2. EIA Website
3. IEA, World Energy Outlook 2004.
4. Oil and Development, NIOC Public Relations, 2005
5. United Stats Geological Survey(USGS), World Petroleum Assessment 2000, USGS, Washington DC, 2000.

IEA projections show that natural gas with its market share growing from 21% in 2002 to 25% in 2030 will be the second dominant fuel after oil by the third decade of the 21st century. Nevertheless, there are concerns about the stability of natural gas prices and markets and whether such natural gas projects as GTL, LNG, and natural gas pipelines are economical. Undoubtedly natural gas industry, particularly in natural gas producing countries will face serious challenges if natural gas markets are not managed in a decent way. Therefore, cooperation between natural gas producing and consuming countries seems to be inevitable and necessary.

Islamic Republic of Iran, the world's second biggest country holding natural gas reserves, cannot ignore exports opportunities introduced by international energy markets. Thus Iran has intensified its efforts to develop natural gas exports since the huge South Pars natural gas field was explored and consequently Iran's natural gas production increased dramatically.

European Union and South Asian countries such as India and China with negligible natural gas reserves and strong demand for natural gas are among promising markets for Iran's natural gas.
European Union is projected to face a considerable shortfall in its domestic natural gas production which can be a good opportunity for Iran to find a niche in this big market. The Persian Gulf states are also considered prospective markets for Iran's natural gas. Based on Iran's 2015 outlook, the country should become the third biggest natural gas producer in the world with 10% share of global natural gas trade; therefore the production should increase to 900 MCM per day.

Natural gas prices have recently grown considerably in international markets. The US markets are believed to play a leading role in recent developments. European markets are also predicted to follow the example of the US markets experiencing a rapid growth of natural gas prices at the moment. However, Asian markets will be affected by the developments with a time lag.

Sources

1. BP Statistical Review of World Energy, June 2005

In Atlantic region, the outlook for LNG is better. There is a good capacity in the United States for the development of LNG trade due to increasing demand for natural gas in this country. LNG markets are acting more freely so that some analysts believe that an LNG plant should not supply for a specific terminal as it was usual in 1970's, but it should adopt a more flexible outlook. It seems that huge markets will welcome LNG since previous long term contracts are to expire and new terminals become operational in India, China and specially US.

Development of Natural Gas Prices

A survey of natural gas prices in major markets, particularly in the US market, the most liberalized markets in the world, indicates that natural gas well head prices in the United States rose from 53 cents per million Btu in 1976 to $10.68/mBtu in October 2005 which is indicative of a growth rate of more than 1900% in less than three decades. A review of the prices in major US markets shows that the prices in some markets rose to $30/mBtu due to natural disasters or rapid temperature changes. London market spot prices of natural gas, for example, exceeded $30/mBtu in March 2006 which is a red alert for these markets. If these countries do not take serious actions to optimize and/or build new natural gas production, import, transmission, distribution, and storage infrastructures; major natural gas markets will encounter serious crises.

Given low prices of natural gas in the past, consumers have tried to shift from oil to natural gas. But with the rising natural gas prices this trend may be reversed. Recent fuel oil prices might be a harbinger of such a reversed trend.

Conclusions

At the outset of the third millennium, natural gas is considered the fuel of choice due to its unique features and lingering concerns about environment. Projections are indicative of a better out look for such a clean fuel in coming years.

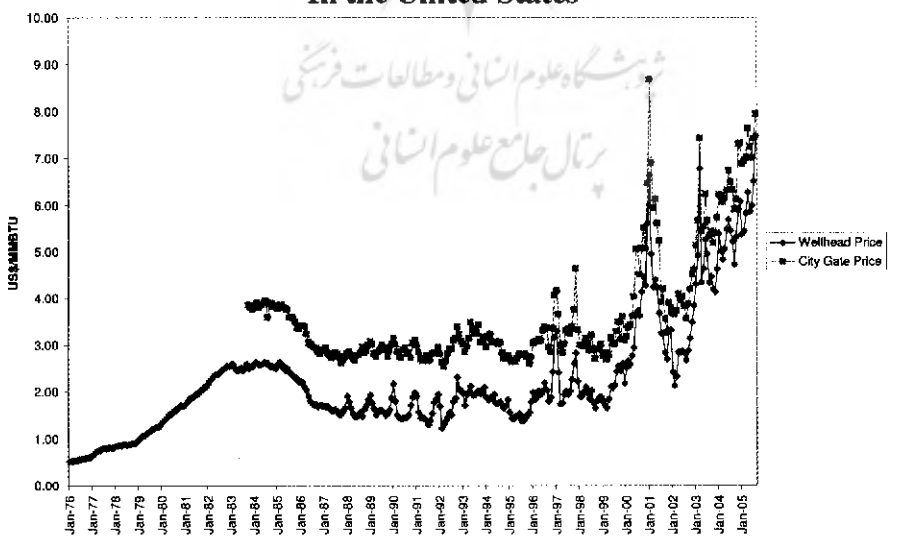
remote markets which has started since 1993 will lead to a great change in LNG trade.

There had been only three LNG trade markets in the world before that time, namely, Asia-Pacific, the United States, and Europe with totally independent pricing mechanisms however at present, LNG trade is developed dramatically particularly trading LNG batches over long distances.

Liberalization policies in the EU natural gas markets will result in the improved economy of short-term plans for supplying LNG to the region. Despite the fact that some 12% of total imported natural gas and 6% of total natural gas demand in Europe was met by LNG imports in 1999, LNG will play a stronger role in the future since the

EU plan to open new markets. LNG prices in European markets should be competitive. In any open market, competitive prices and relative advantages of each energy carrier determine its share the energy mix. Therefore, if LNG is willing to increase its own share in the market, its commercial advantages should compete with those of natural gas transmitted via pipelines.

Figure 3. Development of Natural Gas Prices In the United States



Source: EIA Website

project is equal to 2.8 BCF per day.

3. NIOC-LNG: This project is financed by NIOC. This project includes two trains with nominal capacity of 5 million tons per year for each train. The natural gas needed for this project is 1.8 BCF per day. The design of the project has been completed. For more convenience, the project has been divided into three sections:
    - First: Natural gas process and liquefaction units, utilities and loading outlets;
    - Second: LNG and LPG storage tanks;
    - Third: Sulphur, LPG, LNG, and NGLs Loading docks which is in bids phase.

The NIOC-LNG is the most important project due to its implementation totally done by Iranian financers and expertise[1].

Natural Gas Global Developments

For the first time LNG trade at international level started in 1964 when Algeria exported its first natural gas cargo. Since then, natural gas trade has grown rapidly. Such countries as Indonesia, Algeria, Malaysia, Qatar, Australia, Brunei, Nigeria, Oman, Abu-Dhabi, Trinidad, the United States, Libya, and Egypt are among the exporters of liquefied natural gas in the world. Japan is regarded the biggest consumer of LNG with more than 50% share of the world's LNG consumption. After Japan; South Korea, France, Spain, and the United States are the biggest consumers of LNG in the order mentioned. By 2010-2020, Canada, Mexico, and especially the United States will become the biggest consumers of LNG in the world since demand for natural gas is increasing in North America and these countries are not able to meet the increasing domestic demand.

LNG spot trade started since 1992 accounts for some 4% of global LNG market at the moment. Expansion of spot sales of LNG to

1. Ibd

Table 4. Iran's Natural Gas Exports via Pipeline

Region		Project	Target Market	Latest Status	Sales (MCM/d)	Contract Period (Yr)	Project	Target Market
South	1	Crescent	Sharjah & Dubai	Contract signed	14	25	2005	Operational contract finalized
	2	Oriental Oil	General	Contract signed	4	3	2006	Pending guarantee submission
	3	DUSUP	Dubai	Time Sheet pending signing & sales contract finalized	20	25	2007	Prices in negotiations
	4	MOBADELE	UAE	Terms Sheet being finalized	28	25	2007	Prices in negotiations
	5	Raas-al-kheimeh	Raas-al-kheimeh	MOM signed	10	25	2007	Terms Sheet in negotiations
	6	Kuwait	Kuwait	Terms Sheet signed	8	25	2008	Terms Sheet in negotiations
	7	Oman	Oman	MOU signed	-	25	2008	Terms Sheet in negotiations
East	1	Pakistan-India Pipeline	Pakistan & India	Times Sheet prepared	100	25	2010	Negotiations on finalizing the framework and principles of contract
West (Europe)	1	Azerbaijan	Nakhjavan	Contract signed	10	20	2005	Operational agreement being finalized
	2	Armenia	Armenia	Contract signed	1.1 -3.2 BCM	20	2007	Operational agreement being prepared & operation started
	3	Austria	Europe	Terms Sheet at final stages	11-3 BCM/y	25	2010	GSPA in negotiations Implementation pending NUBAKKU project

Source: Oil and Development, NIOC Public Relations, 2005

2. Persian-LNG: NIOC (50%), Shell (25%), Repsol (25%). This project includes two trains with nominal capacity of 8 million tons per year for each train. The natural gas feedstock of the

1.8 BCF of natural gas per day. At present a Japanese company, JGC, and a French company, Technip, are dealing with the design of the project. The share of Petronas has been recently decreased to 10% and 12% of the project was commissioned to CNPC, China.

Table 3. Iran's LNG Contracts

Project		Customer	Latest Status	Sales (mt/y)	Target market	Start of Delivery	Notes
NIOC LNG	1	IBERDROLA	MOU signed	2.4	Spain & Mexico	2009	Sales Contract finalized
	2	IOC & GAIL PAHARAT & PET	In June 2005 finalized and signed	5	India	2009	25 Yrs and extendable by 7.5 Yrs
	3	MITSUBISHI	CA draft signed & Term sheets submitted by Mitsubishi	0.7-2.2	Japan	10/2009	In negotiations Terms sheets
	4	GENRONG (China)	MOU & Agreement signed	2.5-5	China	2010	30 Yrs
	5	SINOPEC (China)	MOU signed & Terms Sheets in negotiations	10	China	10/2009	250 million ton LNG in 30 Yrs
PARS LNG	1	TOTAL & PETOPARS	Terms Sheet signed & Sales contract in final stages	5	England, Mediterranean and Atlantic region, and India	2010	25 Yrs extendable to 30 Yrs
	2	PETOCHINA	MOU & CA signed	3-4	China	2010	25 Yrs
	3	ITOCHO	Preliminary negotiations	-	-	-	-
	4	GAZDOFRANCE (GDF)	HOA Draft prepared and CA signed	2	India & Europe	2010	Terms Sheet in final stages
Persian LNG	1	SHELL & REPSOL	Agreement Signed and Sales contract in negotiations	8	Mediterranean and Atlantic region, and India	11/2010	30 Yrs extendable to 35 Yrs

Source: Oil and Development, NIOC Public Relations, 2005

- North and North West: Austria (natural gas export to Europe), Switzerland, Ukraine, France, Greece, and Italy[1].

It is notable that the contract of natural gas export to Turkey was signed in 1996 with Botas (Turkey), under which natural gas exports to Turkey was to start from 3 BCM and reach eventually the maximum amount of 10 BCM. Natural gas exports from Iran to Turkey opened a new chapter in commercial ties between Iran and the global energy markets. Such ties are considered highly critical from economic, political, and long-term international relations point of view.

Studies show that Europe's demand for natural gas will outstrip the domestic supply in next two decades and natural gas imports will double. This indicates that European countries are trying to diversify their natural gas resources with the aim of maintaining the security of supply.

The Middle East countries, particularly Iran, are the most promising potential suppliers of natural gas to global markets, so they are able to play a decisive role in this most important economic region through preparing the ground for their own presence.

The South Pars gas field, which is a common field between Iran and Qatar, is the biggest non-associated gas field in the world located 100 kilometers off Iran's southern coasts. The area of this field is 9700 square kilometers. The Iranian side of the field is estimated at some 14.2 TCM of capacity which is equal to 7% of world's total natural gas reserves and 38.6% Iran's total natural gas reserves. Moreover, some 18 billion barrels of condensates is in place in the field.

South Pars, phases 11, 12, and 13 have specialized for LNG projects. To this end, NIOC has defined three separate LNG projects as follows:

1. Pars-LNG: NIOC (50%), Total (30%), and Petronas (20%). This project includes 2 trains with nominal capacity of 5 million tons per year for each train which is able to consume

1. Oil and Development, NIOC Public Relations, 2005

The Middle East is projected to become the biggest natural gas exporter in the world by 2030, that is, natural gas exports from this region will increase to 304 BCM in 2030 from 30 BCM in 2002. In the meantime, LNG regional trade will grow to 250 BCM in 2010 and 680 BCM in 2030 from 150 BCM in 2002. In 2030, more than 50% of natural gas traded regionally will be in the form of LNG[1].

Investment Outlook

A total investment of $2.7 trillion should be made by 2030 in order to achieve favorable balance of natural gas supply and demand. In other words, some $100 billion of investment should be made annually in the global natural gas industries by 2030.

OECD countries will absorb half of the projected investments in natural gas industries by 2030. North America will spend one forth of the investments by 2030. In the second rank, Russia, the Caspian region, the Middle East, and African countries will absorb the investments in natural gas industries.

The Middle East will require the biggest portion of the investments in LNG industries while the CIS countries (including Russia) will absorb the greatest portion of the investments in natural gas transmission grids[2].

A Summary of Iran's Gas Export Projects

Four contracts regarding the export of 17 BCM per year via pipeline have been finalized and signed so far. Natural gas export to Turkey started in 2001. Natural gas exports to Nakhjavan and the UAE will start this year. The fourth contract to export natural gas to Armenia will be materialized by winter 2007. Other contracts in negotiations are as follows:

- South: Oriental Oil Co, DUSUP, Mobadele, Raas-al-Kheimeh (natural gas exports to the UAE), Kuwait and Oman
- East: Pakistan-India land pipeline project

1. Ibd
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condensates cover development and production costs to a large measure.

By the end of 2030, the global energy markets will be in need of 7.3 TFC of natural gas new production capacity. Therefore, there is a need to increase global natural gas production by 260 BCM per annum by the end of 2030. Less than one third of this production rise is to be consumed by the global demand growth and the rest will be offset by natural decline.

Annual growth of natural gas production will reach 320 BCM in the third decade. One fourth of this growth will occur in North America where the majority of the fields are mature and natural decline is higher than other regions. Major portion of the growth in production capacity will be materialized in the Middle East countries and Russia[1].

Natural Gas Trade

Inter-Regional trade of natural gas will grow more than threefold by 2030, that is, it will be hiked to 1265 BCM in 2030 from 417 BCM in 2002. In 2030, the European Union will rely on natural gas imports to provide 80% of its consumption. North America and Asian members of OECD will rank the second and third respectively in terms of domestic demand for natural gas in the corresponding period[2].

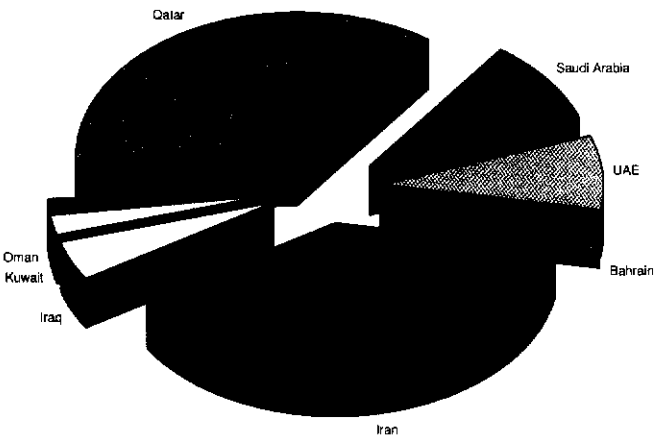
Table 2. Natural Gas Import Dependence

	2002		2010		2030	
	bcm	%	bcm	%	bcm	%
OECD North America	0	0	33	4	197	18
OECD Europe	162	36	267	46	525	65
OECD Asia	98	98	130	97	183	94
China	0	0	9	15	42	27
India	0	0	10	23	44	40
European Union	233	49	342	60	639	81

Source: IEA, World Energy Outlook 2004

1. IEA, World Energy Outlook 2004
2. Ibd

Figure 2.The Middle East Natural Gas Reserves (2004)



Source: BP Statistical Review of World Energy, June 2005

Russia, Iran, and Qatar hold some 55% of conventional proven natural gas reserves in the world.

Uncharted natural gas reserves in the world are estimated at 147 TCM, some 75% of which are non-associated gas reserves and remaining 25% of which include associated gas reserves[1].

Natural Gas Production Global Outlook

The future of regional production of natural gas depends, to a great extent, on the size of the reserves and production costs. Huge natural gas reserves are generally located in remote areas far from major natural gas markets.

It is projected that the volume of natural gas production by the FSU and the Middle East countries will surpass the other countries' production. While natural gas production in Africa and South America will grow faster.

In such areas as Iran (the South Pars gas field), the production costs are very low; therefore the revenues from the sales of

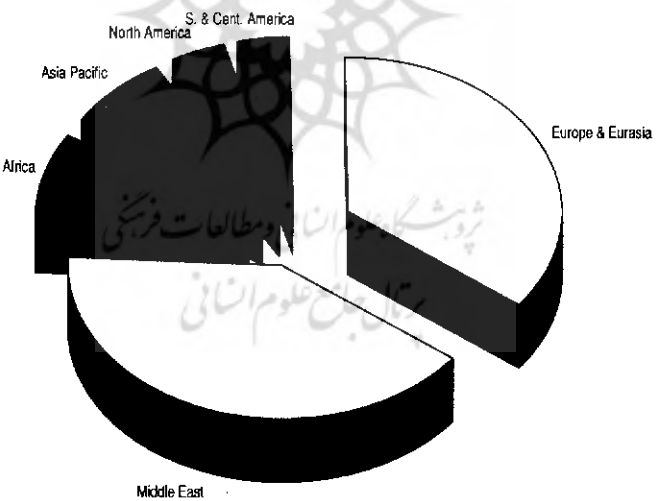
1. United Stats Geological Survey(USGS), World Petroleum Assessment 2000, USGS, Washington DC, 2000

Power generation sector is predicted to contribute to the 59% of natural gas growth by 2030 so the share of this sector will grow from 36% in 2002 to 40% in 2030[1]. It is worth mentioning that in 1990-2002, the annual growth rate of global demand for natural gas averaged 2.5%.

World's Conventional Natural Gas Reserves

Conventional natural gas reserves in the world were estimated at some 180 TCM by 2004 which has doubled for last 20 years. Considering the current rate of production, the volume of the said reserves will provide the global demand for next 66 years. If the growth rate of global demand for natural gas is supposed to be 2.3% per year, these reserves are able to meet the global demand for natural gas at most for next 40 years[2].

Figure 1. World's Natural Gas Reserves (2004)



Source: BP Statistical Review of World Energy, June 2005

1. Ibd
2. Ibd

Natural Gas Demand Outlook

According to the studies by the IEA, natural gas demand will grow 2.3% annually by 2030 where power plants account for the major portion of the demand growth. Therefore, the share of natural gas in global energy mix will rise from 21% in 2002 to 25% in 2030[1].

Natural gas demand growth in India and China would be more than 5% by 2030 due to the replacement of natural gas for coal in power plants. Therefore, share of developing Asian countries in global demand for natural gas will rise to 14% in 2030 from 8% in 2002.

Table 1. World Natural Gas Primary Demand (bcm)

	2002	2010	2020	2030	2002-2030%
OECD North America	759	866	1002	1100	1.3
OECD Europe	491	585	705	807	1.8
OECD Pacific	130	173	216	246	2.3
OECD	1380	1624	1924	2154	1.6
Russia	415	473	552	624	1.5
Other Transition economics	220	254	311	360	1.8
Transition economics	635	728	863	984	1.6
China	36	59	107	157	5.4
Indonesia	36	53	75	93	3.5
India	28	45	78	110	5.0
Other Asia	109	166	242	313	3.8
Brazil	13	20	38	64	5.8
Other Latin America	89	130	191	272	4.1
Africa	69	102	171	276	5.1
Middle East	219	290	405	470	2.8
Developing Countries	597	864	1307	1753	3.9
World	2622	3225	4104	4900	2.3
European Union	471	576	684	786	1.8

Source:IEA, World Energy Outlook 2004.

It is projected that power generation sector in the developed countries will play a critical role in the growth of natural gas demand.

1. IEA, World Energy Outlook 2004

infrastructures, and preparing the political grounds should be made in the meantime. Iran with huge natural gas reserves is known as the most economical, safest, and closest natural gas transit route to the regional and international energy markets especially European and South East ones. Therefore it seems reasonable to study the possibility of exporting Iranian natural gas to the world's leading energy markets by means of pipelines or in the form of LNG.

Key terms: ***Natural Gas Markets, investment, LNG industry, Natural gas supply and demand, Power generation sector, Natural gas price.***

Introduction

Islamic Republic of Iran, located on a land separating two hydrocarbon-rich regions, the Caspian Sea and the Persian Gulf, is considered geopolitically critical.

More than 70% of the world's proven natural gas reserves are located in the Persian Gulf and FSU countries. Russia, Iran, and Qatar hold more 55% of the world's proven natural gas reserves. In 2004, total recoverable natural gas reserves in the region was estimated at 130 TCM[1] which is indicative of its crucial role in providing energy for the whole world since the current and prospective share of natural gas in global energy mix proves to be increasingly considerable.
Unlike such regions as the North Sea where natural gas reservoirs are mature, most of the Persian Gulf gas fields are at their beginning production stages and the region's R/P ratio is 130 years which is much higher than the world's 66 years average.

Iran plans to promote its domestic natural gas consumption considering the country's unique geographical and climate diversity, natural gas replacement policies, need to inject natural gas into mature oil fields, need to develop petrochemical industry, and increasing need to build more power plants. However, Iran with the second largest natural gas reserves in the world, cannot ignore the world's natural gas markets.

1. BP Statistical Review of World Energy, June 2005

A Glance at Iran and the World's Natural Gas Markets

Abstract

Most energy experts and economists believe that natural gas is one of the main prerequisites for securing a sustainable economy since natural gas is considered the fuel of choice for the 21st Century. Natural gas consumption will follow the fastest trend by 2030 compared with other energy carriers due to its unique features which have made it the most environment-friendly fuel. This means that the share of natural gas in the world's energy basket is growing. Iran bridging two natural gas-rich regions, the FSU and the Persian Gulf, is regarded the world's second biggest country (after Russia) in terms of natural gas reserves. European natural gas markets as well as intact and fast growing markets of India and particularly China have proved to be the most luring targets for Iran, an emerging natural gas exporter with 27 TCM of proven natural gas reserves. Such being the case, each potential market and the pertaining opportunities and threats should be surveyed elaborately while required investments with the aim of promoting production capacity, building needed exports

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