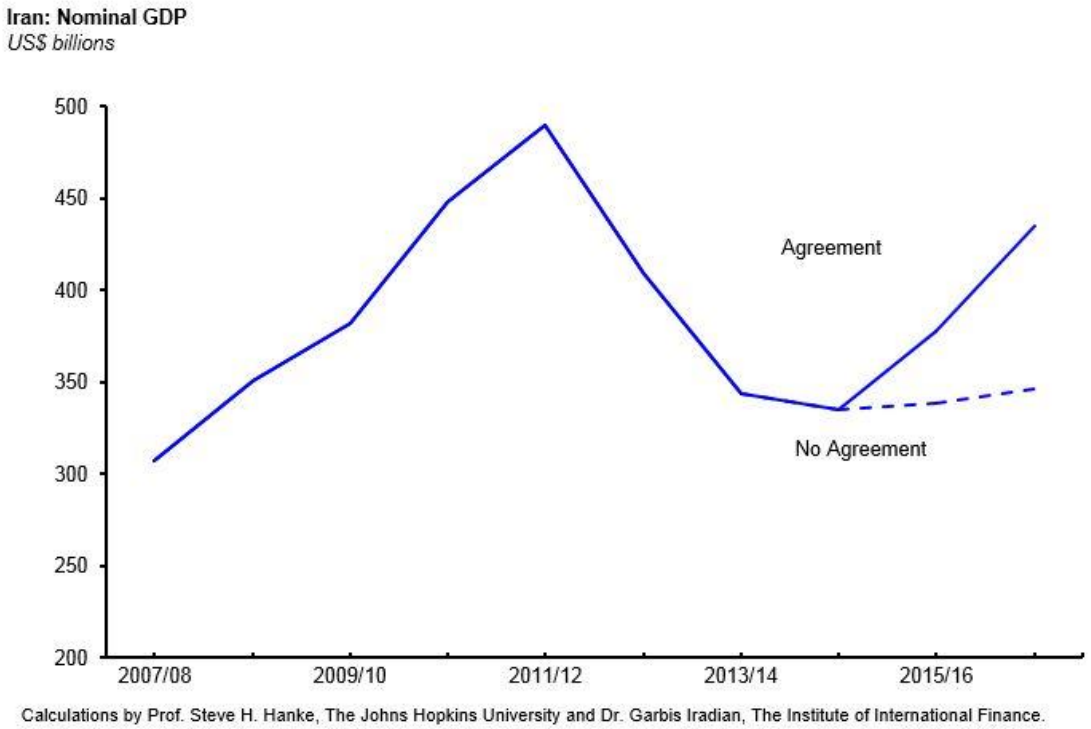
negotiating sides know that pressure and sanctions against Iran were futile," he said. Rouhani faces heavy pressure from hardline conservatives at home who have already blocked his drive to ease restrictions on Iranians' individual freedom. But John Kerry, the U.S. Secretary of State defended the decision not to abandon the talks. "We would be fools," he said, raising his voice, "to walk away from a situation where the breakout time (for Iran to develop a nuclear weapon) has already been expanded rather than narrowed, and the world is safer because this program is in place."

(4.2) What Iran Stands to Gain

As mentioned, the IEA does not maintain a high growth forecast out to 2020 but maintains that, even had an agreement been reached Nov. 25th or if an agreement is reached by June 2015, it will still be post-2018 before any significant volume increases would materialize simply because of the slow moving nature of the industry and historical experience of (uninhibited) operations in Iran. Nevertheless, were a deal to be struck a full lifting of sanctions would occur and certainly improve production prospects beyond 2020. Oil Minister Bijan Namdar Zanganeh has stated that Iran could boost output by 700,000 barrels a day within two months of the removal of sanctions – or nearly all production currently off the market due to sanctions. Furthermore, signaling the Islamic Republic's readiness to court American business interests amid a potential deal, Zanganeh mentioned that he would like Total, Shell, Eni, Statoil, BP, Conoco Philips and Chevron to return to the country. As discussed, western companies are still banned by their governments from investing in Iran's oil and gas fields, and June 2014 is the first time Iran has named particular U.S. companies it would like to enter the country. In the 1990s, ConocoPhillips and Chevron tried to enter Iranian oil projects but their efforts were scuttled when Washington banned such investments for American companies. Many European companies, such as Total and Shell, did move in before being forced to completely pull out when the European Union forbid their presence in 2010. BP's name stands out in this group of European companies because it didn't enter Iranian projects after the Islamic Revolution. BP's predecessor company, Anglo-Iranian Oil, played a controversial role under the previous regime of the Shah. A BP spokesman said Iran "has not had access to a lot of recent technological developments in the oil and gas industry.

Additionally, although Iran's aspirations to build a liquefaction facility date back to the 1970s, the country has yet to build one. The lifting of sanctions could finally see liquefaction facilities introduced for the world’s second largest reserve holder. Pipeline projects, which are also currently scuttled, to gas hungry MENA neighbors could also be realized.

According to the Cato Institute, the economy would boom with real GDP growth rates forecast during the fiscal year 2015/16 and 2016/17 to jump by 4.1 and 4.6 percentage points, respectively. And for those two fiscal years alone, the cumulative GDP would be $125 billion greater than if the sanctions were left in place.



The election of President Hassan Rouhani in June 2013 brought about widespread expectations of economic improvements and greater international engagement among the Iranian public. The supreme leader, Ayatollah Ali Khamenei, has the last word but his role is to adjudicate between the claims of an elite made up of thousands of politicians, clerics, generals, academics and business people. They form an ever-shifting pattern of competing factions and coalitions which while hardly amounting to a democracy approximates a political marketplace and, as former President Ahmadinejad discovered, policies that tack away from the consensus do not last. If a decision is reached it will track the consensus reached in this group. The hope is the significant economic and development boom that will likely occur following a deal eliminating Iran's nuclear weapons capability will prove to be an outcome of greater interest to this influential elite than the present path which maintains strict sanctions crippling Iran's energy potential.

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