

Iran's oil development scenarios by 2025

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HIGHLIGHTS

- ▶ Iran's energy state is evaluated.
- ▶ Oil future scenarios which developed by Iranian parliament, have been analyzed.
- ▶ 4 scenarios that express different modes of production and consumption are developed.
- ▶ Comprehensive analysis on the geopolitical, geo-economic and geo-cultural situation.
- ▶ Recommendations to Iran's energy policy framework.

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ABSTRACT

Energy resources in Iran consist of the fourth largest oil reserves and the second largest natural gas reserves in the world. At present, due to political reasons, the investment trend does not go over well. Based on the Fifth Development Strategy, Iran needs \$200 billion of investment in the country's first industry (i.e. oil), and given the objectives of the perspective document, the country needs more than \$500 billion investment during the next 15 years. This paper examined Iran's energy status. Afterwards, oil future scenarios which developed by Research center of Iranian parliament, have been analyzed. Then four scenarios that express different modes of production and consumption are developed, namely: Thunder, Behemoth, Snowman, and Poor Addict. Finally, a comprehensive analysis for achieving the secure and sustainable future on the geopolitical, Geo-economic and Geo-cultural situation is presented.

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1. Introduction

Various objectives have been mentioned in Iran's oil and gas industry perspective for the horizon of 2025, some of which are considered to modify consumption patterns and others to determine the rate of production and exports. One of Iran's primary goals is to maintain the position of second largest crude oil producer in the OPEC which requires maintaining proper distance from other competitors of this position in terms of creating production capacity (Ministry of Petroleum of I.R. Iran, 2012).

According to this perspective document, in 2025, Iran will cover 7% of the share of world oil supply (Fars News, 2006).

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Currently, world oil consumption is 84.5 million barrels per day, 7% of which equals to 5.6 million barrels per day (Ministry of Petroleum of I.R. Iran, 2009). Of course, the increasing share of world demand until 2025 should be added to this amount. On the other hand, Iran's current production is about 3.6 million barrels which represents a 500,000 barrel decrease compared with the last year (Fars News, 2010a). Fig. 1 shows Iran's oil fields which include totally 102 oil fields and 205 oil reservoirs. As Iran's mature oil fields are in need of enhanced oil recovery (EOR) techniques such as gas injection to maintain production, with current technology, it is only possible to extract 20% to 25% of the oil in place (EIA (Energy Information Administration), 2011b).

According to the above mentioned issue, it can be concluded that based on the perspective of oil industry, Iran should increase the rate of production by 2 million barrels per day up to the next 15 years. In other words, the average growth rate of oil production must be 130,000 barrels per year in order to reach the determined rate in the perspective document. One of its initial

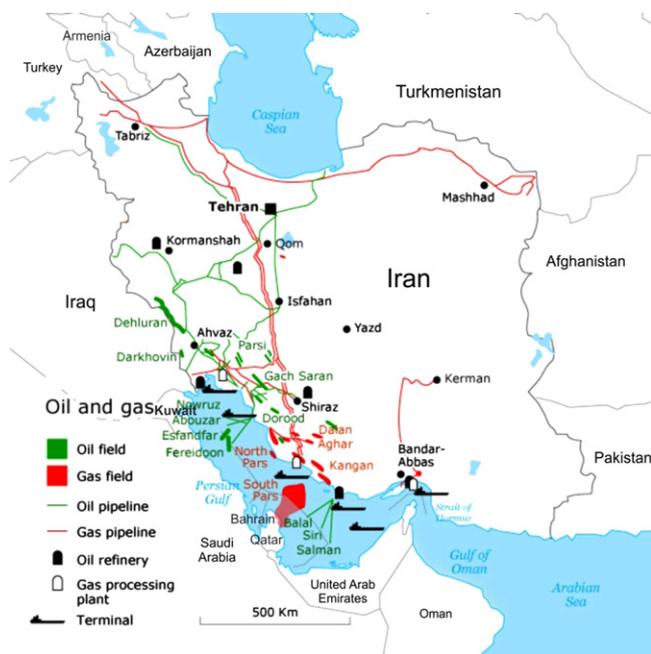


Fig. 1. Iran's oil fields (Fanack, 2012).

conditions is to provide the required capital and technical knowledge. At the same time, Iran must substitute additional capacity because of its delectable aged oil fields.

At present, due to political reasons, the investment trend does not go over well. Based on the Fifth Development Strategy, Iran needs \$200 billion of investment in the country's first industry (i.e. oil), and given the objectives of the perspective document, the country needs more than \$500 billion investment during the next 15 years. According to experts, annual production rate of oil reserves decreases due to the increased age of the reservoirs and entering into the second half of their lives, and also, lack of proper implementation of policies to maintain pressure and plus higher pressure of reservoirs. In order to stabilize the current oil production capacity and to maintain and increase production, there is also a need for investment on maintenance projects in oil fields, and part of capital should be allocated for explorations and drillings new wells in order to produce and develop fields that are faced with declining production rate, and another part should be allotted to operate the defined phases of South Pars with the aim of injecting, maintaining or increasing reservoir pressure (consolidation of production).

The paper has been organized as follows: Section 2 describes the Iran's energy status. Section 3 develops four scenarios that express different modes of production and consumption, namely: *Thunder*, *Behemoth*, *Snowman*, and *Poor Addict*. Section 4 gives a summary about the paper results. Suggestions for the future associated with paper results and findings are highlighted in Section 5.

2. Iran's energy status

Iran is the second largest economy in the Middle East and North Africa in terms of GDP—US\$400 billion in 2011 (after Saudi Arabia) and in terms of population—78 million people (after Egypt) (World Bank, 2012). Energy resources in Iran consist of the fourth largest oil reserves and the second largest natural gas reserves in the world (World Fact book, 2012). In recent years, Iran's energy demand has increased by 6.2%. Oil and natural gas constitute 41% and 58% of this amount, respectively, and are the primary energy sources for Iran. The rate of oil consumption by

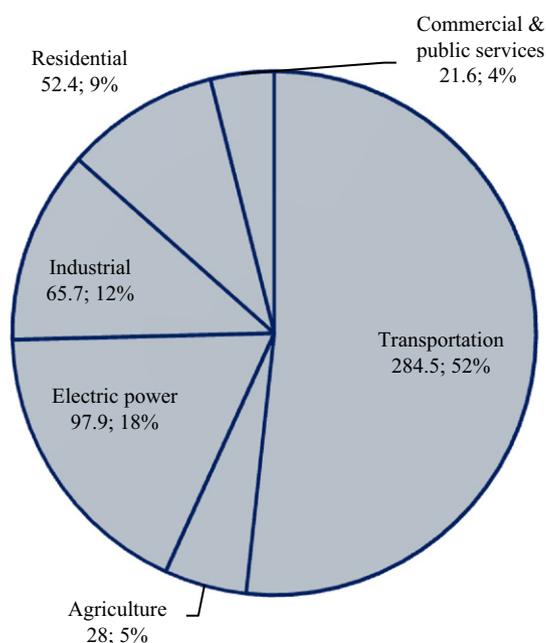


Fig. 2. Pie chart of oil consumption by sector for Iran in 2009 (Data in Mtoe and in percentage).

Source: (NIOPDC (National Iranian Oil Products Distribution Company), 2009).

sector for 2009 is shown in Fig. 2. With consuming more than half in transportation sector, this rate is fueled by many factors, including fiscal policies structural, as well as infrastructural factors (Mazraati, 2007). The vehicle ownership (intensity), efficiency of vehicles, public transportation, transport infrastructure, per capita income, cost of vehicle use, and fuel prices are among the factors which are shaping the trend of oil demand in this very important sector (Mazraati, 2007).

In order to make opportunity for oil exports, gas is used as domestic fuel. Since 2000, the largest demand growth among all types of energy carriers has been observed in natural gas sector with an annual increase rate of 10.7% (Azadi and Yarmohammad, 2011). In 2010, Iran produced approximately 4 million barrels (bbl) of total liquids per day, of which roughly 3.7 million bbl/d was crude oil, equal to about 5% of global production (EIA (the US Energy Information Administration), 2011a). Iranian total oil production and consumption from 1997 to 2010 is seen in Fig. 3.

In Fig. 4, primary energy consumption shows a growing trend while fossil fuel resources with an unprecedented trend are declining. Iran similar to other countries is faced with the growth of greenhouse gases. Under such circumstances, it seems a change in "strategic national energy plan" is in order. Table 1 presents an overview about energy in Iran from 2004 to 2009.

For developing the strategic national energy plan, renewable energies must be considered more than ever. Currently, Iran's renewable energy consumption is low. With 9% of the world's oil reserves and 15% of its natural gas reserves (80% of which have not been developed), Iran has an abundant supply of fossil fuel resources, which tends to discourage the pursuit of alternative, renewable energy sources (Mostafaeipour and Mostafaeipour, 2009). However, Iran has plans to generate more than 5,000 MW of electricity from renewable energy resources by 2015.

Renewable energies have great potential in the country and can significantly decrease the pressure on petroleum industry in provision of domestic needs. For instance, studies carried out in the field of wind energy indicate that in just 26 regions (including more than 45 suitable sites) the nominal capacity of the sites is around 6500 MW, considering a general efficiency of 33%,

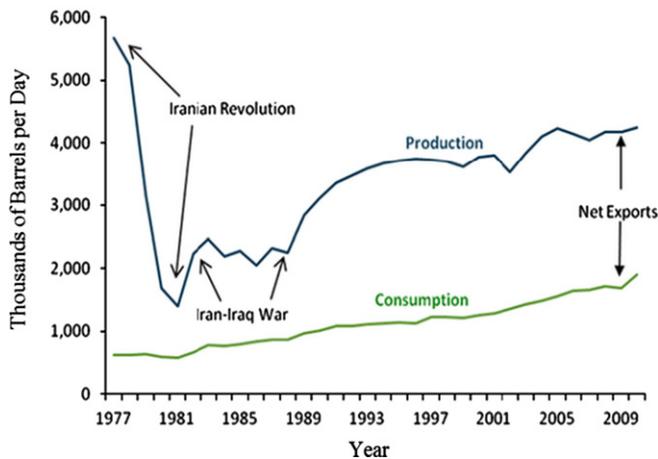


Fig. 3. Iranian total oil production and consumption.
 Source: (EIA (Energy Information Administration), 2011b).

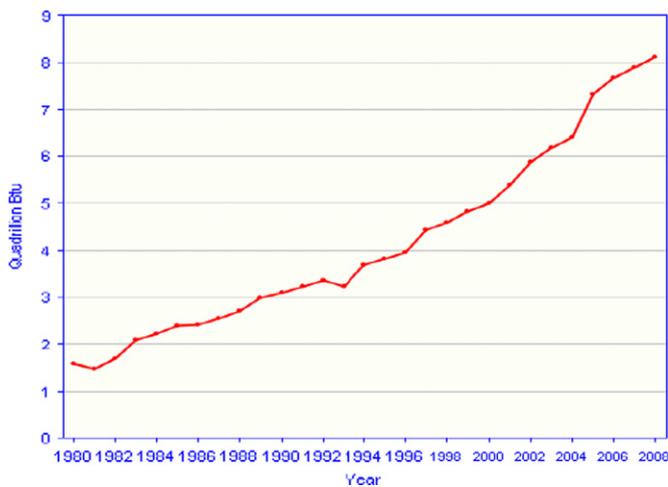


Fig. 4. Iran's primary energy consumption.
 Source: (EIA (the US Energy Information Administration), 2010).

Table 1
 Iran's energy situation ^a (IEA, 2011, 2010, 2009, 2006).

Year	Capita (Million)	Prim. Energy (TWh)	Production (TWh)	Export (TWh)	Electricity (TWh)	CO ₂ -emission (Mt)
2004	67.0	1696	3233	1530	137	369
2007	71.0	2151	3757	1602	165	466
2008	72.0	2350	3801	1429	174	505
2009	72.9	2514	4068	1537	168	533
Change 2004–2009	8.8%	48.2%	25.8%	0.4%	22.4%	44.4%

^a Mtoe = 11.63 TWh, Prim. energy includes energy losses.

whereas the total nominal capacity of power plants is 60,000 MW (currently). As for solar energy, there are 11 projects pertaining to solar energy which are being utilized or carried out by the Ministry of Energy (Iran). The total solar electricity generation in 2004 was 14.020 MW. This rate has reached 67 MW by the end of 2010. These advances can be seen more or less in other renewable energies as well and in the case of government support, one can hope to see the extensive presence of new energies in the national energy consumption basket in two decades.

3. Oil development scenarios

Iran is a member of the Organization of the Petroleum Exporting Countries (OPEC). Fig. 5 shows that OPEC Crude Oil Production in 2010. Oil reserves are estimated at about 16,241.24 bl (Billion liters), about 11% of world proven reserves, which account for 16% of the world's total known reserves (Hessari, 2005). Oil production is projected to grow from 4.1 mb/d (million barrels per day) in 2004 to 4.5 mb/d in 2010 and to 6.8 mb/d in 2030 (EIA (the US Energy Information Administration), 2011a). Fig. 6 shows that top proven world oil reserves as of January 1, 2011.

Four scenarios can be considered for Iran's oil production and consumption as concurrent analysis that express different modes of production and consumption: *Thunder*, *Behemoth*, *Snowman*, and *Poor Addict*. Before introducing these scenarios, it is necessary to consider the discussions of the future of the production and consumption separately and then to combine them at the next sections.

Fig. 8 represents two trends for crude oil production in 2025. The first forecast of oil production assumes that the necessary investments in exploration, drilling and production fields will not be made. So, by increasing the operational life of oil wells and the declining trend of the production reservoir pressure, the production rate of reservoirs is going to be reduced. As oil production statistics indicate (Fig. 7), Iran's oil production has had a decreasing trend since 2006 due to reduced pressure of reservoirs. Reduction of oil production in the last 3 years has averaged about 500,000 barrels per day (Fars News, 2010b).

The second forecast of oil production in Iran takes into account as optimistic forecast. By considering this scenario, most country's investment plans move forward to the increasing of the oil production. Hence, average annual production of 130,000 barrels per day is added to the country's hydrocarbon resources. In this



Fig. 5. OPEC Crude Oil Production 2010, Thousand barrels daily (BP, 2011).

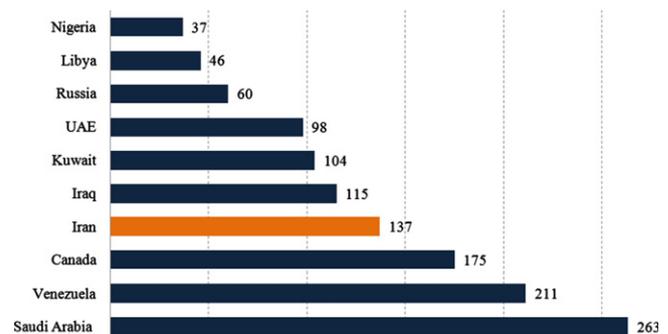


Fig. 6. Top proven world oil reserves as of January 1, 2011, billion barrels (EIA (Energy Information Administration), 2011b).

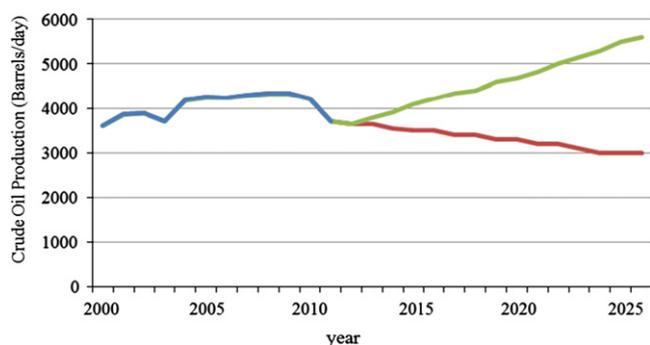


Fig. 7. Status of Iran's crude oil production to 2025.
 Source: (BP (British Petroleum), 2010).

case, based on the goals set in the perspective document for oil industry, Iran will cover 7% of oil production in 2025. To fulfill this condition, it is necessary to draw foreign capitals into the country. There are more reasons about the trend of foreign investment have not been put in place. Among the main stated reasons in this regard include the existence and intensity of international sanctions as well as types of oil contracts.

In recent years, Iran's nuclear program has led to imposing intense resolutions and international sanctions (catching of technology or investment). US-led sanctions against Iran are costing OPEC's third-largest producer \$133 million a day in lost sales without raising global crude prices.¹ Hereunder are some key facts in the same connection:

- Iran's oil shipments have plunged by 1.2 million barrels a day, or 52%, since 1 July.
- Current exports at 1.1 million barrels a day.
- Lost sales are valued at \$133 million a day, based on the 2012 average price of \$110.60 a barrel.
- This would cost Iran \$48 billion in lost revenues, equal to 10% of its economy, each year.
- Drop in Iranian supplies encouraged more outputs by others like Saudi Arabia.
- Saudi Arabia also pumping more oil to dull Iran's threats to close the Strait of Hormuz.
- Iran sanctions show little effect on international oil markets: Brent oil has dropped 3.7% to \$106.51 a barrel since January, US paying 6.2% less than a year ago for imported crude, US output from fields highest in 13 years, stockpiles also at all-time highs, low oil prices encouraging the US to pursue the sanctions against Iran stronger.

These new round of sanctions have made the progress and development of oil industry more costly. Mostly these costs associated to the fact that the large transnational corporations which have already invested in oil and gas projects have quitted, and have been replaced by smaller internal companies or not-so-famous foreign companies. Besides, the numbers of interested countries in Iran's energy are continuously declining as recently, Azerbaijan's State Oil Company (OSCAR) announced that Iran's Naftiran Company (NICO) has been removed from plans to export natural gas to Europe, including Trans Anatolian gas pipeline (TANAP). However, in response to these new sanctions, and in order to avoid declining production, some decisions were made by Iran's Government for the country's energy sector, namely: finding new customers and investment in industries related to oil,

particularly in the research and development section and facilities for conversion industries to avoid crude oil sale trap. Furthermore, Supreme Leader Ayatollah Khamenei called on the government to adopt a "resistance economy" in order to respond to pressures. He suggested "petrol rationing" as one idea for implementing a resistance economy.

In response to why foreign companies fail to participate actively in oil and gas projects is the issue of oil contracts (especially the buyback) and that such contracts are not very attractive for foreign companies. At present, many efforts have been exerted for changing the funding models as well as serious revisions on this type of oil contracts. For a comprehensive analysis of development scenarios, it is necessary to look at the trends in energy consumption in the country. Fig. 8 represents the consumption trend of primary energy until 2010.

Some points are noteworthy in relation to the primary energy consumption in Iran: First, the primary energy consumption in Iran is extremely ascending, and because of low fuel prices, the resulted exhaustion and also lack of equipment efficiency, the energy intensity is much higher than other countries. The second issue is the stabilized oil share in primary energy supply in the country, which is due to increased gas production and its replacement by oil. The Research Center of Iran's Parliament has examined oil status scenarios in three modes, namely optimistic, base and pessimistic:

In the first scenario which is a pessimistic scenario, Iran will be among the oil-importing countries up to the next 8 years. The increasing world economic growth which leads to increased demand and energy consumption will bring many vicissitudes during the next decade. One of these changes that can lead to higher crude oil prices is the increased energy consumption of oil producing countries. According to New York Times, some countries that today are the producers of crude oil will become the importer of this production during the next 10 years due to increased domestic consumption (which is a result of positive economic and population growth). If the needed investment is not made in Iran, and crude oil production capacity remains the same, given the increased energy consumption trend there will be no oil for export in the next 4 years. According to experts, in case of the operation of the refineries under construction, Iran's crude oil consumption will increase up to 3.6 million barrels per day. According to this scenario, if the needed investment is not made in the development of oil fields, with a pessimistic view, Iran's oil exports will be zero up to the next 8 years, and Iran will become an oil importer country from an oil exporter one. In the base scenario, this time will be increased to 16 years.

The optimistic scenario assumes that there will be \$4.5 billion investment to avoid a decrease in exports in oil field development. In this scenario, assuming a constant export rate for the country, the 12.5% of Iran's share in OPEC oil basket in 2007 will

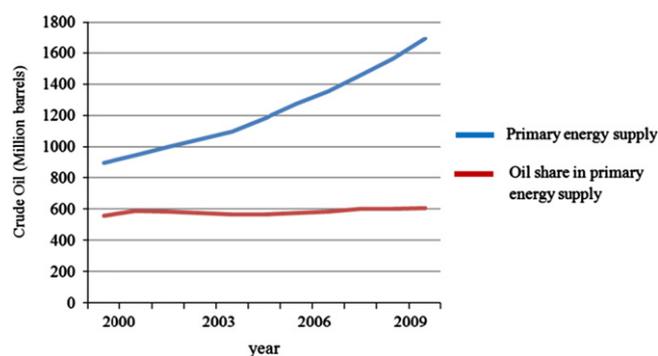


Fig. 8. Iran's primary energy supply and oil share until 2010.
 Source: (Ministry of Petroleum of I.R. Iran, 2008).

¹ Bloomberg, August 3, 2012.

be reduced to 5.7% up to 2030 which will lead to a decline in the country's influence on regional and global equations.

However, with the implementation of the Targeted Energy Subsidies Act, the scenario presented by the Research Center of Parliament seems unlikely in some ways. Because in this scenario, an increasing trend is considered for oil consumption; while with the enforcement of this Act, certainly the trend in oil consumption will be adjusted. For example, within a short term following the implementation of the Targeted Energy Subsidies Act, oil consumption has dropped by 9%, gasoline 26%, gas 6% and electricity 11% and in total, the country's primary energy consumption has been reduced.

The driving forces in the issue of Iran's future oil resources are several factors. Some of the most important ones include: foreign investment, proper reservoir management, and production and consumption technologies. In recent years, production and consumption trends are moving against each other. Oil production has decreased while its consumption has increased. Oil prices also have increased significantly but now its slope is decreasing.

The future of oil is accompanied by various uncertainties in a wide range, some of which will have small effects and others will have dramatic impacts. In some cases, uncertainties will be in the country's interests and in other cases, will be at the expense of the country. Among uncertainties of oil fields, the followings can be pointed out: exploration of large reservoirs in new regions that are under study, oscillation in oil prices, increased demand for Iranian oil and removing of sanctions or reducing demand and tightening of sanctions, access to new technologies, and increase in the recycling rate up to 100%.

3.1. Methodology

Visualization is one of the scenario development methods. This technique is among judgmental methods, which their information is presented in Table 2. According to Peter Bishop's study, who is one of the pioneers in the scenarios development techniques, starting point of this method is personal information (focusing on present data and researchers' ingenuity), unconscious ideas and values. The procedure of this method includes relaxation and stimulation of imagination.

Bivariate minimal approach is used to implement relaxation and stimulation of imagination procedures. According to Pillkahn, Using Trends and Scenarios as Tools for Strategy Development, in the minimal approach scenarios are developed by two basic and important criteria that can affect future (Pillkahn, 2008). These two criteria contain a lot of information and represent other

changes in future elements. Oil production and consumption are significant future elements from the perspective of supply and demand. Meanwhile, future behavior of these criteria causes different scenarios development. Each one of these scenarios has also its consequent events. Therefore, the main frame of scenario development is to study the probabilistic changes in the oil production and consumption as the two essential criteria indicating future condition of oil in Iran. Methodology of scenario development is a combination of visualization and cross impact analysis, which is illustrated in Fig. 9. Assumptions and their appropriate trends in the case of oil production and consumption are summarized in Table 3.

3.1.1. Combining trends and scenario development, using minimal approach

The cross impact matrix is created to study the effect of different trends on each other; where the matrix elements indicate the degree of importance (Table 4). The Delphi method is used to fill this matrix. The Delphi panel participants were asked about the conditional probability of occurrence of each cell and the average of their answers was placed in each cell after it was corrected by an expert's opinion. The output of cross impact matrix is used as the input for the scenario development.

The numbers inside each cell indicate the conditional probability of two trends impact on each other. For example, $P(T1|T4)=0.8$ is the probability of occurrence of T1, provided that T4 is occurred. It is also assumed that $P(Ti)=P(Tj) \forall i, j=1,2,\dots,6$.

The output of the cross-impact matrix suggests that the combined trends T1T6, T1T4, T4T3 and T4T2 have high scores. The perspective of combined trends forms the initial structures of the scenarios. Table 5 presents the results of cross impact analysis for attaining the initial structures of scenarios.

After obtaining the main framework of the scenarios, the scenarios have been built according to the assumptions and the combined trends of each one of them, the results of which are presented in the next section.

3.2. Thunder scenario

In this scenario, the combination of roughly constant consumption-high production is considered. Under this scenario, by replacement of gas in the transportation sector, using renewable energies and particularly solar and wind in some province, oil consumption is almost constant or with low growth along with

Table 2
Judgmental scenario developing techniques (Bishop et al, 2007).

Technique (Judgmental)	Starting point	Process	Product
Genius	Personal information	Thinking, imagining	One or more scenarios
Visualization	Personal information unconscious ideas, values	Relaxation, Stimulation of imagination	One or more scenarios
Role playing	Personal information, unconscious ideas, values	Act out one or more pre-arranged conditions	One or more scenarios
Coates and Jarratt	Personal or team information	Define domain and time horizon, identify conditions or variables of interest, develop scenario themes, estimate values of conditions and variables under each scenario theme, write the scenarios	Four to six scenarios



Fig. 9. Methodology of scenario development.

Table 3
Assumptions and trends in the case of oil production and consumption.

Assumptions	Trends
Because of foreign investment, the oil production is increased and the technology level will experience a significant rise.	T1—Rise in export, discovery of new sources, increases in the added value of oil production.
Due to the lack of foreign investment, technology gap and widening the sanction's impacts, the oil production will be low.	T2—Reduce in export, moving toward oil import, Loss of Iran position in the OPEC.
Oil production will stay fixed.	T3—Continue on the current trend (Business as usual).
The oil consumption will increase due to the population growth as well as lack of attention to other resources, including renewable resources.	T4—Focusing on the enhancement of oil resources, concentration on local politics to increase the resource access in order to gain short-term political popularity.
The oil consumption will decrease thanks to the replacing gas in transport and focus on the other renewable energy resources.	T5—Enlargement of renewable energy share in the energy consumption basket in the country, Reaching to 16% share by 2016, high oil export
Oil consumption will stay fixed.	T6—Continue on the current trend (Business as usual).

Table 4
Cross impact matrix.

Trends	T1	T2	T3	T4	T5	T6
T1		0.4	0.3	0.8	0.2	0.9
T2	0.4		0.2	0.8	0.4	0.2
T3	0.3	0.2		0.94	0.4	0.4
T4	0.8	0.8	0.94		0.4	0.2
T5	0.2	0.4	0.4	0.4		0.4
T6	0.45	0.2	0.4	0.2	0.4	

Table 5
Cross impact matrix results for specification of scenarios framework.

Combination of trends with high occurrence probability	State of production factor	State of consumption factor	Scenario name
T1T6	High	Constant	Thunder
T1T4	High	High	Behemoth
T4T3	Constant	High	Snowman
T4T2	Low	High	Poor Addict

increased production which lead to increased exports, and increased regional power of the country. That is why this scenario is named Thunder. With the implementation of the Targeted Energy Subsidies Act and development of gas industry in various sectors, it is expected that the country's oil consumption have little growth up to 2025 to reach 1.88 million barrels per day.

In this scenario, the aim of high production is to achieve the perspective targets which can be extended up to 5.8 mb/d. Increased production is realized by using state-of-the-art technologies and necessary investments. Due to the reasons listed for the reluctance of foreign companies for sufficient investment, Iran's officials must increase their efforts to solve this problem.

In this way, reaching a breakthrough on Iran's nuclear program and consequently removal or reduction of the West sanctions against Iran could do a great aid to return large companies in order to invest in oilfields in Iran. In addition, granting concessions and persuasive policies of the government for the presence of foreign investors and large oil companies could be a huge step forward in the reconstruction of old fields and oil pipelines.

3.3. Behemoth scenario

If oil consumption growth is high and also production rates are high, we enter the Behemoth scenario.

To explain the increase in production and consumption of oil, rising inflation caused by macroeconomic policies of Iran in the next decade will be considered. By producing more oil than ever and utilizing the revenues derived from sales, the next government will purchase required merchandises to curb the wild inflation. According to BP's perdition suggesting the increase in global oil prices in upcoming years, the government is willing to produce and sell more oil in order to control and gain more profits. On the other hand, some factors such as intangible competition with countries like Iraq to maintain the OPEC's second place as well as increasing reliance on oil revenue will exacerbate it.

With the advancement of technology and the increased participation of domestic companies as well as foreign countries such as China, the volume of oil production will reach 5.2 million barrels per day. On the other hand, with the increase of prices due to the high rates of inflation, the government will try to control the price rise trend by subsidizing the energy sector. With this decision, the state will witness a huge increase in fuel consumption, especially in the transportation sector. Hence, for this reason and others, such as changing the policy in gas sector, reaching a level of 2.9 thousand barrels per day and even more will not be far-fetched. This intensification trend will be exacerbated through the improvement of the industrial sector. That is the reason the scenario is named Behemoth because it is an animal whose food consumption is high, but cannot have much mobility in land because of its high weight. In this scenario, the country is like a Behemoth, it means that although the country's oil production increases, the country consumption also increases which leads to its heaviness, and thus the country will lose its momentum and growth. This scenario is similar to the optimistic scenario presented by the Research Center of Parliament. It is mentioned in the report that although Iran's oil exports remains the same, its share will still decline in the future which will contribute to the reduction of Iran's influence.

3.4. Snowman scenario

In this scenario, the combination of "high consumption-fixed production" indicates oil production and consumption trends; i.e. the trends in the oil sector in 2007–2010.

The factors shaping this scenario are as follow:

- Iran's nuclear program is one of the most polarizing issues in one of the world's most volatile regions (New York Times, 2012).
- With no concrete results in the negotiations between Iran and the so-called "P5+1" group, the hopes to resolve this conflict seem out of reach. In this situation, continuing the sanctions seems inevitable, and this leads the major oil companies interested in investing in Iran turn their attention to neighboring countries such as Iraq.

- Falling oil and gas output and lower oil prices will weaken the government's ability to stimulate the economy, which could result in slower economic growth and higher unemployment (Mohamedi, 2012).
- At first, shock of sanctions against Iran will lead to the negative mutation of 1.7 million barrels in oil production. However, by replacement of European customers with new destinations such as India, oil wells overhaul as well as the presence of not-so-famous Chinese companies, the country will be able to maintain oil production up to 2.9 million barrels per day and to prevent the further reduction.
- Increasing demand for energy, high consumption and yet, low efficiency of power plants of Iran and finally, lack of enough attention to the new energies, will increase consumption of oil and its products such as fuel oil and gas oil to 2.7 million barrels per day in 2025. This will be ceaselessly increasing according to the country's status.

In this mode, the country's exports experience a declining trend and this process continues until production and consumption become equal and exports equal to zero. Exactly like a snowman in a little warm weather that gradually melts and no trace of it remains. This scenario is the same as the base scenario presented by the Research Center of Parliament. Fig. 10 represents the decrease trend in oil exports, which has started since 2007. On the other hand, Iran has a potential competitor such as Iraq. Iraqi officials have said that the country's oil production will reach 12 million barrels per day up to 2017 (Pana News, 2010). Consequently, this scenario will lessen Iran's influence in the world and Iran will be replaced by Iraq.

3.5. Poor Addict scenario

The most pessimistic and unexpected scenario which can be imagined for the country is "high consumption-low production".

Looking at the political equations between Iran and the West, continuance and even strengthening of sanctions are not far from expected. The sanctions, which have created severe restraints on Iran's ability to conduct routine banking and shipping operations, have caused severe disruptions to Iran's economy as the nuclear program remains an increasingly acrimonious issue between Iran and the West (New York Times, 2012). If continued, these sanctions will cause severe damages to the oil and gas industry, the effects of which will be visible in the entire economy of Iran. Some of these effects on the oil sector are:

- Lack of provision of insurance cover for any ship carrying Iranian oil, regardless of destination, problems of delivering cargoes because of the shipping cover hurdle, limitations of the country's banking system, and thereby, problems in transferring oil revenues.

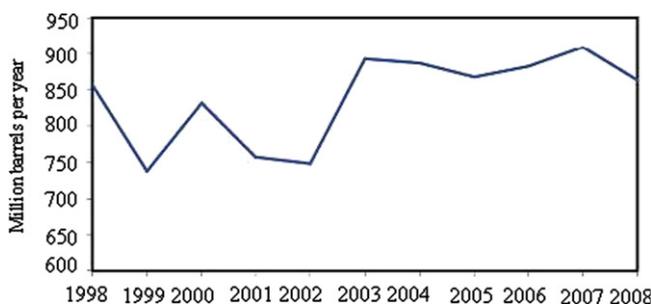


Fig. 10. Crude oil exports during 1998–2008.

Source: (Ministry of Petroleum of I.R. Iran, 2008).

- Lack of equipment, supplies and services mostly because of the departure of reputable companies.
- Gradual withdrawal of traditional partners of Iran like China from oil and gas market, and subsequently, multiplier increase in the oil field development costs.
- Substantial reduction of Iran's oil production to 1.5 million barrels per day, one of the main causes of which is the lack of investment of foreign companies and the inability of domestic companies to replace these companies.

As the oil production declines, its exportation will gradually stop and it is utilized merely for domestic consumptions. Cutting oil exports will not only cause Iran to lose its effectiveness in the international transactions, but will lead to sharp depreciation of the national currency. With the increase in domestic consumption of oil on the other hand, the government will take some measures such as increasing the price of fuel carriers to control the fuel consumption. However, as population grows and also refineries demand more oil to provide the sanctioned gasoline, oil consumption expected to reach the minimum of 2.4 million barrels per day. Inconveniently, OPEC's second largest producer and the possessor of the fourth largest oil reserves in the world, in this scenario, will be the oil importer from its substitutive country in OPEC, i.e. Iraq or other neighbors.

In this case, the country's status is like a poor person who is suffering from addiction. The consumption of the addict increases every day without being able to earn more income. So, each day he will have a worse situation and his dependence on others will be more. In this scenario, Iran would not only lose its influence but also it would be highly dependent on the oil exporting countries.

4. Concluding remarks

In the perspective of Iran's oil and gas industry for 2025, various objectives have been mentioned, some of which are set in order to modify consumption patterns and others in order to determine the rate of production and exports. By reviewing the country's status in oil production and consumption, four scenarios have been presented through the combination of forecast of oil production and consumption. Table 6 summarizes the scenarios and situations of the country.

The outputs of Figs. 11 and 12 have been achieved by using the combination of Delphi and expert opinion methods, after identifying the scenarios requirements and framework. The participants of Delphi panel were placed in various scenarios framework. Afterwards, they were asked about oil² production and consumption rates according to assumptions of each scenario. The answers were corrected by expert opinion and quantitative predictions for each scenario were obtained.

By reviewing the status of Iran's energy and the scenarios outlined in the country's oil production and consumption, it is concluded that Behemoth and Snowman scenarios are among the possible scenarios. Thunder scenario does not happen with the existing trend but with politicians and scientists working in various sectors related to oil industry, the weakness of capital-technology can be overcome. Absorbing enough foreign investment along with maintaining of authority are possible issues which can be achieved through redoubled and of course targeted efforts.

The horizon of Iran's oil industry has been undeniably tied to the strategies devised for increase in the volume of production

² Includes crude oil, shale oil, oil sands and NGLs (the liquid content of natural gas where this is recovered separately). Excludes liquid fuels from other sources such as biomass and coal derivatives.

Table 6
Oil development scenarios and country's status.

Scenario	Consumption	Production	Country's status
Thunder	Constant/ ↑	↑	By replacement of gas in the transportation sector, oil consumption is almost constant or with low growth along with increased production which lead to increased exports, and increased regional power of the country.
Behemoth	↑	↑	The country is like a Behemoth, it means that although the country's oil production increases, the country consumption also increases which leads to its heaviness, and thus the country will lose its momentum and growth.
Snowman	↑	Constant/ ↓	Due to sanctions, the country's exports experience a declining trend. By response however, the country maintain oil production up to 2.9 mb/d. On the other hand, consumption rate increase continuously and this process continues until production and consumption become equal and exports equal to zero. Exactly like a snowman in a little warm weather that gradually melts and no trace of it remains.
Poor Addict	↑	↓	In this case, the country's status is like a poor person who is suffering from addiction. The consumption of the addict increases every day without being able to earn more income. So, each day he will have a worse situation and his dependence on others will be more.

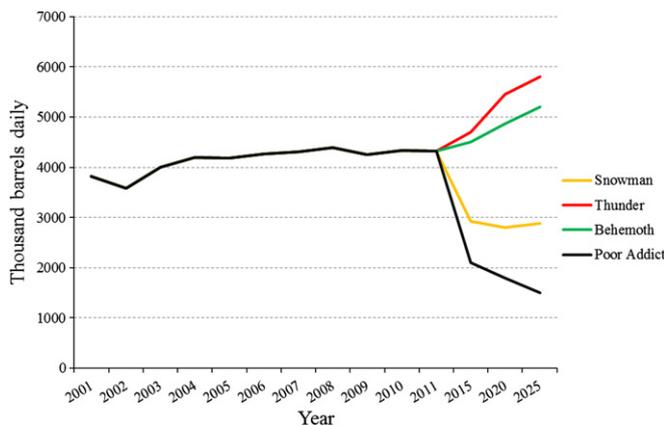


Fig. 11. Iran's oil production scenarios. From 2001 to 2011. source: (BP, 2011).

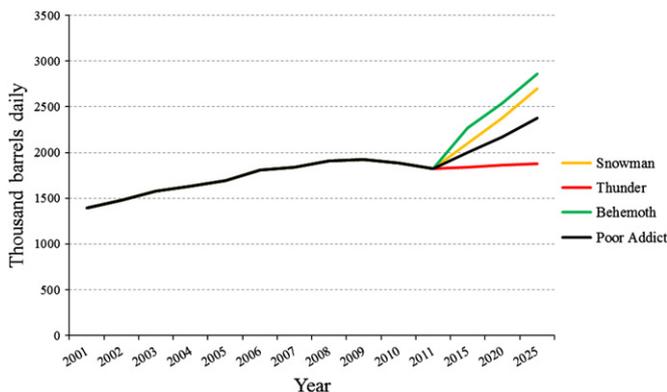


Fig. 12. Iran's oil consumption scenarios. From 2001 to 2011. source: (BP, 2011).

and sustainable development of the oil industry. According to the performed researches, Iran's optimal oil production amounts to 5.5–6 million barrels per day (mb/d). A figure which has been referred to in the upstream documents of oil development and the Thunder scenario has also detailed it. Resolving the foreign barriers and developing the new oil fields such as "Azadegan" and "Yadavaran" are among the necessary items in order to reach the above-mentioned volume of production.

Besides, some studies on the optimization of oil consumption have been conducted in Iran. These studies indicate that considering the present potentials and capacities, the petroleum export must be reduced to the minimum amount possible, and in contrast, the country must switch to light oil and intermediate products export by increasing the refinery capacities. Expansion of the capacity of the units reforming heavy products to light products, especially the catalytic cracking units, is one of the important instances that could be mentioned in relation to the oil production and export optimization.

But, the reality is that Iran's refineries are not still capable of meeting the domestic demands; and in this state, talking about the export of light and intermediate petroleum products does not seem rational. Before planning for optimal use of petroleum products, it is necessary to reach the ideal level of oil production in Iran. In this regard, the Thunder scenario could be the most appropriate option to optimize oil production in Iran.

5. Suggestions for the future

All economic, social, political and geopolitical indicators and facts suggest that the country can benefit from the driving forces of local, national, regional and international in order to achieve comprehensive development. For this purpose, the management is essential. On the other hand, the problems in development of oil and gas industry in terms of investment and technology for energy supply, and especially uncontrolled energy consumption in the country's industrial and domestic sectors are of the worst conditions in the world. The necessity of creating a proper space for sustainable energy development is a common concern of all experts in this field as well as the government. If Iran's economic growth would become positive since 2010 and would gradually increase (see Fig. 13), the following suggestions are recommended for Iran's energy policy framework.

5.1. Development of South Pars gas fields

Given the properties of Iran's gas reserves and their importance, clearly the first priority of the country's energy sector should be exploitation of South Pars gas fields as soon as possible. In addition, operation and signing contracts for gas transmission through pipelines from Iran to India, Iran to Europe via Iraq and Syria, and also selling to the southern Persian Gulf emirates including the Crescent contract are worthy to be considered.

countries having energy products including oil, gas and nuclear energy, can develop regional and trans-regional and international assistants. Moreover, it can encompass the basic steps for developing an energy strategy and consolidating Iran's presence in cooperation with the international system. The most important achievement of this thinking is to provide challenge with the energy interaction limitation strategy of the Islamic Republic of Iran by the powers conflicting with its strategic objectives.

5.8. Consolidation and expansion opportunities in the Middle East

Realization of strategic and geopolitical goals of the Islamic Republic of Iran in the long term vision of the country's measures to achieve the top position in the region of Southwest Asia requires interaction with effective international powers, and establishment of a strategic-political order in effective partnerships with other countries in the region. Because the legal rules governing international and regional systems are created after creation of a strategic-political order. In other words, in power queuing, countries must first find their place in economic and political battles and a structure is explained proportionate with that place and then the countries' positions are determined accordingly. Through peaceful negotiations with regional countries, the Islamic Republic of Iran must achieve a situation where they are also receptive to this new situation in the region. Since many of the region countries regardless of Iran's internal structure, on the one hand, have focused their attention on foreign policy and regional role of Iranian authorities among the Arabs, and on the other hand, domestic developments in Iran's political spectrums are not attractive for Arab countries, the Islamic Republic of Iran has unique diplomatic justifications to enter effective negotiations in order to understand the new regional conditions and the geopolitical top talents. If Iran seeks to preserve, stabilize or expand its current situation in the Middle East, it should design and implement its foreign policy commensurate with these talents and based on geopolitical grounds.

5.9. Attention to economic and political security with regional and global priorities

If Iran is able to achieve an economic security with regional and then international priority, by considering the Muslim world geo-economic facilities and its geopolitical position, not only it does not need militarism procedures, but also this actualizes the action capacity of the country, and leads to sustainability and development of excellence in regional power and even its international presence with the lowest cost.

5.10. Energy sectors cooperation with Ministry of Foreign Affairs of Iran

Given the close relationship between production and energy supply security in Iran and political stability and interactive relationships with countries having technology or energy consumer countries, it seems that more cooperation between oil and gas sector and the Ministry of Foreign Affairs of Iran and decision makers is necessary. Due to security concerns and Iran's nuclear activities and widespread international sanctions against the regime, advancing the industry that has long been tied and will be tied to economy, society and foreign policy of Iran, is a very large art which is given to the experts of international energy area and internal and foreign policy. In this regard, the followings are recommended:

First, Iran's role in the Caspian Sea should be increased. Iran and Russia are the only countries that belong to two of the four regions of the world crude oil and gas producers. This advantage

enables Iran to be present again regardless of diversification of the supply ports by major consumers. The Baku–Tbilisi–Ceyhan pipeline was built with a cost of \$5 billion. This pipeline can carry up to 1 million barrels per day of Azerbaijani oil to the Mediterranean. But Azerbaijani oil production has not been yet reached 1 million barrels a day and the Baku–Novorossiysk and Baku–Sopsha pipelines also must be filled first. The only economic justification for this pipeline is to diversify energy ports and get away from Strait of Hormuz, but here Iran is also present and if Iran's energy policy in the Caspian Sea is activated, it can influence the pipeline and the amount of its oil through cooperation with Kazakhstan, Russia and gratuitous project. The Northern–Southern pipeline project of Kazakhstan–Turkmenistan crude oil to Iranian borders and then using the pipeline network in Iran to the Persian Gulf can be a good competitor for the Eastern–Western Baku–Ceyhan pipeline.

Second, energetic cooperation between Iran and Europe should be the goal of Iran's oil and gas exports. Iran is one of the nearest gas resources to continental Europe. Both Iran and Russia can be Europe's most important gas suppliers. Russia's behavior in recent years has shown that it can stop the flow of gas to Europe at times for political or economic reasons. The pipeline project called Nabucco that carries Azerbaijani and Iranian gas through Turkey, Bulgaria, Romania and Hungary to Austria was the last chance for Iran to participate in the continent's energy needs before saturation by other manufacturers. This project is pending as a result of Russian pressure and also Turkish excellence seeking in the field of collecting and monopolizing energy supply. There are several other pipeline agreements between the EU and the oil and gas producers. The first of which is the pipeline called South Stream, which was announced in an agreement in Sochi on May 15, 2010 between the authorities of Bulgaria, Greece, Serbia, Italy and Russia. This pipeline exports 31 billion cubic meters of Russian gas to Europe annually, and obviously, Russian monopoly on energy markets in Europe will be stronger which is now without a rival with 130 billion cubic meters annually. The second pipeline is known as the "Southern Corridor New Silk Road" the agreement of which was signed in Prague between the Presidents of Azerbaijan, Georgia, Turkey, Turkmenistan, Uzbekistan, Kazakhstan, Egypt and the Europe Union officials on May 8, 2010. It should be noted that part of this pipeline goes from the depths of the Caspian Sea which has catastrophic environmental threats for Iran, and Iran also has no place in this agreement that covers Egypt to Kazakhstan. The third pipeline is called White Stream which goes from Georgia and the Black Sea to Romania. The fourth pipeline is a gas pipeline between Turkey, Greece and Italy. Iran should pursue two new pipelines to Europe. The first one is called Persian which goes from Iran to Turkey, Greece, Italy and Switzerland. The second one is a pipeline that can go to the Mediterranean Sea through Iraq and Syria and from there it can be connected to Greece. This one is called Islamic pipeline.

In summary the research results indicate that the most preferred scenario for Iran is the thunder scenario. According to this scenario, in the fifth economic, social and cultural development program of country, 70% of the investment in the oil industry development must be obtained through foreign investment. According to the obtained outputs of production and consumption rates of thunder scenario, the estimated amount of needed investment in various parts of oil industry by the horizon of 2025, is more than 500 billion dollars (U.S \$ 2011), and 70% of which (350 billion dollars) must be obtained from foreign investment.

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