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Gas Exporting Countries Forum in a New Era

At the seventh meeting of the energy ministers of the Gas Exporting Countries Forum (GECF) in Moscow on Dec. 23, 2008, the creation of the GECF as an "official organization" was finalized after its charter was approved. The Qatari capital, Doha, will be the forum's headquarters. In view of the importance of this event, it is appropriate to present an analysis on the issue.

In recent years, natural gas has become one of the most important energy sources in the world. It has been converted from an indigenous fuel consumed in limited regional markets to an important commodity used in international trade. Currently, natural gas is being produced and consumed in about 50 countries in the world. Natural gas has quickly become a choice for consumers preferring it due to its relatively lesser environmental impacts.

In case of the continuation of the current trend, natural gas demand will rise with an annual growth rate of 2.4% which is the highest growth rate relative to other energy carriers. With the development of new technologies to convert natural gas into liquid fuels, the gas demand will further increase. Increasing importance of natural gas in advanced economies has led to new concerns regarding security of gas supply.

This fact has also led to the idea that cooperation among gas exporters should be established.

Forum's Background

Cooperation between producers of different commodities in the world, whether in regional level or at international level, is very usual. These forums and unions are formed with the aim of cooperation, exchange of ideas about common problems, exchange of information and technical know-how as well as resolution of other issues. In view of this necessity, the "Gas Exporting Countries Forum" convened its first ministerial meeting in Tehran on May 2001 with initiative and pivotal role of the Islamic Republic of Iran and with the objective of expanding exchange of idea and cooperation between gas producers. Algeria, Brunei, Iran, Indonesia, Malaysia, Nigeria, Oman, Qatar, Russia, Norway and Turkmenistan participated in the meeting. The ministerial resolution of GECF stressed that they are not seeking agreement to establishing output quota and rationing system in their preliminary meetings.

When the establishment of such a forum was under study and investigation by the then oil ministry officials and relevant experts, it was noted that using terms such as "Gas OPEC" should be avoided. This was because such terms, apart from being incorrect, could create unnecessary sensitivities and rhetoric by the consuming countries overshadowing such cooperation. In addition, it should be noted that: Firstly – The Organization of Petroleum Exporting Countries (OPEC) was established more than forty six years ago for much different objectives and under much different international circumstances. Under such international situations and in view of the type of relations between oil producing and consuming countries, OPEC was practically transformed into an organization consisting of developing countries. It is interesting to note that today OPEC and its members have practically much distanced themselves from their initial goals due to changing international conditions. Secondly – the issues and problems associated with natural gas market is generally different from those in the oil market. Thus, the range of counterparts in the gas market as well as the issues for cooperation could be entirely different and there is no reason to create limitations in this regard by making use of some titles.

Considering the set objectives, the first conference of "Gas Exporting Countries Forum" attained relative success with the participation of a wide range of countries. All participants believed the level of cooperation should gradually increase. The second official ministerial conference of GECF was convened in Algeria with the participation of 13 countries including Bolivia, Egypt, Libya and Venezuela which were not present at the Tehran meeting. The results of some studies conducted on the long term natural gas market in the world were presented at the conference in Algeria (Norway and Turkmenistan did not attend this conference). The third ministerial meeting was held in 2003 in Doha, Qatar, with the presence of 14 countries including Algeria, Brunei, Egypt, Indonesia, Iran, Libya, Malaysia, Nigeria, Oman, Qatar, Russia, Trinidad and Tobago, UAE, Venezuela and Norway. The meeting reviewed and examined reports that some countries had been committed to prepare during the conferences held in Tehran or Algeria. The forum's fourth conference was held in Cairo in 2004 with the presence of the same group of countries who participated in the last conference. In this conference, the forum's board of governors was nominated. In view of the low crude oil prices, the members exchanged views regarding separation of the price relations between natural gas and crude oil. The forum's board of governors held more meetings in July 2004 and January 2005. The fifth ministerial conference of GECF was convened in Trinidad during April 25-27, 2005 with the presence of ministers from Trinidad and Tobago, Iran, UAE and

Qatar. Libya, Oman and Indonesia did not take part in this meeting. The board of governors suggested to the ministerial conference the establishment of the cooperation office of gas exporting countries in Qatar. This proposal was approved by the ministerial conference. Due to the rise in crude oil prices, the member countries did not pay attention to the issue of separation of the price relations between natural gas and crude oil discussed at the Cairo conference. Also, it was decided to hold the next meeting in March 2006 in Venezuela. However, the meeting was ultimately cancelled due to prevailing political crisis in Venezuela. The forum's sixth conference was held in Doha, Qatar on April 2007. In this meeting, which was held behind the closed doors, it was decided that a high-ranking group become in charge of developing a common methodology for formulation of the export price of gas as well as managing the research with respect to consuming markets. In addition, it was decided that this group (mainly comprising oil and energy ministers or their representatives) present a proposal regarding the charter of this organization to the next meeting due to be held in Moscow.

The forum's seventh meeting held in Moscow on Dec.23 brought about more serious cooperation within the forum after seven years. In addition to pivotal countries of Russia, Iran, Qatar, Venezuela, Norway and Algeria, the other participants in this meeting were Bolivia, Egypt, Libya, Trinidad and Tobago, guinea, Nigeria and Kazakhstan. Russian Prime Minister Vladimir Putin announced at the opening of the meeting that we won't sell gas at cheap and low prices any longer. Such remarks increased the sensitivity of this meeting.

Obstacles to Cooperation

There are obstacles for development of mutual cooperation among gas exporting countries which should be heeded and resolved in a continuous and gradual trend.

The number of gas exporting countries as members of an organization has a great impact on the organization's performance. As the number of members grows and their interests become more diversified, the process for decision and policy makings as well as reaching unanimity within the

organization will become more difficult. This is an important issue since the gas exporting countries are not at present at the same level having different and sometime contradictory interests. Currently, the most important anxiety of the gas industry in the Middle East countries is to secure access to technologies for gas production, exploitation and liquefaction as well as making gas transportation more flexible. This is whilst countries such as Russia and Algeria are making endeavors to increase production capacity in order to meet the consuming countries' (especially in Europe) growing demand for gas. On the other hand, the gas exporting countries also have very different export destinations. And some of the forum's members are hardly considered as potential gas exporters. On the other hand, a number of very important gas exporters such as Australia, Holland and Canada have not yet joined this forum. Some of the very important countries in this group particularly Russia and Qatar have concluded long-term (15-25 years) contracts with different countries and in particular Europe. Such contracts, from one side, guarantees their gas market for several decades in the future and on the other hand, cancellation of these contracts will impose heavy compensation costs on the exporters if the other parties take the cases to the international tribunals. In other word, it seems impossible for the contracts already signed to be cancelled.

Investment in the gas industry will not easily be economical due to its high development costs, less flexibility in gas transportation compared with coal and crude oil, high expenses for storage facilities along side the relatively low gas prices due to its pricing formulation being tied on crude oil. But the world developments and the swap of LNG cargos even in return for receiving gas through pipeline will gradually make the gas market more flexible leading this market toward globalization. With increasing political risks in gas producing countries, the world's big investors have become unwilling to invest in these countries' gas fields. And due to incapability of these countries to finance their own projects, their production capacity and market share has not grown to the extent of available potentials in these countries. Such an issue would indirectly impact expansion of the cooperation.

An increase in demand for one of the energy carriers will have an impact on the price of other energy sources. As demand for gas grows, it will also result in an increase in price competition between oil and gas leading to the gradual reduction in their price differentials. But at the present time, the pricing structure of natural gas is still formulated based on the price of crude oil. Consequently, the role of replacing natural gas with crude oil has not been taken into consideration. Putin's address at the opening of the seventh meeting brings to the mind the point that the forum may try in the future to separate natural gas pricing system from that of crude oil and define an independent pricing system for gas.

But what is important is that such international unions and organizations will be successful when their members do not give preference to short term and political goals but take up comprehensive and long term positions in order to settle down and develop the market of their commodity. A group of informed people bring up this probability that: Russia's goal in welcoming and pursuing issues such as this forum is to take advantage of this potential for pursuing its own goals with respect to its energy relations with Europe and consolidating its gas leverage to break up western pressure following the assault on Georgia. Islamic Republic of Iran who has been the original founder of this forum (and news indicate that it has also suggested the draft of the forum's charter) must follow the forum's developments vigilantly and effectively.

Director

Iran's Gas Export to Europe; Challenged by the Bermuda Triangle

Afshin Javan

Turkey's Strategic role as a gate for the entrance of Iran's gas into Europe should be considered from several angles. – Europe's future needs for natural gas, - Russia's current exclusive role in supplying gas to Europe and the strategy of eliminating the rival and –the real potentiality of Iran for gas supply, clear position with regard to export and the US sanction

Europe's need for natural gas

Natural gas has an important role in Europe's energy basket. In 2006, natural gas took 25% in total energy consumption in Europe. The seven countries of England, Germany, Italy, France, Holland Spain and Belgium consumed 83% of European Union's (EU's) total consumption in 2006. The housing and commercial sectors were the largest consumers of natural gas followed by the industrial and power plants' sector. Gas consumption in these sectors has an increasing trend. The demand of the above mentioned sectors were 39%, 33% and 23% respectively in total consumption in 2005.

Europe is the third largest customer of natural gas after the countries of the former Soviet Union and North America. The consumption of natural gas in the EU and Turkey has been about 18% of the total demand for gas in the world. Based on forecasts, however, the reserves in this continent are declining and natural gas production in this region was only 6.6% of world production in 2006. To achieve its

main goal of securing an exclusive supply of gas, the EU requires suitable and sufficient infrastructures.

The Europe's natural gas network, with the exception of Spain, Portugal and part of southern Europe, is suitably developed. In addition, there are 14 terminals for LNG import in the EU and 2 terminals in Turkey. License has also been issued for construction of another 9 terminals in the Western Europe. They are to be completed by the year 2012 increasing the total liquefaction capacity in this region to about 154 million tons per year. A number of important pipeline projects have also been developed. The 1200-km Langeledd pipeline is connecting Norway to England. Also, Holland and England are connected via Balgzand-Bacton (BBL) pipeline. Both pipelines have become operational since 2006.

The politicians and consumers have recently been worried about the outlook of relying on rising volume of gas import. Since 1975 the annual growth rate of natural gas consumption in the EU has been averaged at 3%. Although there was a boom in the natural gas market in Turkey only at the end of the

1980s, but the country's demand has gone up greatly. The average growth rate of demand in this country has been about 14% since the year 2000. Spain, which imported its first LNG import in 1969, has also experienced a significant growth in the natural gas market. The annual growth rate of demand in Spain is averaged at about 11% since 1973 and about 13.3% since 1985.

Russia's exclusive role in supplying gas to Europe and the strategy of eliminating the rival

Europe has excessive dependence on Russian gas. In 2006, the EU25 countries imported 40% of their gas requirements from the Russian Federation. This is almost equivalent to 119 billion cubic meters or 11.5 billion cubic feet per day. Russia possesses the largest natural gas reserves in the world. The country's proved gas reserves at the end of 2006 have been estimated at 47.7 trillion cubic meters (1682 trillion cubic feet). Most European countries, with the exception of England and the Iberian Peninsula, import gas from Russia though pipeline.

The natural gas production in the EU countries (EU25) reached its maximum volume in the late 90's. Natural gas output by the EU25 in 2006 was 190 billion cubic meters (18.4 billion cubic feet per day) amounting to 6.6% of the total world production.

The two countries of England and Holland have accounted for 77.5% of Europe's natural gas production. In England, which is the biggest market for natural gas in Europe, domestic output is declining exerting a significant impact on the supply structure from the north of Europe.

The proved reserves in the EU25 countries have been estimated at 2.43 trillion cubic meters or 85 trillion cubic feet at the end of 2006. The resources will last for less than 13 years at the current rate of production.

The production of natural gas from the above countries is only covering about one-third of the demands by the EU and Turkey. The remainder of supply is imported via pipeline from the neighboring producing countries. An increase of import through pipeline from Russia and Norway has been covering 70% of demand between the years 1998 to 2006. This is while domestic output had diminished by about 20% during the same period.

Is Russia, in spite of having reliable European customers, prepared to tolerate a new rival in this field jeopardizing its guaranteed income?

The real potential for gas supply by Iran, clear position with regard to export and the problem of the US sanction

At the ceremony held for signing the Memorandum of Understanding (MoU) between Iran and Turkey for cooperation in the energy sector on November 17, 2008, the Iranian petroleum minister stated: "in addition to the exportable

volume of gas to Europe, 50 million cubic meters of gas per day will be exported to Turkey and in total, 160 million cubic meters of gas will be transferred to the Turkish border." He evaluated as very large the volume of gas transferred to the Turkish border and said: out of this quantity, a daily volume of 110 million cubic meters will be transferred to the Turkish border through the ninth trans-pipeline. He also added: The phases 22 to 24 of the South Pars will be developed based on buy- back contract. The Turkish side would receive the gas by investing in these phases.

The petroleum minister announced that the permit to transit Iranian gas to Europe via Turkey was another issue discussed with Turkey and stated: Meanwhile, the Turkish side will also be allowed to transfer the Turkmenistan's gas to the Turkish border via the Iranian territory. Nozari emphasized that the cooperation MoU in the energy sector concluded between Iran and Turkey will be changed into a contract within the next one year.

But the important question is: what is the tool with which Iran plans to enter into the European market via Turkey?

Iran's pricing policies for gas export is one of the important issues having a lot of critics. It is a key issue which must become transparent before thinking about entering foreign gas markets.

Some pricing critics believe that we should enter the market with a high price of gas because the whole world is in need of our gas. They overlook the fact that there is also a rival watching us carefully and will be able to influence our pricing policy. Thus, the gas should be priced rationally with the assumption of the long term penetration into the European market and we should abstain from using slogan and publicity.

Our geographical position is very unique and this situation should be used cleverly. But will Russia give us this opportunity in view of its own exclusive role?

It seems as though Russia exerts influence on Iran's gas market by two ways. Our import sector is being affected through Turkmenistan and our export sector through Turkey. It seems this pivotal role can not be ignored. In the area of gas import, the Turkmen desire an increase of the price and in the area of export, the Turks desire a reduction of the price from Iran. It is interesting that both the seller and the buyer make their claims on the basis of the Russians. The Turkmen claim that they sell gas to the Russians much more expensive than they do to Iran. And the Turks have claimed for years that they import gas from Russia cheaper than they do from Iran. This Russian paradox deserves contemplation.

Europe's need for Iranian gas is inevitable. But it should be noted that this is a very difficult and complicated matter. In the meantime, the existence of the Turkish gate should be taken into consideration. In this connection, the decision making role, the risk management as well as the right policy making in the gas trade by our country is very determining. It should be implemented in such a way that, in addition to justify Turkey, minimizes Russia's influence. But there is another problem in this respect. That is the Turkey's close relations with the USA and Israel which adds to the intricacy of the condition.

Does Turkey have enough independence to ignore the US sanction against our country? How could the European countries' role - whose security of their supply has been linked to the Russians and are eagerly looking to diversify their gas import - be evaluated?

We should have a trust on the future. The passing of time may perhaps reduce the intricacy of Iran's gas export to Europe enabling us to cross the Bermuda triangle. But do not forget that the time should also be managed.

The Address by Deputy President and Head of Iran's Atomic Energy Organization HE Gholam Reza Aqazadeh At the Int'l seminar on

"Nuclear Power Plants, Environment and Sustainable Development"

Nuclear sciences and techniques are among the advanced and superior technologies in the current era. Today, the impact of these sciences on developing human knowledge, gaining control of the nature and safeguarding the welfare and progress of the mankind has been unquestionable. And it can correctly be considered as the elements and essential pivots for sustainable development as well as the prime factor of a country's power and authority. In fact as a result of persistent effort made by researchers during the past half a century, this technology has played an important role in the growth of industry, agriculture and medical practice. Using radioisotopes in diagnosis and treatment of diseases, employing nuclear sciences in electricity generation, production of materials with special properties, and also production of species of agricultural products resistant to pests and small supply of water are only among some of the various usages of these sciences in medicine, industry and agriculture. In view of the excellent and impressive impact of nuclear technologies in scientific, economic and social branches and generally sustainable development, the Islamic Republic of Iran is determined to open its way in the meandering road of peaceful uses of this technology.

Throughout the world, various reactors are currently functioning many of which are being utilized to produce power for the purpose of converting it to electrical energy, some are used to provide motor power for the ships and submarines, some are being used to produce radioisotopes and for the purpose of scientific researches whilst other types are useful for experimental and educational purposes.

At present, there are 439 nuclear power plants in operation in the world out of which 104 nuclear power reactors are operating in the USA, 59 power plants in France, 55 power plants in Japan and 31 plants in Russia. Therefore, the advanced nuclear countries possess the highest number of atomic

power plants in the world due to the necessity of energy resources for their industrial development. Thus, they have the highest rate of production and consumption of nuclear fuel in the world. Currently, a significant number of atomic power plants are under construction in the world. There are eight power plants in Russia, six power plants in China, six power plants in India, four power plants in South Korea, two power plants in Japan , one power plant in the Islamic republic of Iran and one power plant each in France and USA are under construction. In view of the above figures, it is clear that the countries possessing advanced nuclear technologies – for the reason of accessing energy sources - have considered

the usefulness of nuclear power plants in their countries as one of the most important and essential tools to produce energy. At present, France produces 76.9% of its electrical energy from nuclear reactors while this share in Russia is 16%, in England 15%, in the US 19.4%, in Japan 27.5%, in Germany 27.3% and in Finland 28.9%. The above figures demonstrate that the advanced and developing nuclear countries have a tendency toward producing nuclear power as one of the principal sources of energy production.

Careful of its need and requirement for diverse energy sources, at present one of the main goals of the I.R. Iran is accessing nuclear power as one of the main sources of energy production.

Having a population of 70 million people, the Islamic Republic of Iran has a primary energy supply of more than 1000 million barrels crude oil equivalent. With an average yearly growth rate of 6.11 percent, the total energy consumption has been increased to 725.1 million barrels oil equivalent in 2003 from 180.9 million barrels oil equivalent in the year 1977. The average growth rate of electrical generation has been more than 8.5 percent annually during the same period. Since these power plants are mostly fuelled by gas oil, oil and natural gas, it is expected that the country's power plants continue to rely on oil products. The energy consumption of the country's power plants for electricity generation has been increased by 9 percent during the past two decades which is a very high figure. Also, the amount of energy subsidies paid by the government is the highest amount paid among commodities and government services.

Now we must think of a remedy. In view of the following considerations, the Islamic Republic of Iran - because of possessing massive oil and gas resources - can not merely rely upon fossil fuels for meeting its energy requirements:

Firstly, these resources are limited and belong to the country's future generations. Therefore, it is not permissible to misuse them.

Secondly, taking advantage of these resources in particular industries such as petrochemical will definitely bring about higher add value to the country.

Thirdly, the consumption of these resources as fuel inside the country has severely overshadowed the foreign exchange obtained from the export of crude oil and natural gas. It is declared that in case of continuation of the trend of consumption of energy carriers, Iran will become an importer of crude oil

and some of its related products in the next few decades.

Fourthly, the government pays a lot of hidden subsidies for fuel consumption in the country. This imposes a great deal of expenses on the state in such a way that under the current pricing system, the production and distribution costs of these fuel products can not be obtained.

Fifthly, the environmental concerns are another very important issue in this respect. This issue is causing regional and global problems and countries are obliged to some extent to observe and implement environmental regulations for the survival of the earth and its environs. In particular, the international activities have long been started in this area.

Based on the above mentioned reasons, the dependence of the country's energy supply system on fossil fuels has become illogical making the use of new technologies such as nuclear technology competitive compared to fossil fuels. At present, the country's energy demand and consumption in the perspective of 2025 has been estimated between 3000 million barrels oil equivalent and 4500 million barrels oil equivalent considering different choices of expansion and consumption of energy in the country. In view of the aforesaid necessities, the development of atomic power plants and generation of nuclear power in the country is considered as one of the most important solutions for the Islamic Republic of Iran for meeting its energy requirements in the future decades. Based on ratifications of Islamic Consultative Assembly (Majlis), legal obligations and studies conducted by different research groups, Iran's Atomic Energy Organization has been charged with a duty to produce 20,000 Mwe nuclear electricity in the country. Thus, the Atomic Energy Organization of Iran has compiled a comprehensive plan for development of nuclear electricity, development of manpower resources, production of nuclear fuel, equipping research centers and production of needed equipment for implementing the above mentioned necessities.

If the plan for construction of nuclear power plants and generation of 20,000 Mwe nuclear power capacity is fulfilled by the year 2025, a saving of hundreds of million barrels of crude oil in the consumption of the country's power plants will be achieved considering output factor of 60 percent. The economic value of such a saving will be very significant. In addition, from social and environmental point of views, it will prevent the production of hundreds of thousands tons of carbon dioxide, thousands tons of suspended particulates, hundreds of tons of sulfur and nitrogen oxide. It is certain that if the output factor is taken in excess of the amount considered, the economic and environmental savings of the construction of nuclear power plants will definitely be more than the above mentioned quantities.

A cardinal point in this regard is Iran's will and determination to diversify atomic power plants by paying attention to local ability to design and construct power plants and taking advantage of the scientific knowledge which has been developed in Iran.

In addition to power plants of the type PWR – a unit of which is currently under construction in Bushehr - the Islamic Republic of Iran is determined to build and put in operation a 360 Mwe power plant by benefiting from domestic technology.

Undoubtedly, the Islamic Republic of Iran's firm determination to develop the technology for construction of the medium-scale (360 Mwe) power plants and research reactors will encourage Iran's Atomic Energy Organization to gain the necessary know-how by relying on domestic specialists and resources. In this respect, I propose regional countries to form a consortium to construct and develop light water nuclear power plants in the region. Islamic Republic of Iran is ready to provide very soon a comprehensive plan for the proposal if it were approved in generalities by the Persian Gulf littoral states.

Iran offers more gas to Turkey

Iran is prepared to increase gas exports to Turkey after Ankara's supplies - along with those of several European nations - were cut due to a dispute between Russia and the Ukraine, an Iranian diplomat said Tuesday.

Iran's official IRNA news agency quoted the country's economic attach in Turkey as saying Tehran is "prepared to put extra gas at Turkey's disposal in tune with its technical capability and potential" to compensate for the halt in Russian gas supplies.

The diplomat, Ahmad Nurani said Tuesday that Iran currently supplies 18 million cubic meters of gas per day to Turkey.

Iran is the second biggest gas supplier to Turkey after Russia.

Russia and the Ukraine's bitter dispute over gas pricing and overdue payments has resulted in Moscow shutting off supplies to six European nations. The gas supplies affected transit through Ukraine.

Liberalization of Iran's gasoline price to start next year

As of the beginning of the next Iranian year (21st March), the price of gasoline in Iran will start its gradual liberalization so that in three years' time the product will be sold at a price equal to 90% of its FOB Persian Gulf market price, says Iran's deputy oil minister for planning Akbar Torkan.

According to ISNA, Torkan went on to stress: "That means, neither the rationed rate of Rials 1,000 per liter nor the open market Rials 4,000 p/l gasoline will be available in Iran next year".

Iran cuts oil output by 545,000 bpd

Iran said on Wednesday it would cut oil output by 545,000 barrels per day from Jan. 1 in line with OPEC's decision to reduce production.

The Organization of the Petroleum Exporting Countries agreed in Algeria this month to cut output by 2.2 million bpd from Jan. 1 to try to halt the slide in crude prices that have fallen from $147 a barrel in July to below $40.

"The Islamic Republic of Iran, starting from Thursday, will cut its crude production by about 14 percent," said Seifollah Jashnsaz, the head of state-owned National Iranian Oil Company, the Iran's state broadcaster reported on its website.

"From tomorrow the daily crude production of the Islamic Republic of Iran will be reduced by 545,000 bpd," he said.

"This action by the Islamic Republic of Iran takes place in the framework of executing the decision made at the last meeting of OPEC oil ministers," Jahnsaz said. He did not give a total output target.

Iraq offers 11 oil & gas fields to foreign firms

Iraq on Wednesday opened up some of its most prized oil and gas fields to international firms that have been excluded for decades, part of new deals that could more than double its output within a few years.

In a second bid round, following on from one earlier this year, Iraq has put forward 11 oil and gas fields, including super giants.

'Under service contracts prepared by the oil ministry, 11 oil and gas fields will undergo complete development,' Oil Minister Hussain al-Shahristani told a Baghdad news conference.

Two of the oilfields - Majnoon and West Qurna Phase II - are classed as super giants and between them could produce 1.2 million barrels per day (bpd) when fully developed.

Shahristani named the other fields as Halfaya, East Baghdad, Gharrafa, Qayara, Najmah, Badrah, Kifil/West Kifil/Mirjan and a group in Diyala province, as well as the Siba gas field in Basra province.

He said the 11 fields could increase production by up to 2.5 million bpd within three to four years of the contracts being completed at the end of 2009. That increase is roughly equivalent to what Iraq produces today.

Three of the fields are jointly owned with neighbours Iran and Kuwait. Developing them would require bilateral deals with those states, which were not opposed, Shahristani said.

Producing crude oil in Iran costs max $ 5 p/b: Official

According to director of corporate planning dept. of NIOC Abdol-Mohammad Delparish, in order to calculate the precise cost of producing a barrel of crude oil in Iran, one has to make use of industrial accounting method and the figures mentioned in the media are not precise enough.

Delparish said, one could say that by and large producing a barrel of crude oil in Iran does not cost more than $ 5 per barrel.

Iran, Pakistan move forward on gas deal

After two days of negotiations over terms of Iran-Pakistan gas deal, the two have reached an accord on a new gas pricing formula and on the conditions in the 'price revision' clause of the contract, says Hojatollah Ghanimi Fard, Iran's chief negotiator in the famous IPI pipeline project, adding: "We and are now waiting for the final comments of the high ranking officials of the two countries on what has been agreed".

According to ISNA, Ghanimi Fard said in the revised 'price revision' clause, both sides can now ask for a 'price revision' a year before the start of delivery of gas.

Asked if it had also been agreed that Iran would have the right to extend the pipeline beyond Pakistan's territory into a third country if need be, Ghanimi Fard said that clause was already in the deal and did not have to be discussed again.

Reliance to stop gasoline sales to Iran

Reliance Industries Ltd has decided to stop gasoline supplies to Iran after fulfilling all contractual obligations, the Business Standard newspaper reported on Wednesday.

The decision came after eight U.S. congressmen wrote to the U.S. Export-Import Bank to suspend all financial assistance to Reliance until it agreed to halt sales to Iran, the newspaper said, without naming its sources.

The move will not impact Reliance's business as sales to Iran were not substantial, the newspaper said.

"As a corporate policy and to maintain business confidentiality, we do not comment on specific transactions," a Reliance spokesman told Reuters.

Reliance last month started up a new refinery in western India, almost doubling company output and creating the world's biggest refining complex just as global oil demand slows.

Are neighbors beating Iran in tapping shared fields?

Few high level managers of Iran's oil industry have recently been claiming that Iran's Southern Arab neighbors in the Persian Gulf are tapping the hydrocarbon reserves they share with Iran at a rate 'many times' faster than Iran is. For instance, managing director of NIOC Seifollah Jashnsaz has said the Arab neighbors are moving 'nine times' faster than Iran in using the common reservoirs. Similar figure was mentioned a little earlier by managing director of PetroIran Ali Beheshtian, when addressing a ceremony marking the 100th anniversary of birth of oil in Iran.

This 'nine times' was then reverberated in Iran's news agencies and newspapers with large font headlines, creating an atmosphere of disappointment amongst members of the public.

To find out the volumes of oil or gas the Arab neighbors are actually producing from the fields they share with Iran, IranOilGas Network has conducted a survey and produced the following table, displaying details of productions of those shared fields in the Persian Gulf:

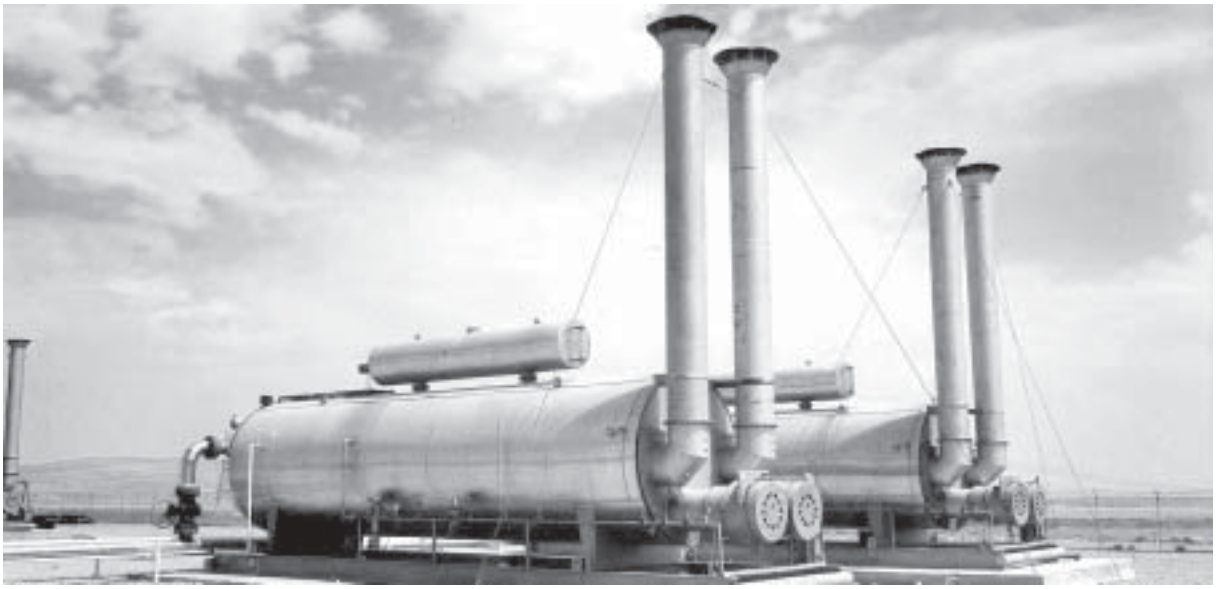
Field (in Iran) Sharing Field (Country) Field Type Production

Based on figures in above table, Iran is producing a total of 123,000 bpd of oil and 150 mcm/d of gas from the shared fields, while Iran's neighbors are producing a total of 732,000 bpd of oil and 295 mcm/d of gas from the same fields in the Persian Gulf.

Field (in Iran)	Sharing Field (Country)	Field Type	Production	
			Iran side	Neighbor side
Arash	Dorra (Kuwait)	Gas	No pro	No pro
Esfaindiar	Lulu (S.Arabia)	Oil	No pro	No pro
Forouzan	Marjan (S.Arab)	Oil	46 kbpd	270 kbpd
South Pars (Gas)	North Dome (Qatar)	Gas	150 mcm/d	280 mcm/d
South Pars (Oil Layer)	Shahin (Qatar)	Oil	No pro	240 kbpd
Reshadat	Al-Khalij (Qatar)	Oil	5 kbpd	80 kbpd
Salman	Abu Al-Bukhoosh (UAE)	Oil/Gas	No gas Pro & 65 kbpd	540 mcf/d & 42 kbpd
Farzam	Fallah (UAE)	Oil	7.5 kbpd (Farzam + Nosrat)	25 kbpd
Nosrat	Fateh (UAE)	Oil	7.5 kbpd (Nosrat + Farzam)	75 kbpd
North Saleh	Saleh (UAE)	Gas	No pro	Small quantity
Hengam	West Bukha (Oman)	Oil/Gas	No pro	No pro

Managing Director of South Zagros Oil & Gas Production Co. announced in an interview with "Mashal"

Annual Production of 80 Billion Cubic Meters of Gas From Southern Zagros



The South Zagros Oil & Gas Production Co. and the East and West Production Companies are subsidiaries of the Central Oil & Gas Fields Company (COGFC). The South Zagros Oil and Gas Production Co. manages production from large gas fields in the country's three provinces. The company has a special place due to production of significant volume of the country's required gas. An interview has been conducted with Javad Owji, the company's managing director to tell us about the company's activities as well as its development projects.

Mashal- Which regions and fields are managed and operated by Southern Zagros Co.?

Southern Zagros manages production from large gas fields located in three provinces. We have two gas fields of Nar and Kangan in the Bushehr province with a capacity of 104 million cubic meters per day and six gas fields of Aghar, Dalan, Tabnak, Shanol, Homa and Varavi in the Fars province capable of gas production at 120 million cubic meters per day plus the Farashband gas refinery. Also, we possess the two gas fields of Qeshm and Sarkhun in the Hormuzgan province which can produce at 151 million cubic meters per day. In total, the level of production of 10 gas fields stands at 250 million cubic meters per day which will reach 258 million cu. m. per day in the winter of the current year by drilling 15 new wells in the fields of Nar , Kangan, Aghar , Dalan, Sarkhun,

Tabnak, Varavi and Shanol.

Mashal- Have you implemented any improved oil recovery (IOR) prior to drilling new wells in the southern Zagros fields?

The company's average production stood at 177 million cu. m. per day during the first six months of the year 1386 (2007), reaching 199.5 million cu. m. per day during the same period in the current Iranian year by improving conditions and employing the current capacities. The total gas production in the first half of 1387 reached 37.111 billion cubic meters plus 12.62 million barrels of condensate. The figures indicate more than 11 percent increase in the gas production and 11.8 percent increase in the production of condensate compared to the first half of the year 1386.

Mashal- What measures have so far been taken in the southern Zagros for optimization and increase in the output?

Since the beginning of the current year, the South Zagros Oil & Gas Production Co. has succeeded in implementing the necessary basic maintenance within its operational regions. These measures include basic maintenance in the Aghar, Dalan production unit, 8 gas gathering centers in the Aghar and Dalan, repairing 14 wells by drilling rig and 23 wells by wire-line truck as well as maintenance of all burning pits in the southern Zagros regions without interruption in the oil and gas production. These maintenances caused an increase of about 11 percent in the output compared to the first half of 1386. Also, by commissioning the section for well services in the operational zone of the southern Zagros during the past years, most of well repairs are being conducted by this section. This is economical and can also save time. The southern Zagros will be fully self-sufficient in the near future following development of this section for repairing the wells.

Mashal- You mentioned about drilling 15 new wells in the region. When do these wells will be put into operation and how much will their rate of production be?

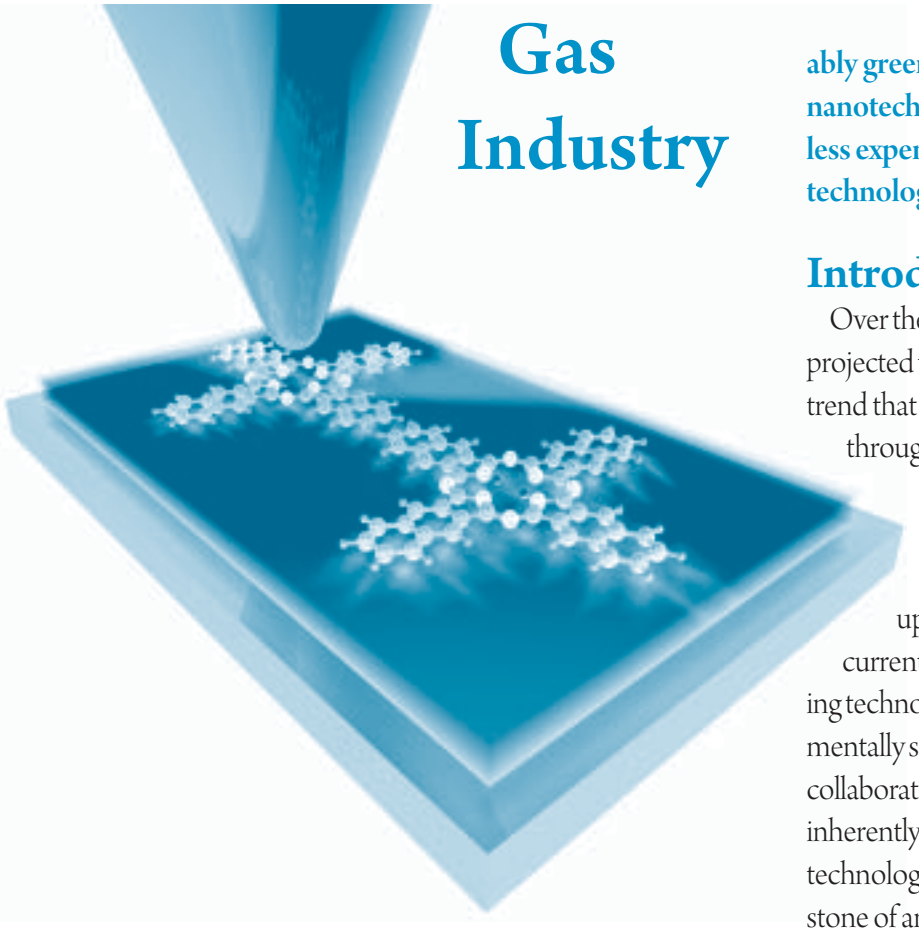
It is hoped that these 15 wells will be put into

operation in the month of Azar (December 2008) thanks to the close cooperation between our company and COGFC. Out of 15 wells anticipated, 4 wells have currently been completed in the Nar and Kangan regions starting production in the next 45 days. Thus, the production from Nar and Kangan will be raised to 11 million cubic meters from 10.4 million cubic meters. Kangan field is the biggest onshore gas field in the Middle East. So far, about 30 percent of the field's gas reserve has been exploited. Thus, it was essential to drill new wells due to the field's high potential. As regards to the Nar field, some 72 percent of its gas capacity has already been exploited. Investigations indicate that the Nar pressure boosting station should be put into operation as soon as possible. Fortunately due to the station's 94 percent physical progress, it is hoped to be commissioned in the early month of Azar (end November 2008). By putting this station into operation, the reduction in the output of about 10 million cubic meters per day will be prevented. This is a significant task considering the Nar field's production capacity of 34 million cubic meters per day. Altogether, by drilling and producing from 15 new wells, it is predicted that up to 80 billion cubic meters of gas will be produced by the end of the current Iranian year (1387). This volume is equivalent to the production of 11 phases of the South Pars gas field.

Mashal- What development plans have been envisaged for the southern Zagros oil & gas Co. and whether the developments of the region's oil fields are a part of these planning?

We shall initiate exploitation of the oil fields located in the southern Zagros region from the second half of 1388 (October 2009). The fields include Khesht, Sarvestan and Saadat Abad. The crude oil produced from Sarvestan and Saadat Abad amounting to 25,000 barrels per day will be delivered to the Shiraz refinery while the oil from the Khesht field at about 30,000 barrels per day will be transferred to the Ganaveh port for export. Also, the development of two gas fields of Sefidza and Haghrudi is on the agenda in the Central Fields Co. which will come into production in the year 1389 with an output capacity of 14 million cubic meters per day. For the first time in the history of the Iranian oil industry, gas is going to be injected into the oil fields of Khesht, Sarvestan and Saadat Abad simultaneous with the start of production from these fields. To this end, the solution gas from Majidieh field will be injected into these fields simultaneous with production. The crude oils produced from the three fields are one of the lightest oils produced in the country. The recovery of these fields can be improved up to 45 percent by injecting CO_2 gas produced from the Persian Gulf power plant. On the other part of the three fields, Sefidzakhor, Day and south Geshu are under development. Preliminary studies have been conducted on these fields and drilling rigs will shortly be installed in defined locations. In the Parsian zone, we also have Tabnak field with the capacity of 42 million cubic meters per day and Hush field with the capacity of 38.5 million cubic meters per day. By implementing basic maintenance in the phase 2 of the Parsian zone in the current year, we predict that in the upstream sector, the field's production will be increased to 85 million cubic meters and 95,000 barrels of oil.

Applications of Nanotechnology in Oil and Gas Industry



Abdollah Esmaeili & Maryam Dehghani

Abstract

Nanotechnology is poised to impact dramatically on all sectors of industry. Nanotechnology could be used to enhance the possibilities of developing conventional and stranded gas resources. Nanotechnology can be used to improve the drilling process and oil and gas production by making it easier to separate oil and gas in the reservoir. Nanotechnology can make the industry considerably greener. There are numerous areas in which nanotechnology can contribute to more-efficient, less expensive, and more-environmentally sound technologies than those that are readily available.

Introduction

Over the next 30 years, global energy demand is projected to rise as high as almost 60%, a challenging trend that may be met only by revolutionary breakthroughs in energy science and technology. The industry needs stunning discoveries in underlying core science and engineering. Breakthroughs in nanotechnology open up the possibility of moving beyond the current alternatives for energy supply by introducing technologies that are more efficient and environmentally sound. Nanotechnology is characterized by collaboration among diverse disciplines, making it inherently innovative and more precise than other technologies. Such a technology may be the cornerstone of any future energy technology that offers the greatest potential for innovative solutions.

The laws of classical dynamics begin to deteriorate at high velocities and small scales where Einstein's relativity and quantum mechanics take over, respectively.

Accordingly, small particles traveling at high velocities are subject to the laws of relativistic-quantum mechanics. Amazing phenomenon begin to occur in this domain, and new technology is trying to take advantage of these phenomenon to create miraculous machines.

Quantum Mechanics becomes extremely important at these atomic scales. Quantum Mechanical

uncertainty begins to play a large role in our ability to determine how a nanoscale machine such as a small robotic arm will behave in certain conditions. Effects like electrons tunneling through potential barriers can form both hindrances and advantages in creating such machines. Interestingly, the scanning tunneling microscope (STM) widely used in both industrial and fundamental research to obtain atomic-scale images of metal surfaces, itself uses the quantum tunneling effect to view and manipulate nanoscale particles, atoms and small molecules and to map surfaces. The STM, first used in the mid-1980s, allowed scientists not only to see details of atomic structures, but also to manipulate those structures.

Unlike relativity, which has remained unchanged since Einstein's formulation, quantum mechanics is still being formulated to some extent. This theory is not a result of only one person but of many people's calculations and ongoing experiments. Alongside, other theories are also developing for describing small scale and high velocity behaviors such as Superstrings which has been quite popular in the recent years. The theoretical developments are closely correlated with recent discoveries in nanotechnology that remained unexplained by older theories. The seemingly sudden new discoveries are not a result of an impulsive idea but sequences of small experiments gradually done in labs until a refined product is seen. When the new discovery comes into the attention of thousands of physicists all of a sudden, new ideas begin to evolve, and new theories and experiments are formed. Take for example, quantum dots which are still undergoing this gradual development.

Quantum dots are tiny particles of semiconductors such as cadmium selenide that behave as if they were individual atoms. They can absorb light energy, kicking their internal electrons up to higher energy levels, and then release the energy by emitting light. A quantum dot fluoresces much more brightly than a dye molecule, making it a desirable marker especially to track the moving molecules of a living organism since an electron microscope cannot be used. This process is known as *biological tagging*.

Importance of Nanotechnology in Industry

Nano" denotes a thousand millionths (10^{-9}), with a nanometer equaling a millionth of a millimeter. That corresponds to the width of 10 hydrogen atoms. A nanometer is merely ten angstroms long where an angstrom is named after Swedish astronomer and physicist, Ångström, Anders Jonas (1814–1874), who was one of the early formulators of the science of modern spectroscopy. Ångström wrote extensively on terrestrial magnetism, the conduction of heat, and especially spectroscopy. He published a monumental map of the normal solar spectrum that expressed the length of light waves in units of one ten-millionth of a millimeter. This unit of length usually used to specify radiation wavelengths is now known as the angstrom (10^{-10} meters). He discovered that hydrogen is present in the sun's atmosphere, and he was the first to examine the spectrum of the aurora borealis. Although, the diameter of atoms varies and the basic unit is taken to be the Bohr radius ($5.2917725 \times 10^{-11}$ m), the diameter of an atom depending upon the element is approximately one to five angstroms. This puts from 2 to 10 atoms in a nanometer and 2000 to 10000 atoms in a micrometer. For example, there are about 3 silicon atom diameters in a nanometer.

So the nanotechnologist is concerned with building new structures and substances by manipulating molecules and atoms on this scale. Technically, nanotechnology is the art and science of building materials that act at the nanometer scale. It builds at the ultimate level of finesse, one atom at a time, and it does it with molecular perfection.

In a general sense, nanotechnology is the ability to create and manipulate matter at the molecular level that makes it possible to create materials with im-

proved (or, more accurately, altered) properties, such as being both lightweight and having ultrahigh strength, and greater capabilities such as in electrical and heat conductivity. Another research approach is known as top-down nanofabrication, which involves working with bulk materials and reducing them to nanometer size. This is most common in currently used technology development schemes.

Nanotechnology is poised to impact dramatically on all sectors of industry. In oil and gas applications, nanotechnology could be used to increase opportunities to develop geothermal resources by enhancing thermal conductivity, improving downhole separation, and aiding in the development of noncorrosive materials that could be used for geothermal-energy production. Nanoscale metals already have been used to delineate ore deposits for geochemical exploration. Nanotechnology can be used to improve the drilling process.

Some specialized petroleum laboratory has developed an advanced fluid mixed with nanosized particles and superfine powder that significantly improve drilling speed. This blend eliminates damage to the reservoir rock in the well, making it possible to extract more oil.

Nanotechnology and Gas Industry

Nanotechnology could be used to enhance the possibilities of developing unconventional and stranded gas resources. Near-term challenges focus on liquefiednatural- gas (LNG) infrastructure and efficiency, LNG quality, and developing gas-toliquids (GTL) technology. Midterm challenges include developing superpipelines; constructing floating GTL platforms; production, regasification, and storage issues; and compressed-natural-gas transport. Long-term issues to be addressed are production of methane hydrates and gas by wire—producing electricity at the location of the gas source and carrying the electricity by wire to market rather than the gas to market by pipeline. Nanotechnology can address the problems associated with accessing stranded natural-gas resources by developing nanocatalysts and nanoscale membranes for GTL production and creating nanostructured materials for compressed-natural-gas transport or long-distance electricity transmission.

Nanotechnology and Oil Industry

The oil industry needs strong, stable materials in virtually all of its processes. By building up such substances on a nanoscale, it could produce equipment that is lighter, more resistant, and stronger. GP Nano Technology Group Ltd. in Hong Kong was one of the first to develop silicon carbide, a ceramic powder, in nano size. It yields exceptionally hard materials. The company is now investigating other composites and believes that nanocrystalline substances can contribute to harder, more wear-resistant and more durable drilling equipment.

Nanotubes have many potential applications within the oil industry. For instance, nanotubes could be used to create lighter, stronger, and more corrosion-resistant structural materials in platforms for offshore drilling.

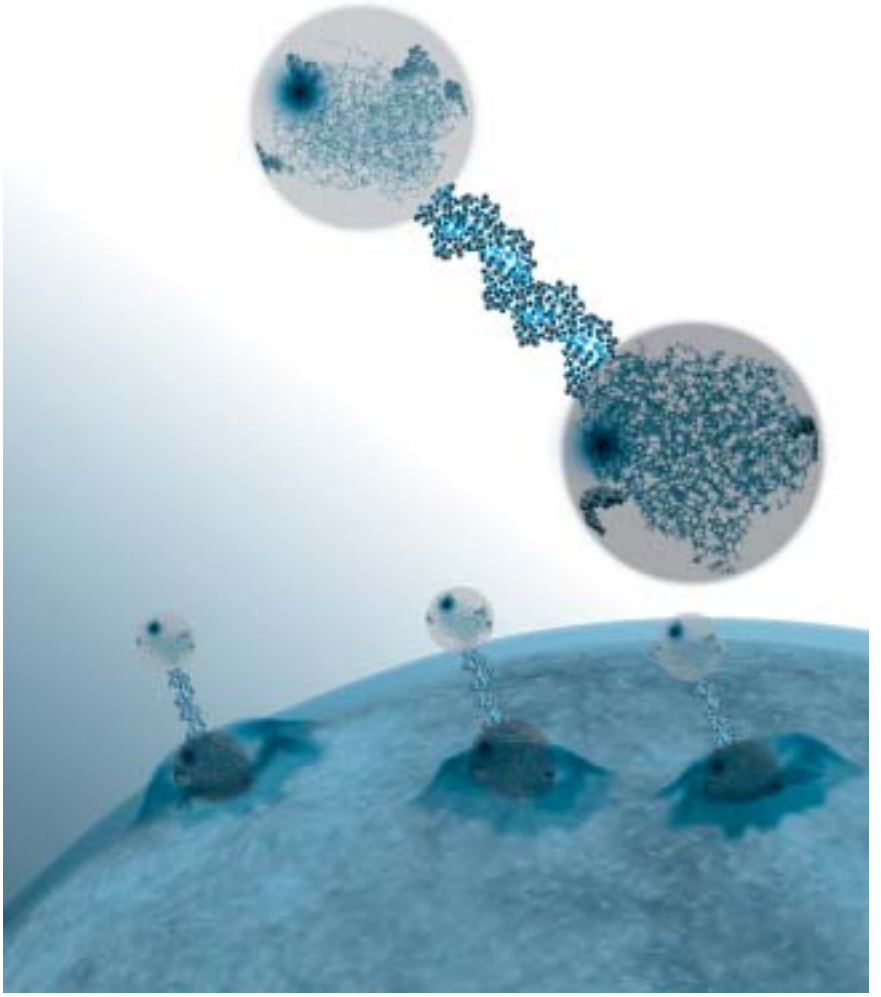
Nanotechnology could help improve oil and gas production by making it easier to separate oil and gas in the reservoir—for instance, through improved understanding of processes at the molecular level. There are many other potential clean energy sources that could be enhanced through the use of nanotechnology. The practical application of nanotechnology in the oil sector is, fortunately, less frightening. It opens interesting prospects for improved oil recovery, not least through better understanding of processes at the interface between liquids and solids. The aim is to understand how oil and water can be separated more effectively.

Nanotechnology could be applied to improved oil recovery in the form of tailoring surfactants. These can then be added to the reservoir in a more controlled way than with existing substances, thereby releasing more oil. It could also help develop new metering techniques with tiny sensors to provide improved information about the reservoir.

Nanotechnology and Environment

Pollution by chemicals or gases is a difficult aspect of petroleum production, but the signs are that nanotechnology can make the industry considerably greener. Filters and particles are now being developed with a nanostructure that allows them to remove volatile organic compounds from oil vapor and mercury from soil and water. Filters and membranes designed with nanoscale precision provide full control over what flow through.

A new type of fluids, which can be labeled as "smart fluids," is becoming increasingly available to the oil and gas industry. These nanofluids are designed by adding nanofabricated particles to a fluid in order to enhance or improve some of its properties. Essentially, nanoscale particles are suspended in the liquid phase in low volumetric fractions. The liquid phase can be any liquid such as oil, water, or conventional fluid mixtures. The nanoparticles used in the design of such fluids are preferably inorganic with properties of no dissolution or aggregation in the liquid environment. They can be designed to be compatible with reservoir fluids and are environmentally friendly.



Recent experiments have shown some promising nanofluids with amazing properties such as fluids with advanced drag reduction, binders for sand consolidation, gels, products for wettability alteration, and anticorrosive coatings.

Nanotechnology and Exploration

In high-temperature/high-pressure conditions, old electrical sensors and other measuring tools often are not reliable. But researchers currently are developing a set of reliable and economical sensors from optical fibers for measuring temperature and pressure, oil-flow rate, and acoustic waves in oil wells. These new sensors are small in size, work safely in the presence of electromagnetic fields, are able to work in high temperatures and pressures, and can be changed at a sensible cost without interfering in the procedure of oil exploration

changing and displacing old sensors in oil wells is very costly. But this technology could, with its accurate and reliable measurements, make a great improvement in oil exploration. In the future, the industry may be using nanoscale sensors for probing properties deep in the reservoir, allowing us to unravel the complex nature of the rock/fluid interactions and their effects on multiphase flow and providing the ability to design a suitable exploitation plan for the asset. Another area of significant challenge lies in the upgrading of bitumen and heavy crude oil. Because of their high density and viscosity, it is difficult to handle and transport them to locations where they could be converted into valuable products. Significant resources and intense research activities have been devoted to develop processes and specifically designed catalysts for on-site field upgrading combined with hydrogen/methane production. These processes would incorporate a minimized and controlled carbon rejection, in conjunction with a catalytically enhanced hydrogen generation performed on the rejected carbon from the upgrading process.

This central activity will be complemented with an effort to integrate the research for ultradispersed catalytic formulas for the in-situ upgrading of bitumen as well as for hydrogen generation from coal/coke or petroleum pitch. The former requires research on specifically designed adsorbents and catalysts to be introduced into the reservoir porous media in nanosized form. The latter requires extensive research on catalytic active phases and process setup as well as adopting different catalytic forms for effective contact with the gasifying materials. This research has the potential to generate significant technology to convert bitumen and heavy-oil reserves into products cost-effectively.

Nanomaterial Application

People have wanted to be rich for centuries. People have been trying to create gold ever since gold became the measure of wealth. People have also been trying to make diamonds because not only are they expensive and a display of aristocracy, but also rare, and quite useful in industrial applications such as cutting. Unlike gold, diamonds are constructed of carbon which is readily available at dirt cheap prices. If anyone could cheaply put carbon atoms together to form diamonds, he would become

rich instantly. Some of the possible benefits of nonomaterials are the outcome of miniaturization, while others are the result of change in the property of the material. As readily accessible reserves become depleted, the oil and gas industry faces increasing technical challenges, which lead to increased costs and limit the operating envelope of drilling and production technologies. This represents a significant market opportunity for nanomaterial-based solutions, which contend with corrosive impurities, high temperatures and pressures, shock loads, abrasion, and other hostile environmental conditions. However, very few nanomaterial-based products have yet to appear in the oil and gas technology basket. This can be attributed to a number of factors, including:

- Lack of innovation in the E&P sector.
- Barriers to entry and adoption.
- Perceived cost and risk.
- Lack of awareness.

To facilitate this, oil and gas companies should enter into partnerships with nanomaterial developers at an early stage. Both sides need to accept that some necessary investment risk must be taken to bring nanomaterials into the market. There are numerous areas in which nanotechnology can contribute to more-efficient, less-expensive, and more-environmentally sound technologies than those that are readily available. Although the most significant contributions may be unglamorous applications such as better

materials for exploration equipment or improved catalysis, nanotechnology is being proposed in numerous energy domains. Considering the substantial budgets for research dedicated to nanoresearch, much of this potential is likely to be realized in the coming decades.

In the future, nanotechnology will let us take off the boxing gloves. We'll be able to snap together the fundamental building blocks of nature easily, inexpensively and in most of the ways permitted by the laws of physics. This will be essential if we are to continue the revolution in computer hardware beyond about the next decade, and will also let us fabricate an entire new generation of products that are cleaner, stronger, lighter, and more precise.

Results and Conclusions We identified the following possibilities of nanotechnology in the petroleum industry:

• Nanotechnology-enhanced materials that provide strength and endurance to increase performance and reliability in drilling, tubular goods, and rotating parts.

• Improved elastomers, critical to deep drilling and to improve drilling in hightemperature/ high-pressure environments.

• Designer properties to enhance hydro-phobic or hydrophilic behavior, to enhance materials for waterflood applications.

• Nanoparticulate wetting carried out using molecular dynamics, which shows promise in solvents for heterogeneous surfaces and porous solids.

• Lightweight, rugged materials that reduce weight requirements on offshore platforms, and more-reliable and more-energy-efficient transportation vessels.

• Nanosensors for improved temperature and pressure ratings in deep wells and hostile environments.

• New imaging and computational techniques to allow better discovery, sizing, and characterization of reservoirs.

• Nanosensors deployed in the pore space by means of "nanodust" to provide data on reservoir characterization, fluid-flow monitoring, and fluid-type recognition.

• Small drill-hole evaluation instruments to reduce drilling costs and to provide greater environmental sensitivity because of less drill waste.

References

Wasan, D.T., and Nikolov, A.D. 2003. Spreading of Nanofluids on Solids. *Nature* 423,156–159.

Ying, J.Y., and Sun, T. 1997. Research Needs Assessment on Nano-structured

Catalysts.*J.of Electroceramics,*1(3),219–238.

Scott, S., Crudden, C.M., and Jones, C.W. (eds.). 2003. *Nanostructured Catalysts. Nanostructure Science and Technology Series.* Springer, New York, 342.

Smalley, R.E. and Yakobsonb, B.I. 1998. The Future of the Fullerenes. *Solid State*

*Communications,*107(11),597–606.

Wang, X., Cheng, Z., Lu, Y., Xu, L., and Xie, X. 1997. Nanoscaled Metals in Earthgas and Mobile Forms of Metals in Overburden in Wide-Spaced Regional

Exploration for Giant Deposits in Overburden Terrains. *J. of Geochemical Exploration,*58,63–72.

Jackson, S. A. 2005. Innovation and Human Capital: Energy Security and the Quiet

Crisis.AmericanPetroleumInst.

Karoub, J. 2004. Focus on Energy: Nanotech Extracts Benefits for Oil Industry. *Small*

TimesMedia.

Zhou, W., Heiney, P.A., Fan, H., Smalley, R.E., and Fischer, J.E. 2005. Single-

Walled Carbon Nanotube-Templated Crystallization of H2SO4: Direct Evidence for

Protonation. *J. of the American Chemical Soc.,* 127, 1640–1641.

Baker Inst. Study. 2005. *Energy and Nanotechnology: Strategy for the Future.*

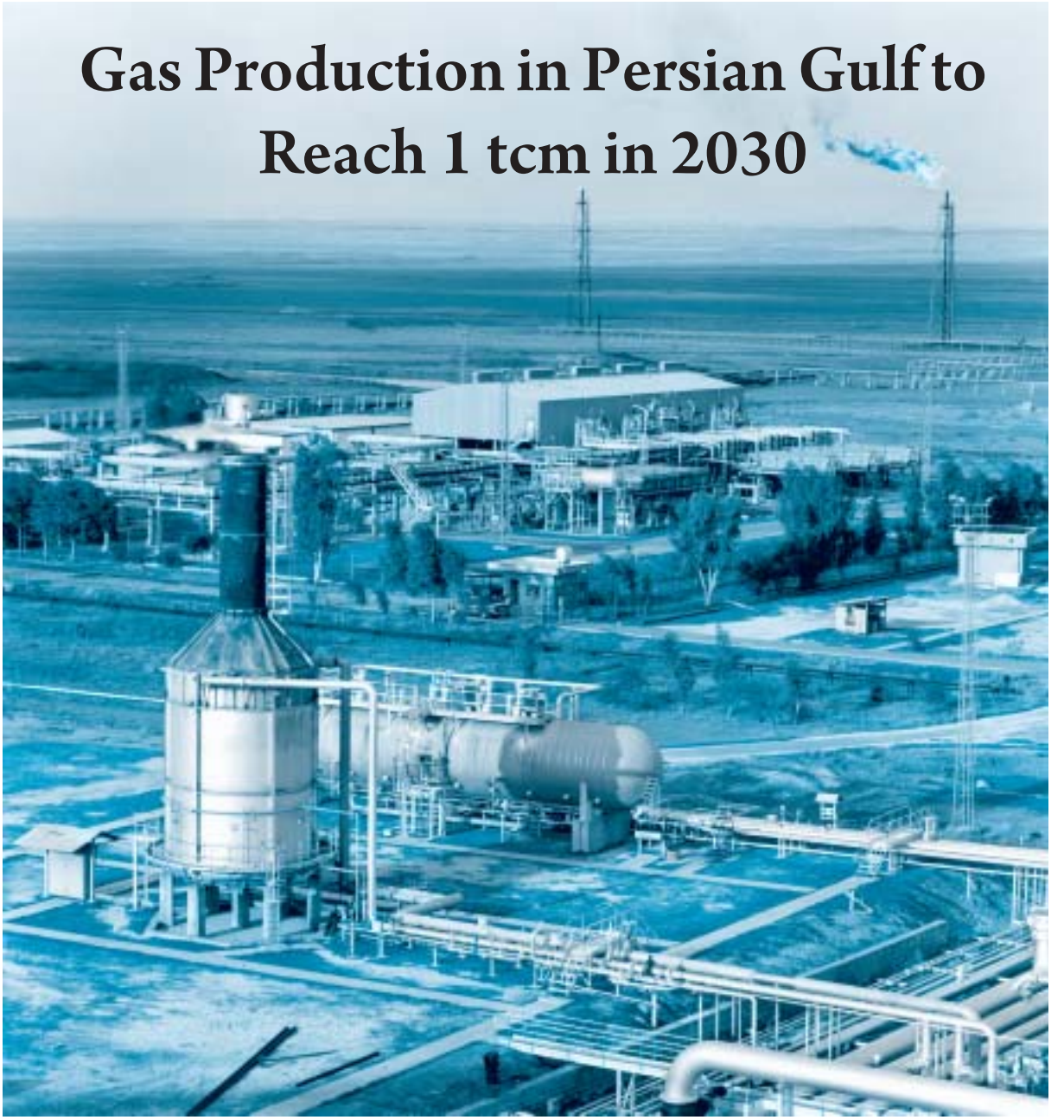
Houston:RiceU.,30,1–20.

Chaudhury, M.K. 2003. Complex Fluids: Spread the Word about Nanofluids. *Nature*

423,10,131–132.

Goa, T. 2002. Nanoscience—A Small Scale Revolution. Norwegian Petroleum Directorate, 10, 10.

Gas Production in Persian Gulf to Reach 1 tcm in 2030



Source: IranOilGas.com

The Persian Gulf countries hold around 40% of world gas reserves with Iran, Qatar, Saudi Arabia and United Arab Emirates holding the largest volumes.

Gas reserves in Iran and Qatar alone account for nearly 30% of the world total. Yet, despite a rising trend in production in recent years, these two countries together account for only 5% of global production and the region as a whole for less than 11%, suggesting strong potential to boost supply in the long term, particularly in Iran.

Production in the Persian Gulf is expected to grow more than in any other region. In the Reference Scenario, we project output will jump from 318 bcm in 2007 to 480 bcm in 2015 and to 1 tcm in 2030.

Iran remains the region's biggest gas-producing

country in the Reference Scenario, its production rising from an estimated 107 bcm in 2007 to over 350 bcm in 2030 — on the assumption that the required investment can be mobilised.

The lion's share of the country's reserves, and the expected source of much of the production growth in themedium term, is in the Iranian part (South Pars) of the South Pars/North Dome gas/ condensate field. The combined structure is the world's largest gasfield, with 40 to 50 tcm of reserves. More than one-third of these reserves are in the Iranian sector.

South Pars currently accounts for about one-quarter of Iran's total gas production and just under half of the country's 28 tcm of proven reserves.

The government has, for many years, had ambitious plans to boost production from South Pars and other fields to supply the rapidly growing domestic market and to export (by pipeline and as LNG), but developments have been delayed for technical and political reasons.

New upstream awards have slowed markedly since 2004, due to changes in political priorities and the international isolation resulting from trade embargoes imposed in response to the country's nuclear programme.

A growing proportion of wellhead gas supplies has been re-injected to maintain oil production in some old fields which are faced with high natural decline rates. As a result, production growth is likely to slow significantly through to the middle of the next decade.

Boosting capacity thereafter will depend on a resurgence in awards and the clearance of other obstacles in the next few years. A large-scale internal pipeline construction programme is underway to accommodate higher production to meet domestic demand.

Increasing domestic demand for re-injection, power generation and end uses, however, is likely to mean further delays in planned gas-export initiatives. In mid-2008, Iran officially postponed two of the three LNG developments at South Pars planned for the 2010-2013 period, leaving only the domestic LNG development in place.

Shell and Total are now discussing the prospect of LNG development linked to later phases of the South Pars field. China's CNOOC and Malaysia's SKS have held intermittent talks on LNG development of other fields, but no firm investment commitments have been made as yet. In addition, prolonged negotiations about gas deliveries to the Iran-Pakistan-India (IPI) pipeline mean that the start date for this project is now 2013 or beyond, rather than the original date of 2011.

Qatar, with proven reserves of 26 tcm, is far and away the biggest gas exporter in the Persian Gulf and the region's fastest-growing producer. We project its production to rise from 54 bcm in 2007 to almost 170 bcm in 2030, driven mainly by LNG exports.

Projects currently being developed by Qatar Petroleum with foreign partners will boost the country's LNG export capacity to 105 bcm per year by 2011, up from 40 bcm at end- 2007.

Qatar became the world's biggest LNG exporter in 2006 and looks set to retain that title well into the future. The world's largest trains, of 10.6 bcm per year each, are under construction in the Qatargas and Rasgas ventures, as well as the world's largest gas-to-liquids plant at the Shell/Qatar Petroleum Pearl project (70 kb/d).

The world's biggest GTL plant, Oryx, with a capacity of 34 kb/d, was commissioned in Qatar in 2006. The current raft of projects, however, has been hit by technical problems and cost escalation, resulting from difficulties in securing materials and services. This has contributed to delays of more than six months in the commissioning of the first train at Qatargas 2 and the postponement of Rasgas 3 to early 2009 (delays which are by no means unique to Qatar). Project participants believe that this will have a knock-on effect through the project chain.

The prospects for further growth in Qatari gas production beyond 2012 are clouded by the uncer-

tainty created by a moratorium on new export projects, which was imposed in 2005 while the effect of existing projects on North Field reservoirs was studied.

Gas production in the *United Arab Emirates* is projected to grow less rapidly than in neighboring states, from 46 bcm in 2007 to 72 bcm in 2030. Surging energy demand from industrial projects, power generation and desalination plants has led to shortages in the Emirates of Abu Dhabi and Dubai. Although reserves are large, totalling over 6 tcm, most existing production is earmarked for re-injection at oilfields and for LNG exports from the country's only plant, at Das Island in Abu Dhabi.

Rising international gas prices have made it more attractive to develop the country's reserves, but gasquality problems are holding back investment. For example, although two sour gas fields at Shah and Bab have been put out to tender for development with foreign contractors, negotiations on the Shah field have been hampered by high costs — estimated at between $4 and $5 per MBtu — because of the difficulties in accessing the reserves and the high sulphur content. Bab, together with an integrated gas project and the sour gas development at the Hail field, are expected to provide additional volumes, but much of these will be required for re-injection to boost production at the country's ageing oilfields.

In *Saudi Arabia*, Saudi Aramco's upstream exploration programme has continued to prioritize exploration for non-associated gas. Most of the 67 bcm of gas it produced in 2007 was associated with oil. It has laid out plans to increase reserves, which now stand at 6 tcm, by an average 142 bcm per year over the next ten years. Some successes have been reported, although efforts with foreign partners in the Empty Quarter have not yet yielded any new reserves.

Development plans are currently focused on the offshore Karan field, which is now due to supply some 16 bcm per year into the national gasgathering system from the end of 2011 — 5 bcm per year more than originally planned.

The switch to fuel oil and crude oil in some power stations will make more gas available for domestic uses in the medium term. However, Saudi Arabia remains unlikely to consider any export of natural gas until it is certain that its own increasing needs are assured. We project Saudi gas production to reach almost 190 bcm in 2030.

List of Delayed Oil Refining Projects in Persian Gulf Grows

Source: The National, UAE

The list of delayed Persian Gulf oil-refining projects is growing as demand for fuel shrinks rapidly throughout the industrialised world.

The latest casualty may be a US$15 billion (Dh55.09bn) project to build Kuwait's fourth refinery, with a proposed crude-oil processing capacity of 615,000 barrels per day (bpd).

The development was already at the centre of a political debate, with Kuwait's parliament and some officials of the Kuwait National Petroleum Company opposing it over costs, and the state audit bureau probing alleged irregularities in the tender process for contracts. With the final construction contracts still unsigned, the government now plans to cancel the proposed Al Zour refinery and replace it with a smaller project to revamp two existing oil-processing facilities, according to the Kuwaiti newspaper Al Seyassah.

The political problems, combined with a deteriorating outlook for refining profits, are "definitely pushing back the completion date by one year or maybe even two years", said Raja Kiwan, an analyst with the consulting firm PFC Energy.

Elsewhere in the region, three Saudi refining projects are facing delays and two more in the UAE are vulnerable, analysts say.

"Nobody needs to be in a hurry when it comes to export refineries," said Samuel Ciszuk, the Middle East and North Africa energy analyst with IHS Global Insight.

As Asian demand for transport fuels soared over the past few years, the UAE had been gearing up to double its refining capacity. Two developments were planned: one to increase the capacity of Abu Dhabi's main refining complex at Ruwais to 817,000 bpd from 400,000 bpd, and a second to build a refinery in Fujairah. The Fujairah project,

which has already experienced several setbacks, may be in jeopardy. "From an economic standpoint, it is looking a lot more difficult to justify," said Mr Kiwan.

Last year, ConocoPhillips, the US oil company, pulled out of the venture over soaring costs, and this summer the project's proposed capacity was cut to 200,000 bpd from 500,000 bpd. Abu Dhabi's state-controlled International Petroleum Investment Company, the project leader, is seeking a new partner among European refiners, but has been tight-lipped regarding its progress.

The Ruwais refinery expansion appears to be on more solid ground. Takreer, the refining unit of Abu Dhabi National Oil Company, said last month it would host a job explanation meeting for contractors ahead of soliciting bids for the project. But Mr Ciszuk said it would make sense to delay the bidding in order to benefit from falling construction costs.

That is the approach the Saudi national oil company, Aramco, has taken with several refining projects planned for the kingdom.

Last month, ConocoPhillips and Aramco pushed back construction bids for a proposed $10bn refinery at Yanbu by six months. Total, the French energy company, said the award of construction contracts for another $10bn refinery project with Aramco at Jubail also had been delayed by at least three months over financial uncertainties.

In September, contractors preparing to bid on a contract to build a third Saudi refinery at Jizan were advised that the 250,000 bpd project's completion date had been extended by two years to 2015.

The Saudi petroleum and mineral resources ministry had originally proposed to award the licence last year, but now expects bids to be filed by next March.

The deferred and threatened projects were all considered strategic to supplying Persian Gulf states' increasing domestic needs for petroleum products and to diversify the region's oil exports beyond crude. In the UAE's case, that was part of a broader government plan to diversify the country's economy and increase its resilience in the face of volatile crude prices.

In previous oil cycles, falling crude prices helped oil refiners by reducing their input costs. But those were cycles driven by changes in global oil supply in which a drop in the price of crude would precede any change in demand for refined products such as petrol.

By contrast, in the current demand-driven cycle, a precipitous drop in demand for transport fuels in key oil-consuming markets such as the US presaged and may have set off the slide in crude prices. That has squeezed refiners' profit margins and caused them to cut back processing. As of last week, nearly 15 per cent of US refining capacity sat idle.