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## Natural Gas Industry in Iran

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### **Summary**

*Iran holds the second largest gas reserves in the world with over 27.5 trillion cubic meters (TCM) of natural gas. Due to lack of geological surveys in certain geographical regions in Iran, it is likely to explore further reserves in the future. Hence, for utilizing this energy carrier, it is essential to have comprehensive and explicit planning knowledge. The study of gas industry development policies is indicative of certain barriers in utilizing prospective opportunities. Iran is one of the largest gas rich countries in the world that production capacity exceeds domestic consumption and gas injection requirements. Gas can be utilized as feed stock in petrochemical plants and refineries or exported through pipeline or LNG. Through re-injection of gas to oil reservoirs, while increasing the oil recovery ratios, the produced gases from fields shared with other countries could be stored into domestic gas fields.*

*Gas consumption in domestic markets and its substitution with oil products, in addition to providing environmental benefits, will also result in optimum consumption of these products and relieving the government from the heavy burden of existing subsidies and heavy expenditures of importing these products into country. The need of the world's countries for energy sources along the enormous natural gas reserves in the country opens broad economical / political dialogue scene towards us and contributes an outstanding strategic significance to our gas resources.*

*Supplying gas requirements, proper and timely production and operation of joint reservoirs such as the South pars with the intention of supplying gas requirements and providing balance of supply and demand as well as maximum utilization of our share in these fields are other development requirement requirements of this significant industry. For Planning and policy making regarding the development of gas industry, it is essential to manage all aspects of gas from exploration and production to consumption, injection and exports and etc. through a sole administrative institution so that prearranged plans could be implemented without becoming subject to such problems as lack of coordination, parallel activities and organizational problems. Gas fuels one half of Iran's energy consumption, and to increment this share, the government should increase investment in the gas sector. Natural gas while being utilized as a clean fuel in domestic markets can become a device to implement gas injection to oil wells for increasing oil production from the countries reserves as well as gas exports to ward presence in international venues and commercializing gas globally.*

*Predictions indicate that natural gas being the favorable fuel of the present century, will enjoy the largest growth among items within the energy basket and during the next twenty years as well, the world's natural gas demand growth will exceed other conventional energy sources. In the future, due to various factors such as accessible vaster sources and reserves, developing technologies which in effect reduce project expenditure and construction periods and consequently improve the economy of developing gas transmission projects as well as global endeavors to curtail emission of green house gases are the major reasons for gas consumption growth.*

*Iran, in respect to her geographical and political strategic situation can play a leading role in global gas supply and act as a bridge between the enormous Middle Eastern gas reserves with major gas consumption and demand centers in Europe and Asia. Natural gas still maintains the fastest consumption growth rate among the world's primary energies and is realized to have the highest consumption growth among the developing countries.*

*Gas has been recognized as the fuel for the future. This is entirely evident as a result of decreasing global resources in one the other due to environmental considerations. According to IEA estimates, in year 2015, oil demand will reach 93 million barrels and natural gas demand to 64 million barrels of oil equivalent. This in effect is a 20% increase for oil and 45% for gas in regard to current figures.*



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*In conclusion, it could be stated that more than ever before, gas has gained significance and is the leading basis for modern services in energy, and in the long term, is considered a bridge towards a hydrogen resource based economy. Gas as a new fuel, provides the modern technology of fuel cell construction for vehicles possible, therefore to portray the enormity of Iran's gas reserves, it is enough to consider that Iran's natural gas reserves alone exceeds the total volume of natural gas reserves in USA, Canada, Europe and the entire Asia Pacific.*

## Preface

Iran's oil and gas reserves in March 2005 were estimated at 311 billion oil equivalent with 42.4% for oil and 57.6% for natural gas. Iran presently holds over 27.5 trillion cubic meters of natural gas, which accounts for 17% of global gas reserves and therefore is considered one of the gas rich countries in the world.

The various relative advantages of this carrier such as low-price minimal environmental polluting impacts, low treating expenses scattered and abundant global availability from one side and decreasing trends of global oil reserves on the other, has attracted many countries and major energy consumers and in effect increased its share in the world basket of primary energy to primary energy to such an extent that according to many experts, gas will demonstrate its true value in different aspects of energy supply in the years to come.

According to various, the blossoming of gas industry will occur during years 2010 to 2015 which in regard to decreasing global crude oil reserves and depletion of gas reserves in some countries (including Canada and USA) and their dependency to the market of three and transformations in the supply and demand of this vital substance.

There is no doubt that in the coming years, not only gas and gas condensates will be considered as one of the significant energy sources, but processed products from gas will have a hundred fold value in years to come, and this is while in many industrial and semi industrial countries such as USA, Canada, Japan, Korea, TAIWAN, TURKEY, SPAIN, CHINA AND India, utilization of natural gas (as a substitute for other fossil fuels) has presently expanded tremendously.

The major gas consuming countries and a number of south Eastern Asian countries, in respect to modern economical transformations and rapid economical growth experience, are in urgent and widespread need of energy sources particularly gas, and therefore have initiated widespread negotiations for safe and secure access to gas. Among these endeavors, it is noteworthy to mention the inclination of India, Pakistan and China in pursuing long term contracts and gas imports from Iran through different schemes.

According to plans, Iran will become the third largest gas producer in the world in year 2025.

Iran's geographical and economical characteristics (geo-economics) are considered the positive variables of this country within the framework of international gas trade compared to other Middle Eastern countries.

Iran is presently considered the shortest and most economical means of access for the CIS republics in Central Asia and Georgia to international markets.

Iran along natural gas exports to Turkey is pursuing pipeline exports to India and Pakistan in the east and Europe in west while plans for

LNG and GTL production have been included in the agenda. The soaring of LNG Market in the coming years will provide the viability of investments of gas rich countries in this field.

It is believed that gas market has become competitive and Iran has serious concerns in her endeavors for production and exports.

Presently in construction of domestic gas networks and supply of domestic requirements, the priority is supply of power plant consumption, large industries, other industries and Major commercial and general consumptions, transportation consumptions and eventually fuel supply for heating requirements.

On this basis it becomes apparent that the supply of fuel and feed stock for petrochemical industries has a special disposition for the National Iranian Gas Company.

The national Iranian gas company has also adopted the policy of increasing gas supply safety margin through construction of gas networks in diversified route and implementation of under ground storage projects, construction of national and regional control and dispatching centers.

For the years remaining to the conclusion of the fourth Development plan. It has been anticipated to increase the country gas treating capacity by 250 million cubic meters per day and to reach total figure of 570 cubic meters per day through construction and production of Ilam, Bid Boland 2 and Persian gas dehydration and treating plants as well as some phases of the south pars field. Erections of petrochemical facilities next to many of the above mentioned refineries and providing their feedstock and fuel through these refineries have already been anticipated.

The share of gas in the countries fossil fuel consumption basket during the first year of the fourth plan (2005) will increase to 59% and at the end of the fourth plan (2009) to 63% and 72% in the scope of year 2024.

It is noteworthy that major projects execution in the National Iranian Gas Company during the fourth Development plan requires 20 billion investments in various sectors. This figure does not include investments of the National Iranian Oil Company in the area of gas production.

It is evident that the long-term development of gas industry requires access to proper technical knowledge and capital that effective factors conducive in absorbing capital are essential improvements within the domestic economy. Regulations impacting economical activities towards increasing efficiency and improvement of international relations. It could be concluded that gas consumption growth and especially Middle East share in this respect, will in effect position Iran's in the focal point of attention for gas production and supply. and the administrators of this industry should provide appropriate requirements and provisions such as construction of gas facilities including production transmission and gas treating, increasing gas supply security margins, various consumption and supply of gas in a sound



competitive environment, in order to properly and appropriately respond to this global prospect.

## Natural Gas Treating & Dehydration Capacity

The country's gas treating and dehydration capacity in the years 1996-2005 indicates a substantial increase of 254.5 million cubic meters / day. The natural gas treating and dehydration capacity during this period with an average annual growth rate of % 12.9 increased from 128.5 to 383 million cubic meter/day in year 2005. This increase is generally contributed to Fadjr, south pars, and Khangiran, Parsian and Sarkhun plants.

### THE FADJR ( KANGAN) Plant Capacity Increase:

This increase has been implemented through optimization and capacity increase of existing units and utilizing the spare unit through buy-back gas delivery provisions.

Which has increased from 79 million cubic meters / day in year 1997 to 110 million cubic meters / day in year 2000?

### Sh.Hashemi Nejad (Khangiran) plants phase Two construction:

The operation for Khangiran plants second phase was commenced in year 2001 with capacity of 17 million cubic meters / day, increasing total gas treating capacity to 44.5 million cubic meters / day.

### South pars Gas plant :

1-phases 2 and 3 went on stream in year 2002 with capacity of 57 million cubic meters/day.

2- Phase 1 of this plant with capacity of 25 million cubic meters / day started operations in year 2003.

3- Phases 4 and 5 of this plant with capacity of 58 million cubic meters / day went on stream in year 2004.

### Parsian Dehydration plant:

The plant with capacity of 25 million cubic meters /day started operations in year

2003. for a capacity of 25 million cubic meters / day. The subsequent expansion phases of the plant includes. 20 million cubic meters / day by NIGC and 37 million cubic meters / day by NIOC.

### Natural Gas Transmission Pipelines

Implemented high pressure natural gas pipelines in national Iranian Gas Company indicate construction of approximately 9500 kilometers of pipelines during years 1996-2005.

The average yearly activity during years 1996-2005 has been 1373 Kilometers while at the end of year 2005 total length of transmission pipelines reached 22000 kilometers.

### The Iranian Gas Trunk line IV

To transmit the gas production of Asaluye and Parsian gas plants to northern regions of the country, the Iranian Gas trunk line iv for a length of 1080 kilometers and diameter of 56 inches is under construction en route the cities of Asaluye / eastern shiraz / Abadeh / Esfahan / Tehran that in 2004, with efforts of all parties involved



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in the project, a section of 798 Kilometers went into stream during the cold season of peak consumption period. To compensate pressure drops and to utilize maximum gas transmission capacity, the pipe line will be furnished with 10 compressor station to provide operating pressure of 1305 PSL.

### The Iranian Gas Trunk line V

The south pars phases' 6.7.8 sour gas transmission is intended for injection to oilfield in the Khuzestan province.

The initial volume for transmission of sour gas is approximately 75 million cubic meters / day and will have a 30 % production increase in the next stage. The gas production will be transmitted through a 504 kilometer 56 inches pipeline from south pars to Aghajari. There will be five compressor stations installed en route the pipeline including 2 stations in the south pars and 3 stations in the cities of Khormoj, Ab-pakhs, and Sar-Dasht.

In regard to partial production of 6, 7, 8 in mid 2006, approximately treating 15 million cubic meters / day sour gas production is planned in the Fadjr gas treating plant for subsequent injection in the main trunk line. Therefore, a 70 – kilometer pipeline with diameters of 56 inches is under construction to transmit sour gas to the Fadjr – jam treating plant.

### The Iranian Gas Trunk line VI

The purpose of this 509 kilometer 56 inches pipeline with the capacity of 100 million cubic meters/day is transmission of the south pars gas reservoir to Bid Boland with operating pressure of 1305 PSI utilizing two compressor stations.

In this direction, 30 cities in the Bushehr province and gas shortages in the Khuzestan province will be parallel to Iranian Gas trunk line v. the project was launched in year 2004 and operations are anticipated in year 2006. /

### Gas Delivery Project to the Sistan & Baluchestan Province The Iranian Gas Trunk line VII

The pipeline will be implemented with diameter of 56 inches and length of 900 kilometers with gas transmission capacity of 110 million cubic meters / day and operating pressure of 1305PSI to supply gas requirements of Sistan and Baluchestan province and sections of the Hormuzgan province and also to reinforce the country's eastern high pressure gas network and finally gas exports to Pakistan and India as well as appropriate utilization for gas productions from the south pars reservoir.

The pipeline route begins from south pars extends in the vicinity of cities Gav-bandi and reaching Sarkhun in Northern Bandar Abbas and furthermore extends by the cities of Rudan and Kahnooj eventually ending in Iran –shahr and furthermore extending to Pakistani boarder with another 250 kilometers.

### The project includes 48 cities consisted of:

**17 cities** located in the eastern regions of the Hormuzgan and southern Kerman provinces. **31 cities** in the Sistan and Baluchestan province the project includes 9 compressor stations with 1200 thousand horse powers.

Pipeline execution is at initial stages and provided with financial resources, some segments of the pipeline are anticipated to become operational in year 2009.

### The Iranian Gas Trunk line VIII



In regard to increasing gas requirements of the country, the Iranian Gas trunk line viii has been planned in the context of year 2005-2009 Gas transmission system Requirements study.

According to this report , as of year 2007 , the transmission of gas production of Gas production from the new phases of south pars reservoir and the Parsian Gas treating plant will require the operations for segments of the Iranian Gas trunk line viii ( with priority of Parsian – Naïen segment ) in addition to thorough operation of IGAT 4 and in the frame work of implemented studies , the pipeline will be operational in year 2008 linking to the Tehran's fifth pipeline and the compressor station gradually being implemented unit year 2009 .

The pipe line has a 56 inches diameter and length of 1047 kilometers ( in the route of Parsian , Safa – shahr, Naïen , linking to Tehran's fifth pipeline ) having gas transmission capacity of 110 million cubic meters / day with operating pressure of 1305 PSL and design pressure of 1400 PSI.

10 Compressor stations with 1541 thousand horse powers have been anticipated en route the pipeline.

### **The Main Transmission Pipeline project ( loop – line )**

This project includes installation of 420 kilometers of 56 inches loop line in parallel to IGAT 2 from Kangan to Pataveh, which has been designed for transmission of Fajr gas treating plants production for delivery to the main gas trunk lines and in effect to increase gas pressure within the pipelines especially after Pol kalleh compressor station and prevent pressure drops during pick consumption periods of cities in remote areas.

One of the other tasks submitted to this project is the North and North Eastern pipe line which includes 790 kilometers of 48 inches pipeline as well as 96 kilometers of 42 inches pipeline for a capacity of 60 million cubic meters and also 6 compressor stations that after pipeline commencement, the entire gas shortages over the period to 2020 will be supplied through the fifth Tehran spur line en route the cities of Parchin , Shahrud, Ali Abad , Sang bast and the gas requirements will be supplied to meet future demands of Semnan province and North Eastern region of the country especially southern Khorasan region .

In this direction , the civil activities between Parchin , Shahrud for a length of 400 kilometers has been submitted to " Jihad e nasr " contractor and mechanical operations for a length of 190 kilometers between Semnan , Shahrud with priority for the segment of Semnan , Damghan has been forwarded through a tender to " Ramshir " contractor . Gas delivery to the cities of Kangan and Dayer by construction of a 52 kilometers and 20 inches pipeline is another project which is in progress by " Falat sazan " contractor .

### **Other Main Transmission pipelines**

The Saveh , Hamadan , Miandoab ( the third North western pipeline ) project with diameters of 48 and 40 inches and gas transmission capacity of 70 million cubic meters / day and the 30 inches Sanandag pipeline and also the 30 inches Miandoab , Naghadeh,Orumieh pipeline for total length of 950 kilometers along with 5 compressor station have been included in the agenda. Furthermore the Tabriz Armenia pipeline project Saveh compressor station, Orumieh city Gate station is under study and implemented in year 2005.



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Ahwaz, Bijar/takab –Shahindej/Miandoab ,Kangan / Bandar e Taheri,pipelines for total inch kilometers of 12286 have been included for implementation in the agenda and are in progress.

The Arak – Malayer 36 inches 90 kilometers pipeline Koohdasht 87 kilometers 16 inches pipeline , Taft , Mehriz 50 kilometers 16 and 24 inches pipelines Dorud Azna- Aligudarz 66 Kilometers 12 inches pipeline have commenced operations of year 2004 .

### **Gas compressor stations**

There will be 25 compressor stations with 98 gas turbine units to be implemented in year 2006, and efforts will be made to bring the following compressor stations into operation:

Shiraz ( IGAT 3 ) , Khoramdareh (the second Azerbaijan pipeline) , Marganlar ( the Export pipeline ) , Abshirin and Sirjan ( the Sarkhun – Rafsanjan pipeline ) Zanjan and sh.Mohammadi .

### **National Gas Dispatching Project**

The control and supervise production quantity transmission network and gas consumption quantity throughout the country, the National Dispatching project was included in NIGCS agenda.

The designed SCADA system in this phase that will collect the required online data includes the National Dispatching NCC center, 434 remote terminals 24 GAS Delivery centers and 12 Operation centers.

In March 2006 the project had 99.6 % physical progress.

### **BUY Back Project – phase II Project Documents**

- Part (1) item ( G ) Clause 85 of the Islamic Republic of Iran's Third Economical social and Cultural Development plan .
- Part (1) item (y) and item (H) clause 29 of the country's year 2001 budget rule .
- LAW for Maximum utilization from technical engineering, productive, industrial and executive capabilities of the country for project execution and provide facilities to export services.
- Report NO 15/1-3424 of HE the Minister of petroleum to the Management and programming Organization for Economic Councils consideration.
- Ratification NO 1315/200-22652 dated 11/1/2001 of the National Iranian Oil Company's Board of Directors.
- The Economical Councils ratification NO. 34/2172 dated 28/3/2001.
- Tri lateral service contract of NIOC, NIGC dated 14/17/2002.
- Order NO 1351/200-23158 dated 18/11/2002 of the National Iranian Oil Company's Board OF Directors.

### **Project Specifications**

- Project owner: The National Iranian Oil Company (NIOC)
- Execution contractor: The National Iranian Gas Company (NIGC)
- Financial contractor: The Naftiran inter trade company (NICO)
- Net amount: \$2,144 million
- Gross Amount: \$2,385 million
- Execution period: 5 years
- Initiation date: 14/8/2002
- Repayment period: 6 years
- Repayment source: project incomes or items stated in item (a) clause 120 in Third plans Law.

### **Project Goals**



- Gas Delivery to 2 million urban and rural households in the country.
- Construction of transmission pipelines for delivery of gas to 130 new cities.
- Gas delivery to 1500 industrial & major units.
- Gas delivery to 44 industrial cities.
- Gas delivery to 8 power plants.
- Generate natural gas consumption potential for 67 million cubic meters / day.
- Annual substitution of 186 billion liters of oil products by 25 billion cubic meters of natural gas towards exports and / or decrease of imports.

### Project Items

- Completion of Parsian Gas Dehydration plants emergency section (Final capacity 48 million cubic meters / day.)
- Construction and completion of 12 gas compressor stations with 1108 total horse powers.
- Construction of 744 Kilometers of high pressure transmission pipe line in diameters of 40 to 546 inches.
- Construction of 3634 Kilometers of high pressure transmission pipelines in diameters below 36 inches.
- Gas delivery to villages in the country (204200 natural gas connections).
- To equip and train man power for project operation.
- Completion of remaining projects from the Gas Delivery buys back project phase1.

### Iran's Natural Gas Trade

Iran presently has two natural gas trade contracts with two neighboring Countries of Turkmenistan and Turkey.

The Turkmenistan imports contract for annual quantity of 8 billion cubic meters was signed in year 1995 and gas imports commenced in year 1997.

Implementing the project require construction of a 40 inches 60 kilometers pipeline from Iran of Turkmenistan border to Kordkuy. the of Turkmenistan gas imports to Iran began in year 1997 for a quantity of 0.4 billion cubic meters the of Turkmenistan gas important gas imports to Iran began in year 1997 for a quantity of 0.4 billion cubic meters and in year 2004 was up to 5.9 billion cubic meters .

The gas exports contract to Turkey was signed in year 1996 with the "Botas" company for annual quantity of 10 billion cubic meters.

To implement the export project, 253 Kilometers of 40 inches pipelines were constructed from Tabriz to the border city of Bazargan. Exports was commenced as of December 10,2001 and export quantities during years 2003 and 2004 have been 3.41 & 3.51 billion cubic meters respectively and within the next four



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years, it is planned to reach contract ceiling of 10 billion cubic meters .

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It is worth mentioning that gas exports were officially inaugurated on January 21, 2001.

### A – Varamin's Yortshie Reservoir

This is an aquifer that assessment to modify the reservoir as a gas storage has been concluded and is awaiting the Economical councils permits to employ a qualified Iranian company in consideration to utilizing 51 % minimum domestic facilities , the reservoir specifications are listed in the following table :

### B-Ghom's Sarajeh Reservoir

According to sanction issued by the National Iranian oil company s Board of Directors , initially the central Region s Oil company is required to deplete the sarajeh reservoirs existing gas in place to proper pressure levels .

Agreements sample for implementing the reservoir depletion phase among NIGC & CROC is being prepared but execution activities have commenced by work over of well NO.8 and drilling of well NO .9. Three dimensional seismography and drilling of other wells are set to commence in year 2004.

### C-Other Reservoirs

Feasibility study, assessment and subsequently storage in the following reservoirs have been included in plans of year 2004:

- **East & West Talkheh**
- **Siah Kooh**
- **Parandak**
- **Mareh Kooh**
- **Abr Dejno**

The above fields are located in central Iran and additionally study for storage in Azerbaijan and Western Iran is also included in the plans.

For the set of above mentioned fields such as Yortshie that are aquifers and do not hold oil or gas in place, the project can be implemented by BOO or BOT methods

