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Director and Editor-in - Chief:
Seyed Gholamhossein Hassantash
Editorial Manager:
Homayoun Mobaraki

Layout :
Adamiyat Advertising Agency
Advertisement Dept :
Adamiyat Advertising Agency
Tel: 021 - 88 96 12 15 - 16

Translators: Mahyar Emami, Hamid Barimani

Subscription: Hamideh Noori

IRANIAN ASSOCIATION FOR ENERGY ECONOMICS
Unit 13, Fourth flour, No.177, Vahid Dastgerdi (Zafar) Ave., Tehran, Iran
Tel: (9821) 22262061-3
Fax: (9821) 22262064
Web: www.IRAEE.org
E-mail: Publication@iraee.org

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Rivalries in the Area of Natural Gas;

An Engine Propelling Political Developments

With the lapse of only three weeks since signing of the contract for the construction of Nabucco gas transfer pipeline in Ankara, Turkey in the presence of officials from all states hosting the project on July 13th, 2009, an energy cooperation agreement was inked between Russia and Turkey on August 6th, 2009 in accordance with one of its provisions, Turkish government will allow the South Stream Pipeline to cross Turkish territorial waters in the Black Sea. Although, Russian prime minister Vladimir Putin who signed the said agreement with the Turkish premier Recep Tayyip Erdogan said in a later statement: "Nabucco and South Stream pipelines are basically not in contrast with one another and Russia does not view these two pipelines as rivals and that the European market is so huge that all parties can have a share of it."

However, those who follow Russia's developments particularly since Putin's second term of office as president, are well aware of the fact that the latter's attempt to preserve its monopoly of the European gas market and taking advantage of it as a powerful political lever, is something not easy to neglect while Nabucco pipeline is exactly intended to stall Russia's monopoly of the gas market.

South Stream Pipeline Route

Russians' recent measure unveils the very fact that they are pursuing Nabucco closely and rival with it.

South Stream project foresees construction of a pipeline that extends from Russia and reaches Europe via Black Sea bed without need for crossing Ukraine. This way, Russia could diversify its export routes to the EU and cut dependence on other states for transport of gas. Upon reaching the Bulgarian soil, this pipeline will be divided into the southern and northern routes. The southern route crosses Greece and the northern route crosses Serbia and Hungary. The following constitute the collection of countries through which the South Stream pipeline shall cross: Bulgaria, Greece, Italy, Serbia, Hungary, Slovenia and Austria. The project is scheduled to be implemented mainly by the Russian Gazprom and Italy's Eni companies plus oil and gas companies of the host states. Russia's recent agreement with Turkey will open a more effective phase in the construction of the South Stream pipeline.

Progress in the construction of the South Stream pipeline is expected to submerge the fate of Nabucco gas pipeline into ambiguity since, relying on the natural gas supplied from the Central Asian

Nabucco Natural Gas Pipeline Route

states and possibly Iran, Iraq and Egypt, Nabucco serves as a rival to South Stream.

Bulgaria, Hungary and Austria constitute a joint chapter to South Stream and Nabucco pipelines.

Russia's pursuit of maintaining her monopoly of the European natural gas market is illustrative of the very fact that the question of natural gas and energy-related rivalries in the foreseeable future shall serve to propel many political and perhaps military developments in Central Asia and the Middle East. For instance, Iraq has been discussed as a potential supplier of natural gas for Nabucco pipeline. This is under circumstances when instability still resides here and there in Iraq and there are no assurances whether this proposal will be able to serve her interests or not. Such a proposal may complicate further, the question of Iraq's security for Europe and the west on the whole and encourage their support. Meantime, involvement of Iraq in the Nabucco pipeline project is likely to turn that country into the center of gas-related rivalries triggering more serious rivalries by Russia or other parties that are interested to join Nabucco.

Some time ago and at the threshold of the second round of giant tenders for the development of Iraq's oil and gas fields introduced by the Iraqi oil ministry, a chain of horrific explosions rocked Baghdad some taking place in Baghdad's fully protected Green Zone. These explosions even damaged the Iraqi parliament building. Witnesses suggested that the explosions had taken place by the remnants of former Iraqi Baath party leaving a negative impact on the trend of the progress of the above tender which is intended to attract foreign investments for the development of Iraqi oil and gas industries.

Another potential which has been introduced to secure feedstock for Nabucco pipeline is known as Arab Gas Pipeline. The Arab Gas Pipeline injects Egypt's natural gas to Nabucco. The first phase of this pipeline which transports Egypt's natural gas to Jordan went into operation in 2003 and phase two of the same pipeline which transfers natural gas to Syria was complete in late 2008. The project has been implemented by a subsidiary of Russia's Gazprom Company.

A 100 kilometer long extension of this pipeline goes to Ashkelon port city in Israel via Egypt's El-Arish port in Sinai desert. Egypt is scheduled to deliver an annual 1.17 billion cubic meters of natural gas to Israel. In March, 2006, Egypt, Jordan, Syria, Turkey, Lebanon and Romania signed an agreement according to which The Arab Gas Pipeline would stretch inside Syrian territory to the Turkish borders. On this same basis, on January 4th, 2008 an agreement was signed by Syrian and Turkish governments for the construction of a 63 kilometer long pipeline that would

Arabian Pipeline Route

Natural Gas Pipeline Route Leading to Italy

merger the Arab Gas Pipeline with the Turkish natural gas network. The Project's contractor was selected in October of that same year and the USD 71 million contract for the implementation of this project was signed. This phase is expected to be commissioned by 2011 and the Turkish government expects to extract 2-4 billion cubic meters of natural gas from this pipeline annually. Meantime, an extension from the Arab Gas Pipeline has been under-construction from Syria leading to Tripoli port in Lebanon. A prospect extension from this pipeline is likely to transport natural gas from Syria's Banias port city to Cyprus via Mediterranean seabed.

In September 2004, the Arab Gas Pipeline host countries agreed to the merger of the Iraqi gas pipeline with this pipeline facilitating Iraq's gas exports to Europe via Nabucco.

Russia's stance in the face of Arab Gas Pipeline remains unclear to this date.

Under conditions when South Stream pipeline is believed to serve as a rival of Nabucco, Turkish government has agreed to cooperate with the South Stream project and allowed the pipeline to cross its territorial waters. Turkey is currently importing gas from Russia via two routes. One of these routes is known as Blue Stream which crosses the Black Sea bed. Such cooperation suggest that the Turkish government cares about its national interest more than it may care about the interests of EU. For some time now, Turkey has been taking utmost advantage of its geopolitical position introducing itself as the hub for the trade and transport of natural gas. Through its recent measure, Turkey has in fact prevented Russia from officially and obviously opposing construction of Nabucco pipeline.

The interesting point, however, is Italy's official disapproval of Nabucco pipeline. A few months ago, the Italian foreign minister announced in a press conference that Italy supported the project for the construction of South Stream pipeline and instead voted against Nabucco project. He added that such a stance contained and of course observed the national interests of Italy and many other European states. He reiterated that Nabucco pipeline was in need of natural gas supplies from two unlikely sources i.e. Azerbaijan republic or Iran.

Such a stance adopted by Italy implies the fact that Italy is keeping some distance from EU for the purpose of securing more interests that may lie in transaction with Russia. Italy's geographical advantage and receipt of natural gas from Algeria and Libya via a few pipelines constructed in the Mediterranean Sea bed, provides that country with diversified sources of natural gas supplies compared to other Western European nations differentiating Italy's interests with those of other EU member states.

Challenges Facing Iran's Petroleum Industry

The prevailing bureaucracy in Iran's petroleum industry is the most well established modern bureaucracy in the country which is both rational and technical and shuns politics seriously.

In recent years, however, procedures in the petroleum ministry have been fully politicized and this is most vividly demonstrated in selecting and appointing its managers.

When politics triumph in an entirely technical ministry, creativity and boldness shy away. Such a phenomenon is nothing short of poison for an industry that is in serious rivalry, in both oil and gas domains, with countries like Saudi Arabia, Russia and Qatar where all issues are seen as pure technical.

Accusing the industry to be generally run by Mafia without any specifics has only warded off courage and creativity of the personnel for fear that they would be accused of cooperating with that Mafia.

The petroleum industry has to be run on the basis of trust and confidence instead of skepticism and tension that has prevailed in the industry in recent years.

Such an atmosphere in the industry when it is faced with complications on the international scene, such as threat of banning sale of gasoline to Iran, only helps exacerbate the working conditions in it.

On the other hand, development in the petroleum industry is unable to get by without technology and investment. Sanctions against Iran have practically scared away Western technology and investment and have forced the petroleum ministry to resort to negotiations with Russian, Chinese, Indian and Malaysian companies for the purpose.

This will unquestionably lead to lower technical standard and drop in the production of both crude oil and natural gas in Iran.

In the past decade or so, numerous privately run contractors and manufacturers of equipments used in the petroleum industry have become involved in the industry's projects and expect the government to create conditions conducive to working.

These conditions include setting rules to safeguard interests of the private sector, holding tenders on fair basis and allowing evenhanded situation for competition between state-run companies and those of the private sector.

In sharp contrast, the policies of the government have only limited the scope of work for the private sector in Iran's petroleum industry during the past years.

Adopting a suitable legal frame for developmental contracts is another challenge Iran's petroleum industry has been faced with. Although in recent years Iran's standard 'Buy-Back' mode of contract has been revised to an extent, ostensibly it has not provided adequate incentive for foreign companies to rush for projects in Iran.

Taking on the numerous challenges facing Iran's petroleum industry now and in the coming tough days needs selfless, resourceful and bold managers, who have been brushed aside in recent years.

China's Oil Needs Affect its Iran Ties

China's dependence on Iranian oil could deter it from backing tougher sanctions on Iran, though Beijing supports containing nuclear proliferation as part of a broader push to raise its international diplomatic stance.

China's trade with the U.S., at $150 billion in the first seven months of this year, dwarfs its $12 billion trade with Iran over the same period. But China is the world's second-biggest oil consumer after the U.S., and the Persian Gulf country is one of Beijing's biggest suppliers. Chinese imports of Iranian crude grew to 13 million metric tons in the first half, about 15% of China's total, and up 22% from a year earlier, according to government data.

China's reaction to the revelations that Iran has a secret nuclear plant has been muted thus far.

Despite the diplomatic talk, there are signs that China's leaders could be willing to take a tougher stance on nuclear proliferation as they weigh the impact of destabilizing regional arms races on their trade-dependent economy.

Although China would prefer a negotiated settlement, "we have to keep it clear, commitment to nuclear nonproliferation is China's bottom line," said Yin Gang, a scholar at the Institute of West Asian and African Studies of the government-affiliated Chinese Academy of Social Sciences.

With Iran flouting previous United Nations efforts, patience is running thin, he said, and Iran shouldn't count on China's unconditional support. "If the solution to the nuclear issue is through nonpolitical means, or a military attack cannot be avoided, I don't think China has the power to stop such [a] military attack," said Mr. Yin. He added that even though China and Iran are old friends "it doesn't mean that Iran

could expect that when it comes to the nuclear issues, [China's] interests are bound together with Iran's."

Recent action on North Korea, another longtime China ally with nuclear ambitions, shows how China's position on nuclear arms has stiffened. In May, China supported U.N. sanctions against North Korea after its second nuclear test clearly angered China's leaders. And before the U.S. invasion of Iraq, China declined to exercise its U.N. Security Council veto on action against Iraq.

Nonetheless, China's oil companies have been strengthening their ties to Iran's oil industry in recent months. Chinese state-owned oil companies recently have signed a string of multibillion-dollar deals to develop Iranian oil and gas fields, filling a gap left after Iran's talks with major Western oil companies collapsed under the growing threat of nuclear sanctions.

Some big Western oil traders have recently scaled back or are preparing to halt fuel shipments to Iran in anticipation of sanctions, leaving an opening for Chinese fuel traders.

Oil companies in China — the second-biggest buyer of Iranian crude after Japan — have stepped up investment.

China National Petroleum Corp., the flagship state-owned oil company, has signed billion-dollar contracts to develop oil and natural-gas fields, replacing other foreign companies that have backed out. China's biggest oil refiner, state-owned Sinopec Group, has also signed on to develop Iranian oil fields.

Gas export talks going on between IOOC and 'RAK Gas'

"Iranian Offshore Oil Co. (IOOC) is negotiating with 'RAK Gas' Company of Ras al-Khaimah to export 50-300 mcf/d of gas output of the shared Hengam oil/gas field to the Emirate," said Mahmoud Zirackchian Zadeh managing director of IOOC.

According to the news agency of Iran's oil ministry, Zirackchian Zadeh added that determining the gas export price formula is the major issue of these negotiations as it has always been about other Persian Gulf countries.

He went on to say: "Once Hengam field starts oil production, 100 mcf/d of associated gas will be produced. Thus a tender for the construction of a gas treating unit is to be issued soon. The produced sweet gas will be transmitted to Qeshm Island through pipeline."

Zirackchian did not mention either the capacity of this gas treating unit or the tender's start-date. Nevertheless, the capacity of this unit seems to be about 300 mcf/d .Concerning the early crude oil production project of Hengam, he explained that it would start at the rate of 6,000 bpd in December 09 and that by 20th March 2011; Hengam field's production would reach its peak of 36000 bpd.

2D seismic of 'Moghan 2' block in 2nd Q 2010

The 2D seismic data acquisition of 'Moghan 2' hydrocarbon block located in Ardabil province in northwest of Iran, will start in the 2nd quarter of 2010. Croatian state oil Company INA, the exploration/development (E&D) operator of 'Moghan 2' block, has prepared the documents of tender for 2D seismic operation over an area of 300 km of the block. The tender to select the data acquisition contractor will be issued late this October.

Due to the prevailing sever cold season in the region, the seismic shooting operation will start in April/May 2010 and take 4 months to complete.

The preliminary work-scope of 'Moghan 2' calls for conducting 100 km of 2D seismic, 200 sq km of 3D seismic and drilling of one exploratory well in the block. The 3D seismic will only be carried out only if its 2D seismic produces promising results.

Drilling of a well in the distant past showed that light crude of about 40 API grade existed in Moghan 2 block.

Renewed 3D tender on for Golshan and Ferdowsi

This is the second time this tender is being issued by POGC. The tender was first issued in early 2008; however POGC did not succeed to award it. After a long delay, POGC decided to reissue the tender in August 2009. The new tender is to cover a total seismic operational area of 864 sq km.

Some local and foreign companies such as Dana Geophysics Co., Oil Exploration Operations Co. (OEOC), Chinese BGP and Fugro Geosciences have participated in the tender.

Contract signed for gas sweetening of S.P

The Pars Oil and Gas Company (POGC) and the JV of South Korea's GS Engineering & Construction (GS E&C) & Iranian International General Contractor Co (IGC) inked a contract yesterday to construct the gas sweetening plant of phases 6, 7 & 8 of the South Pars gas field.

National Iranian Oil Company (NIOC) will be providing the financial needs of this •1.24 billion worth EPC project from its internal resources.

The plant will have the capacity to sweeten 3.9 bcf/d of the gas outputs of phases 6, 7 & 8 of South Pars and is foreseen to be ready in 42 months' time.

GS E&C also confirmed today it had been awarded a 1.6 trillion won ($1.37 billion) project to sweeten gas from phases 6, 7 & 8 of South Pars, Reuters reported.

"GS E&C secured a stable base in Iran by winning this project and after it had successfully completed the phases 9 & 10 of South Pars project," Moo-ik Chang, vice president of GS E&C stated.

GS E&C specializes in the construction of oil, gas and petrochemical plants as well as power plants.

GS E&C's 30.5% of stake is held by Chairman Huh Changsu family, who also holds a 46% of stake in GS Holdings, according to data from GS Engineering & Construction. GS is the holding firm of GS Caltex, South Korea's No. 2 crude refiner.

Towards the end of May 2009, POGC opened the bids it received for the construction of the plant and named the JV of IGC and GS E&C as the tender's lowest bidder.

Ilam gas refinery feed resumes early Nov 2009

Ilam (Maimak) Gas refinery, located in Ilam province in the southwest of Iran, has been at total halt due to the failure of Tang-e-Bijar gas field to supply its required gas feed.

The operations manager of Ilam gas refining company Khalil Kamali said that: "The sour gas flow of Tang-e-Bijar gas field to the refinery will be expected to resume from November 6th onwards."

According to the news agency of Iran's oil ministry, Kamali added: "The refinery is ready to receive sour gas feed; upon being fed, treating will start immediately."

Ilam Gas refinery consists of two phases. The first phase has a capacity to treat 6.8 mcm/d of sour gas which is going to be raised to 10 mcm/d in its second phase.

Tang-e-Bijar gas field is located 70 km to the Southwest of Ilam City and handled by the Iranian Central Oil Fields Company (ICOFC). The wellhead facilities of the gas field exploded in January 2009 and brought its production to a total halt.

Sour gas to be injected into Aghajari oil field soon

Sweet gas injection to Aghajari oil field is underway. The gas feed is being supplied from South Pars refinery of phases 9 and 10 and transmitted through IGAT 5 gas pipeline to the field. At present, the volume of injected gas is about 350 mcf/d; whereas since the start of the injection in June 2009, it has also peaked at 1 bcf/d.

The Aghajari gas injection project started in early 2001, aiming to inject 2 bcf/d of the sour gas output of South Pars phases 6, 7 & 8 into Aghajari oil field. After a four-year delay, it eventually got underway in June 2009 though by injecting sweet gas into the field instead of sour.

Four months have passed since the project's inauguration; yet, the produced sour gas of phases 6, 7 & 8 has not been injected into the field.

Sources close to the project blame some technical problems in Aghajari gas injection installations as the main cause of this delay. These problems are supposed to be resolved in the next 2 weeks.

The production rate of South Pars phases 6, 7 & 8 is due to reach its peak of 3.6 bcf/d in a few days. Thus, provided that NIGC could make IGAT 5 ready to transmit the sour gas, a volume of 2 bcf/d of the sour gas will be available to be sent out to Aghajari for injection.

For this reason, IGAT 5 gas pipeline should be re-tested with sour gas before gas transmission starts.

Studies on Aghajari oil fields show that if the volume of injected gas into the field is to be 2 bcf/d in 25 years, after the third year, 5000 bpd of crude oil will have been annually added to the production volume of the field. This process will be sustained for 20 years and thereafter the field production will remain unchanged for the following 5 years.

At present, Aghajari oilfield's crude oil output is about 140,000 bpd.

Study underway on Kilver Karim Asmari layer

Kilver Karim oilfield, discovered in 1967, is located in Bushehr province in the neighborhood of Bibi Hakimeh oilfield and contains Asmari and Bangestan oil layers.

Five wells have been so far drilled in the field; however, due to some particular technical problems, no crude oil has yet been produced from the field.

The field's oil in place is about 3.500 Bln barrels, 2.700 Mln barrels of which lie in Asmari layer and the rest in Bangestan.

Presently, the geo-modeling of the field's Asmari layer is being carried out by the Geological Engineering Department of National Iranian South Oil Company (NISOC).

Iran Ranks First in the Middle East in Terms of Transport of Gas

A company which is no older than three years is in charge of transport of locally produced natural gas, export and import and SWAP of natural gas. This company which is known as Iran Gas Transport Company maintains 30 thousand kilometers of high pressure pipelines in 29 provinces, 10 operational zones, 60 active compressor stations and 33 pipeline operation centers. It is the Middle East's largest such company and stands fourth in the world following the US, Russia and Canada. This extensive network of pipelines and installations utilizes world-class standards and technologies to stand the world's safest and most secure pipeline. The plan for the direct transport of refined gas from Asaluyeh to the northern and northeastern provinces of the country as well as putting into operation of Naeen pipeline and its merger with Tehran's fifth pipeline has been assigned to this Company in order to guarantee supply of natural gas in the forthcoming winter.

Mr. Reza Almasi is the Managing Director of Iran Gas Transport Company who comments on the latest status of the nationwide gas transport pipeline as follows:

-What has been done so far to guarantee sustainability and consistency of gas supplies particularly close to the turn of the season?

-We are currently busy repairing the network. So far, we have registered 112 cases of basic repairs on the grid's turbo-compressors and before the turn of the season, 11 new compressor stations and 2750 kilometers in high pressure pipeline are scheduled to be handed over to us. We are also planning to operate cleaning pigs in a 21 thousand kilometer long pipeline of which over 5 thousand kilometers is complete. Meantime, intelligent cleaning pigs will be run in order to monitor corrosion. And relevantly, 226 hot tap supply lines and leakage monitoring tests have been conducted on a 30 thousand kilometer long pipeline in order to guarantee sound supplies in winter time.

-What volumes of natural gas can the nationwide pipeline handle currently?

-Last year, the pipeline handled 144 billion cubic meters of natural gas, however, this year the figure is expected to exceed 170 billion cubic meters. This volume of natural gas shall be supplied to 770 cities and 7 thousand villages.

The maximum capacity of gas supplies per day last year did not exceed 550 million cubic meters. This year, we expect to be able to transport 650-700 million cubic meters of gas per day. Iran Gas Transport Company is prepared to transport any volumes of gas produced in refineries nationwide inclusive of natural gas imported from Turkmenistan which has been around 25 million cubic meters per day so far, however, we are prepared to handle daily figures of up to 40 million cubic meters. The 2025 prospect plan foresees construction of an additional 40 thousand kilometers of high pressure pipelines reaching the margin of 70 thousand kilometers, that means 2500 kilometers per year. The number of compressor stations should increase to 140 from the present 60. The number of pipeline operation centers is expected to reach 50.

-Are the Iranian gas transport pipelines connected anywhere to the neighboring states and does the possibility exist for the swap, import or export of natural gas?

-We are currently connected to natural gas networks in Turkmenistan, Armenia, Azerbaijan Republic, Nakhchivan Republic, and Turkey. We are also prepared to connect our natural gas pipeline network to the Iraqi gas network along Khuzistan province borders. Meantime, our pipeline can also be connected to Kuwait while the 7th nationwide pipeline i.e. Peace Pipeline is under construction. Peace pipeline is intended to transport Iran's gas to Pakistan. Part of this pipeline will go into operation this year. There is also a pipeline that stretches from Hormozgan in the south to Sistan and Baluchestan province of Iran in the east. Gas supplies to Iran from Turkmenistan shall become available as soon as the required 48 inch diameter pipeline has been constructed.

-Such huge network and installations require frequent repairs and maintenance. How frequent are annual basic repairs and what is the cost?

-As soon as we are in receipt of a request from the operational regions, the dispatching department of NIGC specifies the date and duration of repairs since flow of gas cannot be disrupted. On some occasions a full season is required for repair works. 90 to 95% of works are usually complete by late September. The transport pipeline network's repair costs the company an annual USD50 million excluding network depreciation.

-Are repair works carried out by local or foreign experts?

-We welcome all competent local companies that are qualified to carry out basic repair works and we prefer to assign repair works to such companies. In some cases, however, we need to employ foreign experts. We plan to localize basic repairs. For instance, intelligent cleaning pig run operations have very recently been assigned to local contractors. Meantime, whereas there still resides no natural gas storage system in the country, we have no option but to carry out and commission works in the shortest possible periods of time.

-This Iranian year has been named the Year of the Revision of Consumption Patterns. What is your contribution to that?

-That has been an age old reality. For a long time now, we have been pursuing to institutionalize this culture in the society. Building Culture in the area of revising energy consumption and manpower is in fact the duty of governmental bodies. Revision of the current trends, cutting consumption of resources together with improved productivity constitute some other objectives that we pursue as regards revision of consumption patterns. For instance, if four units are required for the completion of a given process, revised methods should be utilized in order to reduce that number to three while maintaining quality. For this purpose, consumption pattern revision committee comprising six sub-divisions has been formed within the National Iranian Gas Company, an example of which is the Transport sub-division.

- What are the duties of Transport sub-division?

- Number one duty of this sub-division is to implement revision of consumption patterns in the area of trans-

port. Preserving the quality of services rendered and integrity as well as security of the supply of natural gas at minimum costs forms one of the strategies of the Gas Transport Company. The legal obligations attached to the revision of consumption pattern in various departments and divisions of the transport section, presentation of consumption indexes in various units of the transport section and comparison of the same with other countries, presenting index of goods and materials consumed in the transport sector and estimating the potentials available in them for cutting consumption, presenting a report of the existing measurement systems, maintaining control on consumption and identifying outdated and inefficient machineries and compiling the revision program all constitute main duties of this sub-division which is also in charge of examining utilization, operation and maintenance of world-class compressor installations and pipelines. Examination of available renewable energies is yet one of the other duties assigned to this sub-division.

- The Iranian gas transport network is extending on a daily basis. What is the network's waste figure?

- The term waste has no practical application within the gas transport network. The network's design is such that there is actually no waste. Our extension plans comply with globally accepted standards and technologies that yield high productivity. This is a young industry and just a portion of it comprising 29 turbines is rather old compared to the rest of the units and plans are underway to refurbish and modernize such installations. The Save X project is scheduled to be implemented in Qom 3 compression unit that is expected to improve output by 10%.

- Is there any particularity attached to Iran's gas transport network compared with similar networks across the world? Do these installations comply with world-class standards?

- Although Iran Gas Transport Company has a successful track record in the area of maintenance and repair of network as well as development works, however, a structural change needs to be introduced to this company particularly in the area of management. Therefore, investment has to be made if the tendency exists for interaction with the rest of the world. In the area of hardware such as construction and development of the national network, desirable investments have been made already, in the software arena such as manpower, revision of processes and methods and regulations however, we are in need of further investments. We also need to train 60 to 70 competent and qualified managers for the transport section, for one of the aspirations of this Company is training of manpower in compliance with world-class models and methods. The Company has been assigned to train and introduce middle managers for the industry particularly in such areas as maintenance. This company is staffed by young, educated and dedicated individuals and focuses on the education of specialized manpower.

Energy Intensity Reduction Potentials in OPEC and Its Advantages

S G Hossein Hassantash,
Vice President of Iranian Association for Energy Economics (IRAEE), Tehran, Iran
M Amin Naderian,
Senior Analyst, Institute for International Energy Studies (IIES), Tehran, Iran

Abstract:

Rapid increase in population and economic growth in coming decades mainly contributed by emerging and developing countries will increase the global energy demand. This dramatic growth in energy demand occurs provided that the dominance of oil in the world energy mix continues at least in next two decades and the environmental and security concerns of increasing fossil fuels consumption will be intensified. In such a situation it seems that world has encountered a complicated dilemma: How to provide a balance between desired developing countries economic growth and the negative externalities of its energy demand growth? Some of the energy experts believe that energy productivity enhancement is a suitable midterm solution of the dilemma.

Considering the above point and the importance of efficient energy consumption in each country, this paper attempts to evaluate the energy intensity reduction potentials and the impacts of capturing these opportunities in OPEC countries by 2020. The method of scenario building is utilized for calculating energy intensity reduction in OPEC countries and then the impact of capturing these opportunities on oil export capacity, oil revenue, global oil balance and the reduction of CO_2 emission is assessed. Our results show that there exist considerable potential for energy intensity reduction and oil saving in OPEC countries. Such achievement will have a significant effect on the global oil balance and CO_2 emission reduction.

Key words: **OPEC, energy dilemma, energy intensity, scenario building**

1. Introduction:

Demographs from the United Nation and the US Census Bureau estimate that the world population will reach more than 8 billion by 2030, up from roughly 6.4 billion in 2005. Each of those 8 billion individuals needs energy for heat, power and mobility.

Yet another phenomenon is occurring. This pattern of population growth is in a form that is not occurred in centuries. Major regions of the planet face the prospect of very slow population growth or even a decline in population. Between 2005 and 2030, by US Census Bureau projections, the population of countries that are part of the Organization for Economic Cooperation and Development (OECD) would increase by only 80 million persons to 1.2 billion. As a result, the strongest regions of energy demand growth will be the developing economies as more and more people are able to move away from poverty to higher incomes, become integrated into national economies and the global economy and benefit from the contributions that energy brings to everyday life. Clearly strong energy demand points to the equally strong economic development that forecasters anticipate. Yet, although the development is welcome, it creates a global energy dilemma.

According to the International Energy Agency (IEA), demand for energy will grow by between 50% and 60% to 2030 that a considerable proportion of it originates from emerging and developing countries. Oil demand alone will grow by 40% between 2005 and 2030, with even higher growth rates for coal and natural gas. Although lower carbon energy sources are also expected to grow, if the world stays on its current energy path, the total energy demand pie will look remarkably like it does today.

Some of the other reliable energy communities like World Energy Council and American National Petroleum Council have also predicted the future global energy demand in different scenarios and all of them have a common consensus on dramatic demand for energy in the coming decades.

However, the energy demand growth is a fact that will be achieved in the years to come, but, this phenomenon takes place in a condition that its negative externalities in the area of economics, environment and security have been more intensified. Additionally, there are four main negative externalities for energy demand growth in current situation that some of them didn't exist in past decades:

1- Considering the dominance of fossil fuels in global energy mix, increasing energy demand in the following decades will increase the GHGs emissions. If current trends continue, energy related carbon dioxide (CO_2) emissions will rise from 26 billion tones in 2004 to more than 40 billion tones per year by 2030 (WEO 2007). This hazard will bring about some undesirable consequences for the world.
2- Regarding the larger share of Middle East as an unstable and risky region in supplying energy particularly oil and gas in the following decades, providing reliable and secure energy will be one of the major concerns in the future.
3- The dramatic energy demand growth occurs in a situation that oil production of the world is approaching its peak and there will be a lack of oil to meet energy demand, hence; energy supply security due to the lack of oil supply in the world will be one of the major issues of the upcoming decades.

So, the world has been encountered with a complicated question: how to deliver the energy for a growing world in a sustainable path that is more secure and efficient and less pollutant? In fact, which energy system can deliver energy with less carbon and more security in a way that has no detrimental effect on economic development? This question is called global energy dilemma of the 21st century.

Theoretically, the key to getting the global energy system onto a more sustainable path is to break the links among economic activity, energy demand and greenhouse gas emissions. In another word, if it could be possible to increase gross national product in a way that it doesn't necessarily boost energy demand and greenhouse gas emissions, the solution to the dilemma is found.

But practically, according to the Mckinsey Global

Institute (MGI) reports, energy productivity enhancement is among the best identified midterm solutions for solving the aforementioned question. In one of the MGI reports on May 2007 it is concluded that by capturing the potential available from existing technologies with an internal rate of return (IRR) of 10 percent or more, we could cut global energy demand growth by half or more over the next 15 years. This research also shows that enough opportunities are available to boost energy productivity by 135 quadrillion BTUs that is equals 64 million barrels of oil per day, or almost 150 percent of the entire US energy consumption today. In another part of this study it is emphasized that developing regions specially China, India and Middle East countries can contribute more to improving energy productivity, largely because they tend to start from a much lower base, grow more rapidly than developed economies. This institute has published another related report on October 2008. This study is concentrated on the role of energy productivity in fueling sustainable development in developing countries. This research shows that by adopting existing energy efficient technologies that pay for themselves in future energy saving, developing countries could reduce their energy demand growth by half – from 3.4 to 1.4 percent annually in the next 12 years – and reduce their energy consumption in 2020 by 22 percent from the projected levels.

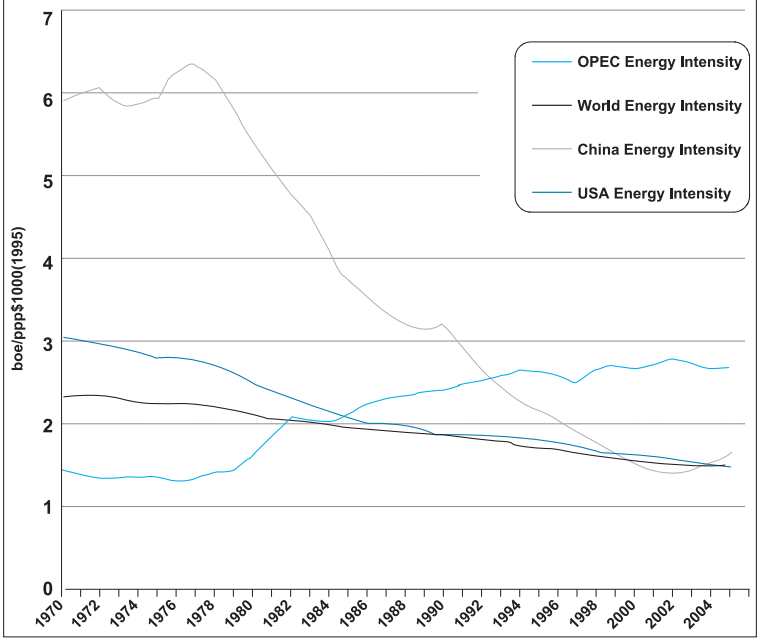
Meanwhile, it seems that oil exporting countries that some of them are included in the Middle East region has considerable energy intensity reduction potentials that has some valuable positive externalities in national and international dimensions. Therefore, regarding the importance of energy productivity enhancement for solving global energy dilemma and at the same time efficient consumption of national resources, it is tried to evaluate the oil saving potentials of OPEC countries that can be derived in different scenarios of energy intensity reduction. The chosen time period of the study is 2005-2020 and it is considered as a midterm time horizon. In addition to estimating oil saving potentials, the impact of capturing these opportunities on oil export capacity, oil revenue, global oil balance and CO_2 emission reduction is examined.

This paper consists of two main parts. In the first section the potential oil savings of OPEC countries are estimated by building scenarios for OPEC energy saving, GDP and oil demand till 2020 and then the effect of these oil savings achievements on oil export capacity, oil revenue, global oil balance and CO_2 emission reduction are evaluated in the second section. In the end the implied conclusions and recommendations of the study is proposed.

2. Oil saving potentials estimation:

Comparing energy intensity of OPEC countries with

Figure (1): Energy intensity trends of different countries (1970-2006)



industrialized countries (US), developing countries (China) and world shows that OPEC countries are among the countries that has experienced an increasing trend of energy intensity (figure.1) whilst others have almost had a decreasing trend. It is also important to point to the higher amount of energy intensity of OPEC in comparison to other countries especially after 1990s. In spite of knowledge and technology development in the area of energy productivity enhancement and energy consumption control after 1970s, OPEC countries are still moving in the increasing trend of energy intensity and their energy consumption efficiency has been deteriorated gradually. At the first sight, this evident reflects the considerable amount of energy saving potentials that currently exist in OPEC countries.

Estimating oil saving potentials of OPEC countries needs our knowledge about the future trend of energy intensity, gross national product (GDP), oil consumption and oil share in energy mix of OPEC countries till 2020.scenario building is a method to deal with the problem. It is an approach to understand the different dimensions of oil saving in different assumptions. Therefore, we have selected this method to find a rough estimation of OPEC oil saving in different assumptions.

At first energy intensity scenarios are introduced. But, it is necessary to consider two important points before building these scenarios:

1- There are large differences in energy productivity among different countries at similar levels of income. According to a study by MGI, three structural factors explain roughly half of the variation. In order of importance, these are energy policies, the structure of an economy and the climate. This research also shows that less than 50% of this difference is due to structural factors. Based on this fact and higher energy consumption of developing countries during their transition to the industrialization, we have selected three different energy intensity scenarios for OPEC countries. The first one is based on a developing country (China), the second on a developed (US) and the third is based on the world average.

2- According to the theory of Solow neoclassical economic growth and leapfrogging effect in economic theory, OPEC countries possess more opportunities with lower expenditures for energy productivity improvement in comparison with China and US while they were in an identical status of energy productivity that OPEC currently has. In fact, after the accumulation of knowledge and technology in an specific area such as energy productivity improvement and energy consumption control, those countries that hasn't utilized these experiences has the opportunity to use them with less expenditure and more effectiveness. Therefore, OPEC nowadays has the opportunity to use the global accumulation of knowledge and technology in the area of energy productivity improvement to leap to the higher levels of energy productivity that the world hasn't touched during crossing this situation. This phenomenon has been experienced in China after 1990s. Rapid decline of Chinese energy intensity after 1990s depicted in figure (1) is an evidence of this subject. But, trying to be more realistic and to somehow pessimistic, this effect that is known as leapfrogging is completely ignored in our scenarios.

Considering the above points, if it is assumed that leapfrogging effect in the area of energy productivity is ignored and OPEC countries will survey in a path that US, China and world have been surveyed in a condition that their energy intensity equals the current level of OPEC energy intensity, it will be possible to build three semi pessimistic scenarios for OPEC energy intensity until 2020.

Now, the year 2005 is chosen as the reference year; the OPEC energy intensity of this year equals 2.67 barrel of oil equivalent per one thousand dollar GDP in purchasing power parity (boe/1000$ GDP). This level of energy intensity is experienced in 1991 in china

and in 1980 in US, but, the world energy intensity hasn't touched this level till 1970. Therefore, three distinguished scenarios have been built for OPEC energy intensity in the next 15 years:

1- energy intensity of china during 1991-2006

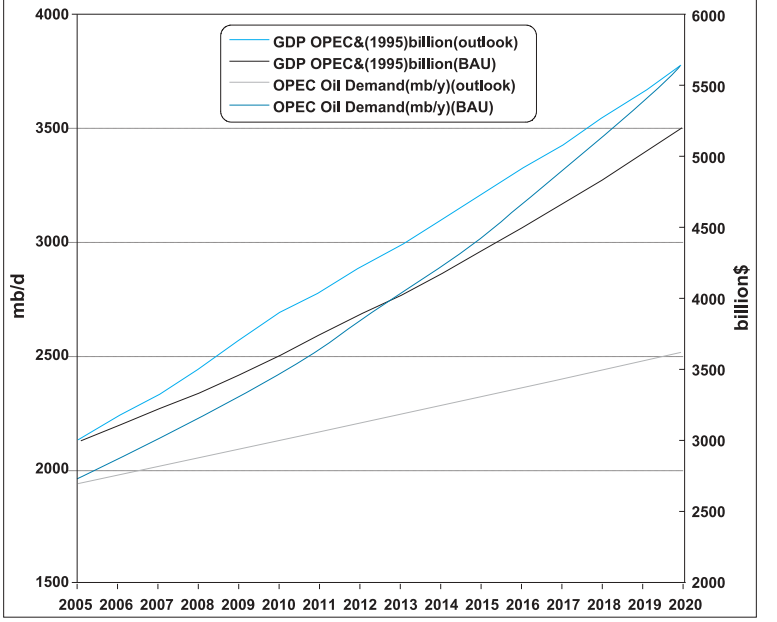
2- energy intensity of US during 1980-1995

3- energy intensity of world during 1970-1985

The trend of OPEC energy intensity in three different scenarios is depicted in figure (2).

In addition to energy intensity scenarios, GDP and oil demand scenarios of OPEC countries are needed to estimate the potential OPEC oil saving. Therefore, Business as Usual scenario (BAU) and OPEC World Oil Outlook 2008 Scenarios have been selected for the future trend of OPEC gross national product and oil demand. In the BAU scenario, it is assumed that current trend of GNP and oil demand of OPEC countries will continue until 2020 and in the World Oil Outlook 2008 scenario, the forecasts of GNP and oil demand that is published in this report has been utilized. The trend of GNP and oil demand of OPEC in these two distinct scenarios has been depicted in figure (3).

Fig (3): The trend of OPEC GNP and oil demand in WOO2008 and BAU scenarios



At last the future trend of oil share in OPEC energy mix must be determined. According to the calculations average oil share in energy mix of OPEC is 45% that is used constantly for all the coming years till 2020.

Building the scenarios for energy intensity, GNP, oil demand and oil share in energy mix in OPEC countries provide the required information to estimate the potential OPEC oil saving in 6 distinct scenarios for the time horizon of 2020[1].

In this paper we have used a contraction form for each of the six scenarios. SC1-1 stands for the scenario that WOO2008 scenario has been used for GNP and oil demand and the Chinese energy intensity is utilized for energy intensity; SC1-2 stands for the scenario that WOO2008 scenario has been used for GNP and oil demand and the US energy intensity is utilized for energy intensity; SC 1-3 stands for the scenario that WOO2008 scenario has

Fig (2): OPEC energy intensity scenarios during (2005-2020)

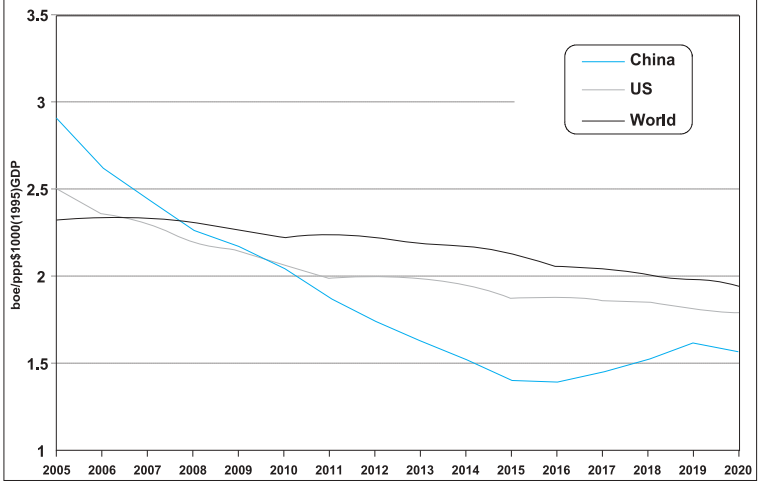


Table (1): OPEC oil savings in Outlook scenarios (mb/y)

OPEC oil saving per year in Outlook Scenario			
	SC1-3:World (mboe/y)	SC1-2:US (mboe/y)	SC1-1:China (mboe/y)
2005	479.2285	307.5895	-73.8305
2006	516.8785	497.8075	249.8845
2007	584.326141	612.932641	488.971141
2008	672.060937	767.415937	719.738437
2009	770.5729271	884.9989271	865.9279271
2010	866.5835	1019.1515	1038.2225
2011	919.901	1158.2885	1263.179
2012	1003.144913	1212.925913	1451.313413
2013	1087.736457	1287.981957	1631.259957
2014	1183.239433	1393.020433	1793.511433
2015	1299.974	1538.3615	1976.9945
2016	1413.6525	1585.2915	2042.9955
2017	1480.613414	1661.787914	2052.743414
2018	1577.157059	1729.725059	2034.861059
2019	1665.158033	1827.261533	2008.436033
2020	1754.0775	1906.6455	2116.4265

been used for GNP and oil demand and the world energy intensity is utilized for energy intensity; SC2-1 stands for the scenario that BAU scenario has been used for GNP and oil demand and the Chinese energy intensity is utilized for energy intensity; SC 2-2 stands for the scenario that BAU scenario has been used for GNP and oil demand and the US energy intensity is utilized for energy intensity and SC 3-3 stands for the scenario that BAU scenario has been used for GNP and oil demand and the world energy intensity is utilized for energy intensity. In addition to these abbreviations, the term "outlook scenario" indicates to the set of scenarios that WOO2008 is used for their GNP and oil demand scenario and the term "BAU scenario" indicates to the set of scenarios that BAU is used for their GNP and oil demand scenarios.

Determining the necessary scenarios provided enough information to estimate the potential oil savings of OPEC countries. The results of our estimation are shown in table (1) and (2). These tables show the results in million barrels of oil per year.

OPEC potential oil savings that can be resulted from pursuing energy productivity improvement is shown in million barrels of oil per day in table (3), (4) as well.

According to the results, there is considerable oil saving potentials in OPEC countries that can be achieved by pursuing energy productivity improvement. Cumulative OPEC potential oil saving during (2005-2020) in outlook scenarios is around 21660 million barrels (mb) in SC 1-1, 19391 mb in SC 1-2 and around 17274 mb in SC 1-3. It is observed that total OPEC oil saving potentials in BAU outlook is 36595 mb in SC 2-1, 27823 mb in SC 2-2 and 24762 mb in SC 2-3. In order to understand the significance of these amounts of oil saving, it must be consider that even in the least scenario the amount of OPEC oil saving is more than Qatar proven oil reserve.

If the OPEC potential oil saving is calculated in mb per day, the amount of oil saving in 2020 in Outlook

Table (2): OPEC oil savings in BAU scenarios (mb/y)

OPEC oil saving per year in BAU Scenario			
	SC2-3:World (mboe/y)	SC2-2:US (mboe/y)	SC2-1:China (mboe/y)
2005	37.5245	-10.153	-57.8305
2006	183.35625	183.35625	431.27925
2007	335.5565625	402.3050625	755.1185625
2008	523.4966156	513.9611156	1076.555616
2009	728.4620714	718.9265714	1300.592071
2010	931.756425	960.362925	1580.170425
2011	1095.630896	1210.056896	1915.683896
2012	1306.317866	1477.956866	2221.725866
2013	1526.108859	1802.638359	2517.800859
2014	1745.923577	2051.059577	2804.364077
2015	2013.917481	2357.195481	3129.570981
2016	2311.52143	2645.26393	3360.42643
2017	2562.978377	2944.398377	3545.134877
2018	2864.196621	3264.687621	3712.856121
2019	3149.008627	3511.357627	4007.203627
2020	3446.630908	3789.908908	4295.290408

scenarios are 5.8 million barrels per day (mbd) in SC 1-1, 5.22 mbd in SC 1-2 and 4.8 mbd in SC 1-3. While these amounts in BAU scenarios are 11.8 mbd in SC 2-1, 10.4 mbd in SC 2-2 and 9.5 mbd in SC 2-3. As it is observed, in the least scenario around 5 million barrels of oil per day can be saved in 2020 that is really notable.

Table (4): OPEC oil savings in BAU scenarios (mb/day)

OPEC oil saving per day in BAU Scenario			
	SC2-3:World (mboe/d)	SC2-2:US (mboe/d)	SC2-1:China (mboe/d)
2005	0.102807	-0.02782	-0.15844
2006	0.502346	0.502346	1.181587
2007	0.919333	1.102206	2.068818
2008	1.434237	1.408113	2.949467
2009	1.995786	1.969662	3.563266
2010	2.552757	2.631131	4.329234
2011	3.001728	3.315224	5.248449
2012	3.578953	4.049197	6.08692
2013	4.18112	4.938735	6.898085
2014	4.783352	5.619341	7.683189
2015	5.517582	6.45807	8.574167
2016	6.332935	7.247298	9.206648
2017	7.021859	8.066845	9.712698
2018	7.847114	8.94435	10.17221
2019	8.627421	9.620158	10.97864
2020	9.442824	10.38331	11.76792

3- Major advantages of OPEC oil saving achievement:

Capturing oil saving opportunities in OPEC countries not only provide valuable advantages for their host countries but it has also major advantages for all human beings in the world. Therefore, these advantages have been evaluated in this paper from two distinct perspectives as national advantages and international advantages.

3-1- National advantages:

A careful review of advantages of energy productivity improvement potentials in OPEC countries from national perspective shows that it is possible to divide them in two main categories of general advantages and specific advantages. General advantages are those that are common in all the developing countries. For instance, investment in greater energy productivity would reduce the supply capacity that these countries need to build to keep up with growing demand. And because energy efficiency improvement require less capital than new power plants or other energy supply investment, improving energy productivity also cuts down on energy related capital needs. Avoiding this expenditure on energy supply is particularly vital for those developing countries that face capital constraints.

As a whole, it is possible to say that focusing on improving energy productivity sets developing economies on a more sustainable growth path that will be more cost competitive in global markets, less dependant on imported fossil fuels, less susceptible to future energy price or supply shocks. In addition to these benefits, decreasing energy consumption by pursuing energy productivity improvement programs provide a suitable opportunity for these countries to mitigate or cut the energy subsides that are paid in many developing countries. In fact,

Table (3): OPEC oil savings in Outlook scenarios (mb/day)

OPEC oil saving per day in Outlook Scenario			
	SC1-3:World (mboe/d)	SC1-2:US (mboe/d)	SC1-1:China (mboe/d)
2005	1.312955	0.842711	-0.20228
2006	1.416105	1.363856	0.684615
2007	1.600894	1.679268	1.339647
2008	1.841263	2.102509	1.971886
2009	2.111159	2.424655	2.372405
2010	2.374201	2.792196	2.844445
2011	2.520277	3.173393	3.460764
2012	2.748342	3.323085	3.976201
2013	2.9801	3.528718	4.469205
2014	3.241752	3.816494	4.91373
2015	3.561573	4.214689	5.416423
2016	3.873021	4.343264	5.597248
2017	4.056475	4.552844	5.623955
2018	4.320978	4.738973	5.574962
2019	4.562077	5.006196	5.502564
2020	4.805692	5.223686	5.798429

Table (5): OPEC oil saving value in Outlook scenario

OPEC oil saving per year in Outlook Scenario			
	SC1-3:World (million $)	SC1-2:US (million $)	SC1-1:China (Million $)
2005	28753.71	18455.37	-4429.83
2006	31012.71	29868.45	14993.07
2007	35059.56846	36775.95846	29338.26846
2008	40323.65622	46044.95622	43184.30622
2009	46234.37563	53099.93563	51955.67563
2010	51995.01	61149.09	62293.35
2011	55194.06	69497.31	75790.74
2012	60188.69478	72775.55478	87078.80478
2013	65264.18742	77278.91742	97875.59742
2014	70994.36598	83581.22598	107610.686
2015	77998.44	92301.69	118619.67
2016	84819.15	95117.49	122579.73
2017	88836.80484	99707.27484	123164.6048
2018	94629.42354	103783.5035	122091.6635
2019	99909.48198	109635.692	120506.162
2020	105244.65	114398.73	126985.59
Total	1036458.289	1163471.149	1299638.089

energy consumption reduction by energy productivity enhancement policies will neutralize the negative effect of cutting energy subsides on production costs. These are some of the benefits of energy productivity improvement from national viewpoints. It must be noted that these policies has also some multidimensional benefits even in the areas of social behavior and national security that is not the subject of this paper.

But, on the other hand, OPEC countries or other oil exporting countries that their domestic energy consumption is largely dependant on petroleum may benefit from some specific advantages as well. This group of countries in addition to general advantages benefit from some specific advantages. The most outstanding advantage in this regard is the additional oil revenue that may be received from oil saving in OPEC countries. It is important to consider this point that these oil savings may be in the form of additional oil reserves that is preserved for the future generation of these countries. And if it is believed that these oil reserves are regarded as global assets that belong to all human beings, then saving these oil reserves not only benefit the host countries generation but it also provide advantages for the future generations of all the human beings. So, despite the inclusion of this advantage in national categories it has some international aspects as well.

Based on the results of the previous section about potential OPEC oil saving, the monetary value of capturing these opportunities has been calculated with the assumption of 60 US$ per barrel for the average future price of oil in the next 15 years. Table (5) and (6) shows the possible OPEC oil saving value in million $ per year.

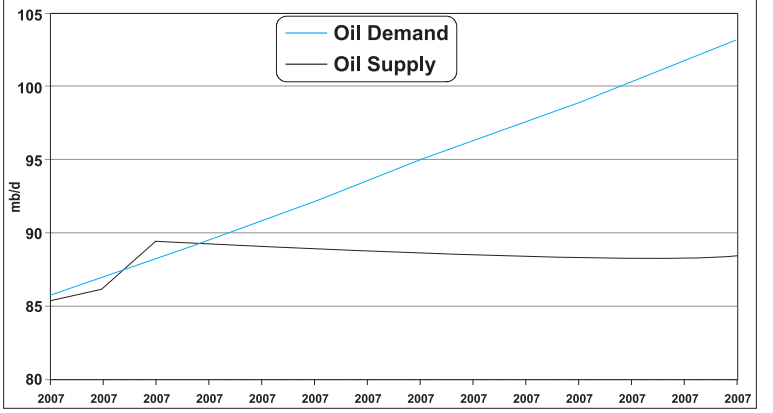
Assuming 60 US$ per barrel for future average oil price, the Outlook scenarios indicate to 1.3 trillion $ in SC 1-1, 1.17 trillion $ in SC 1-2, 1.04 trillion $ in SC 1-3 for cumulative OPEC oil saving value. BAU scenarios estimation for are also 2.2 trillion $ in SC 2-1, 1.7 trillion $ in SC 2-2 and 1.5 trillion $ in SC 2-3. The significance of these quantities are understood when the relatively lower energy productivity investment expenditures and positive internal rate of return for these projects in developing

Table (6): OPEC oil saving value in BAU scenario

OPEC oil saving per year in BAU Scenario			
	SC2-3:World (million $)	SC2-2:US (million $)	SC2-1:China (million $)
2005	2251.47	-609.18	-3469.83
2006	11001.375	11001.375	25876.755
2007	20133.39375	24138.30375	45307.11375
2008	31409.79694	30837.66694	64593.33696
2009	43707.72428	43135.59428	78035.52426
2010	55905.3855	57621.7755	94810.2255
2011	65737.85376	72603.41376	114941.0338
2012	78379.07196	88677.41196	133303.552
2013	91566.53154	108158.3015	151068.0515
2014	104755.4146	123063.5746	168261.8446
2015	120835.0489	141431.7289	187774.2589
2016	138691.2858	158715.8358	201625.5858
2017	153778.7026	176663.9026	212708.0926
2018	171851.7973	195881.2573	222771.3673
2019	188940.5176	210681.4576	240432.2176
2020	206797.8545	227394.5345	257717.4245
Total	1485743.224	1669396.954	2195756.554

countries and particularly OPEC countries are considered[2].

Fig (4): Oil demand and supply in reference scenario until 2020



3-2: International advantages:

Energy productivity improvement policies have also many international benefits. Reducing energy consumption by improving energy productivity lead to oil demand reduction and hence more stabilization in the oil market. This is due to the dependency of global energy mix to oil at least until to future upcoming two decades. This impact can be regarded as a general advantage that is common in all the countries which pursuing such policies. But, OPEC energy productivity improvement and its consequent oil saving not only reduce global oil demand but it boosts the OPEC oil export capacity as well.

In addition to this effect, reducing OPEC oil consumption will lead to lower CO_2 emissions that are resulted from extensive fossil fuel consumption in the world. This is another international advantage of capturing OPEC oil saving opportunities that can be regarded as a national-international advantage because; it has common benefits for OPEC countries and the world. But as the environmental concerns are stronger in industrialized countries this advantage is categorized in international advantages.

As a whole, OPEC oil saving impact from international point of view is evaluated in this part from two perspectives:

1- impact on global oil balance

2- impact on global CO_2 emission

In the next parts these two aspects of OPEC oil saving potentials achievement has been evaluated.

3-2-1: Impact of OPEC oil saving on the global oil balance:

Reducing OPEC oil demand in the condition that the oil dependency of the world will still continues until 2030 and at the same time oil demand grows rapidly can play a significant role in stabilizing the tight oil market.

In order to evaluate the impact of OPEC oil saving on the global oil market, we have better examine its effect on the global oil balance. But, before that, it is required to build a reference oil supply/demand scenario for oil market. Therefore, we have taken an oil supply scenario from a new report of Chatham House written by Paul Stevens. The oil demand scenario is also derived from World Oil Outlook 2008 report that is published by OPEC secretariat. It is necessary to consider that the oil supply scenario is moderately tight and pessimistic. The assumptions that support this scenario are shown in Table (7).

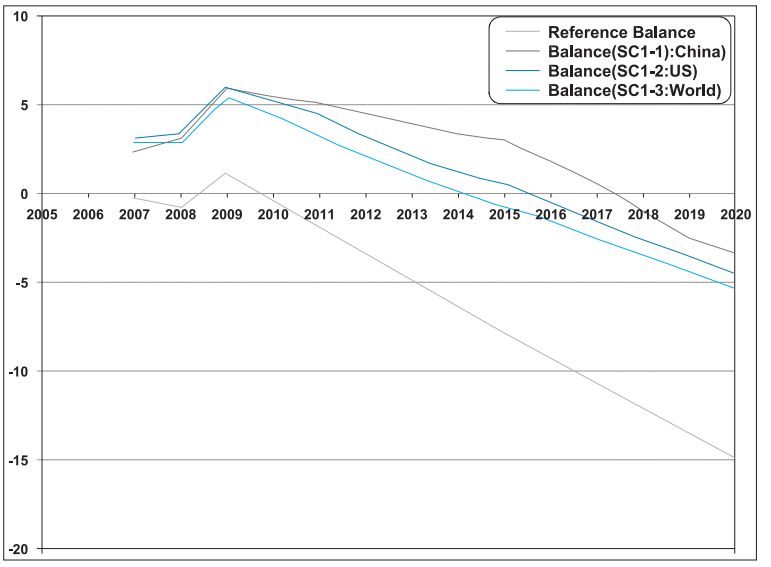
Table (7): Assumptions for supply capacity (mb/d)

capacity	2007	2008	2009	Assumptions post-2008
Saudi Arabia	8.5	9	12.5	flat
Iraq	2.1	2.1	2.1	flat
Rest OPEC-10	20.1	20.1	20.1	flat
FSU	12.8	13.1	13.1	flat
Non-OPEC	37.2	36.9	36.4	-1.29%=average 2005-2008
OPEC NGLs	4.8	5.1	5.35	+5%=average 2005-2008
Total Capacity	85.5	86.3	89.55	

The trend of oil supply and demand during (2007-2020) in reference scenario is depicted in figure (4).

This figure shows that global oil balance

Fig (5): Global oil balance in BAU scenarios



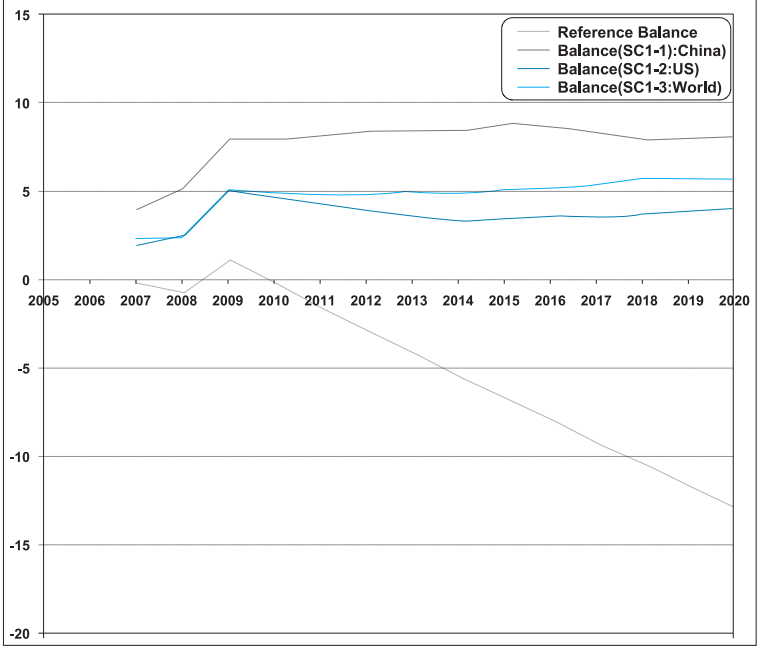
during 2007 and 2020 except 2009 and 2010 is in deficiency and this deficit is growing gradually until 2020. As it is emphasized earlier one of the factors that have a significant fundamental impact on global oil balance is OPEC oil demand reduction. Because this reduction in oil demand not only reduces global oil demand but it also increases the OPEC oil export capacity that lead to oil supply increase. Therefore, this event affects the global oil balance both from demand and supply side at the same time. Figure (5) and (6) depicts the impact of OPEC oil saving on the global oil balance in 6 different scenarios. As it is shown in figure (4), if OPEC has the ability and willingness to capture all the estimated oil saving that is estimated in Outlook scenarios, the global oil balance will be in surplus until 2018 in SC 1-1, 2016 in SC 1-2 and 2014 in SC 1-3. In the same vein, if the BAU Scenarios of OPEC oil savings are achieved the global oil balance deficit will be completely omitted and the global oil balance will be positive in all the upcoming years until 2020. This will bring the desired stabilization to the oil market.

3-2-2: OPEC oil saving impact on CO_2 emission reduction:

One of the aspects of OPEC oil saving impact that is both beneficial from both national and international perspective is its role in reducing global green house gas emissions and particularly CO_2 emission. This advantage can help both OPEC countries and the world in growing in a sustainable path in the future decades. According to our calculations that is based on the data released by EIA, OPEC countries average CO_2 emission per one million barrels of oil that have been consumed in each year during 2000-2005 is 0.3 million metric ton per million barrels of oil. If it is assumed that this ratio will be constant until 2020 for OPEC countries it will be possible to estimate the amount of CO_2 emission reduction by energy productivity improvement in our six scenarios.

The result of estimating OPEC CO_2 emission

Fig (6): Global oil balance in BAU scenarios



reduction by energy productivity improvement in different scenarios is shown in Table (8) and (9). As it can be observed, in Outlook scenarios the amount of total CO_2 emission reduction until 2020 is 7 billion tons in SC 1-1, 6.4 billion tons in SC 1-2 and 5.6 billion ton in SC 1-3. In the same order, total CO_2 emission reduction until 2020 in BAU scenarios are 12 billion ton in SC 2-1, 9 billion ton in SC 2-2 and 8 billion ton in SC 2-3. The significance of these quantities of OPEC CO_2 emission reduction is understood when it is noticed that global CO_2 emission reduction resulting from oil consumption in 2005 was 10.9 billion ton and the European and North American countries that possess the largest share of emissions, has the least economic capacities for reducing their emissions as well. Hence, it is evident that these amounts of emission reduction are beneficial both for OPEC countries and the world[3].

Conclusions and recommendations:

The results of this study shows that OPEC countries has 15.6 billion barrels potential oil saving in the least scenario that capturing it brings around 1 trillion dollar additional oil revenue and it can delay global oil balance deficit to 2014 and reduce around 5 billion ton of carbon dioxide emissions in the next 12 years. So, capturing OPEC oil saving potentials will result in additional oil revenue and emission reduction in host countries that can enhance sustainable development in these countries and at the same time, capturing oil saving opportunities will avoid global oil supply crunch to a great extent and reduce global CO_2 emission. Therefore, energy productivity improvement can be a new and decent ground of cooperation among OPEC members, but OPEC must consider that despite apparent and transparent energy productivity policies from economic and financial point of view, these policies are very complex and sophisticated from institutional viewpoint in OPEC countries. Therefore, pursuing a collective energy productivity improvement policy by OPEC can mitigate some of complexities in this regard.

In addition to pursuing energy productivity policies by OPEC countries, industrialized and developing countries have better cooperate with OPEC in the areas such as knowledge transfer or technology transfer to achieve its goals to higher levels of energy productivity; because these goals has some valuable advantages for these countries as well.

For further investigation in this area it will be recommended to perform a research on the capacities of OPEC members in investing in new sources of energy like solar, biofuel and wind. It is also a new ground of cooperation for OPEC countries and it can be the main question for a separate research.

Table (8): OPEC CO_2 emission reduction in Outlook Scenarios

OPEC CO_2 Emission reduction in Outlook Scenario (Million Ton Metric/year)			
year	SC1-3:World	SC1-2:US	SC1-1:China
2005	156.6118738	100.5202486	-24.1278074
2006	168.9158938	162.683491	81.6622546
2007	190.9577829	200.3063871	159.7957689
2008	219.6295142	250.7915282	235.2105212
2009	251.8232326	289.2176494	282.9852466
2010	283.1994878	333.0587102	339.291113
2011	300.6236468	378.5286818	412.8068972
2012	327.8277576	396.3841884	474.2892234
2013	355.4722741	420.9125035	533.0957539
2014	386.6826467	455.2390775	586.1195363
2015	424.8315032	502.7365382	646.0818026
2016	461.981637	518.0732622	667.6509294
2017	483.8644637	543.0722903	670.8365477
2018	515.4149269	565.2741493	664.9925941
2019	544.1736452	597.149069	656.3568956
2020	573.232527	623.0917494	691.6481802
Total	5645.242813	6337.039524	7078.695457

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Table (9): OPEC CO_2 emission reduction in BAU scenarios

OPEC CO_2 Emission reduction in BAU Scenario (Million Ton Metric/year)			
	SC2-3:World	SC2-2:US	SC2-1:China
2005	12.2630066	-3.3180004	-18.8990074
2006	59.9208225	59.9208225	140.9420589
2007	109.6598846	131.4732944	246.7727462
2008	171.078694	167.9624926	351.8183753
2009	238.0614049	234.9452035	425.0334888
2010	304.4979997	313.8466039	516.3996949
2011	358.0521768	395.4465936	626.0454972
2012	426.9046786	482.9963038	726.060013
2013	498.7323751	589.1022157	822.8173207
2014	570.567825	670.2862698	916.4661804
2015	658.1482328	770.3314832	1022.743797
2016	755.4052033	864.4722523	1098.187357
2017	837.5813336	962.2293896	1158.550078
2018	936.0194557	1066.899915	1213.36138
2019	1029.096019	1147.511673	1309.554145
2020	1126.358981	1238.542231	1403.700905
Total	8092.348093	9092.648743	11959.55403

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(Endnotes)

[1] - It is necessary to consider that this study is concentrated only on the oil consumption of OPEC countries, whilst; inefficiency of energy consumption don't limit to the oil consumption and do include all the energy forms. Therefore, these countries has the opportunity to increase their oil saving by substituting the amount of energy that is saved in the process of increasing the energy productivity of the other carriers of energy like natural gas by oil products. But this indirect impact of energy product
ivity improvement on oil saving is ignored in this study.

[2] -According to the review of authors, there isn't any specific study on the expenditures of energy intensity reduction in OPEC countries. It seems that the major reason of this event is the necessity to access to an extensive set of data on the details of several energy productivity projects in different sectors in OPEC countries, so that, the individual researchers can't perform such a studies and it must done by the organizations like OPEC that has an access to these data. However; studies that are done in
MGI and IEA provide some reliable evidences that prove the profitability of the energy productivity projects in OPEC countries. The International Energy Agency (IEA) estimates that, on average, each additional $1 spent on more efficient electrical equipments, appliances, and buildings avoid more than $2 in investment in electricity supply. According to MGI analysis, developing countries could productively invest some $90 billion annually over the next 12 years on energy efficiency improvement with positive
returns. IEA analysis suggests that it would take almost twice as much investment - $2 trillion over 12 years- to expand the supply capacity for the additional 22 percent of energy consumption that will see if developing regions fail to improve their energy productivity. Based on these studies, it is strongly probable not only to prove the profitability of energy productivity projects in OPE countries but also their preference over energy supply projects in the future.

[3] - Due to the impact of energy productivity improvement projects on reducing the green house gas emissions, some of these projects are included in the category of Clean Development Mechanism (CDM) projects that has international financial aid in terms of emission trading. Therefore, some parts of the expenditure of the energy productivity improvement projects can be supplied in this way.

Development of Yadavaran Oilfield Moving on

The plan to develop Iran's Yadavaran oilfield is said to be making suitable progress and the documents of the tenders to be held for its various projects are reportedly being prepared.

Those projects have been defined in several packages for both the surface as well as the subsurface sectors of the plan.

The engineering division of the plan, which includes its Basic, and Detailed Engineering Designs plus its FEED, has so far made about 36% headway. The FEED part alone has made a progress of almost 67% and is expected to be completed by the end of November this year.

In December 2007, NIOC signed a 'Buy-Back' contract with the Chinese Sinopec for the development of Yadavaran oilfield. According to this contract, Sinopec is obliged to run and complete all various tenders of the plan within 21 months starting from August 2008.

Setting that 21-month time limit was necessary because the contract has no pre-set value (ceiling for its Capital Expenditures or CAPEX). The contract's final value has hence been left open until all tenders of the plan are done with and their total costs assessed. That way, a more realistic value could be at hand for the said contract.

According to sources close to the plan, development of Yadavaran has been defined in a total of 42 packages, 17 for its surface sector and 25 for the subsurface one.

Tenders are currently underway for certain packages of the surface sector of the plan, such as for its Well-Casing, Well-Tubing and Wellhead Facilities.

The major packages of the subsurface sector of the plan are the ones defined for the drilling operations of its appraisal and production wells, for which an EPD tender notice will be issued within a month.

Phase 1 of development of Yadavaran oilfield aims at attaining a production level of about 85,000 bpd. To that end, 45 production, 3 appraisal and 3 wastewater-injection wells will be drilled, which will need a total of seven onshore drilling rigs.

The major packages of the surface sector of the plan are the ones defined for the construction of Production Plants, Oil & Gas Gathering Stations, Compressor Stations, etc. The tender documents of these units are expected to be fully prepared by the end of 2009.

Sinopec is already holding the pre-qualification stage of the tender.

Besides, Sinopec has been working since August last year on the 'Early Production Plan' of Yadavaran, which is supposed to be completed in 16 months' time and produce 20,000 bpd of crude oil. For the purpose, five new production wells will be drilled in Yadavaran and the three existing exploratory wells in the field will be converted into production types.

The 'Early Production' output of Yadavaran will be dispatched to the production plant of Darkhoain for treatment.

About a month ago, the JV of Oil & Energy Industries Development Co. (OEID) and Kish Petroleum Engineering (KPE), both subsidiaries of Oil Industries Engineering & Construction (OIEC), was chosen by Petroleum Engineering and Development Company (PEDEC), the client, as the Management Contractor (MC) of the project.

China's Colorful Presence in Iran's Petroleum Industry

China with its multi trillion foreign exchange reserves has established wide-ranging relationships with oil rich countries to secure its energy needs. Cooperation with Iran in this regard is of great importance to China.

According to the news agency of Iran's oil ministry, China's investment in the upstream and downstream sectors of Iran's petroleum industry has touched $ 50 Bln, some 35-40% of which has take shape in the form of contracts.

China, as the world's second largest consumer of energy, needs about 8 Mln bpd of crude oil, some 5.3 Mln bpd of which is produced locally and the rest is imported. China imports 62% of its crude oil requirements from OPEC member countries, 11% of which (about 484,000 bpd) is imported from Iran.

Following are the prominent petroleum deals China has signed with Iran:

China to provide 90% of Azadegan needs

At present, Naftiran Intertrade Company (NICO) is in charge of securing 90% of financial needs of development of Iran's Azadegan oilfield and the Japanese Inpex has to provide for the remaining 10%.

In line with a Memorandum of Understanding (MoU) signed with NIOC, China National Petroleum Corporation (CNPC) will buy 70% of shares of NICO in Azadegan and finance the remaining 20% as well.

The volume of oil-in-place of the field is estimated at around 33 Bln barrels, of which 2 Bln barrels (6%) are recoverable.

The early production of the field is underway by National Iranian South Oil Company (NISOC) and the field is currently producing less than 20,000 bpd of blend of heavy and light crude oil (API 19-30).

Development of North Azadegan

A $ 2 Bln contract has been signed with China for the development of Iran's North Azadegan oilfield.

To secure the financial needs of this project, NIOC has signed a MoU with CNPC, which has to be approved by the board of NIOC.

Contract for the first phase of development of Iran's North Azadegan oilfield, was signed in January this year with CNPC. The first phase of

the project will lead to the production of 75,000 bpd of crude oil. Given the tough geographical location of the oilfield, this phase is foreseen to take 48 months to complete.

North Azadegan oilfield is located in Iran's south-western province of Khouzestan and houses an estimated reserve of six billion barrels of recoverable oil.

Development of Yadavaran oilfield

In 2007, Iran signed a $ 2 Bln deal with the Chinese Sinopec for the development of Iran's Yadavaran oilfield.

Early production project of Yadavaran oilfield with the target production of 20-25,000 bpd of crude oil is underway.

Yadavaran is located to the south of Iran's Azadegan oilfield and houses an estimated 17.3 Bln barrels of oil-in-place, 3.3 Bln barrels of which are recoverable.

Anglo-Dutch supermajor Shell has expressed interest in farming in for a 20% stake in the field.

Development of phase 11 of Iran's South Pars gas field

NIOC and CNPC have signed a $ 5 Bln contract for the development of phase 11 of Iran's South Pars gas field.

Development of North Pars gas field

A $ 16 Bln agreement exists between Iran and China for the development of Iran's North Pars gas field. In March 2006, CNOOC signed a preliminary accord with NIOC for developing North Pars gas field.

Negotiations on down-stream contract between NIOC and CNOOC are still on. Drilling operations is planned to start in early 2010.

North Pars gas field, located 85 kilometres north of the giant South Pars gas field in the Persian Gulf, has about 80 tcf of gas in place and its development project is planned to be executed in four phases to produce some 4.8 bcf/d of gas.

LNG export to China

CNPC is in negotiations with NIOC for the purchase of more than $ 3 Bln worth of LNG from Iran.

CNPC is also in talks with NIOC to explore and develop energy reserves in Iran's Caspian Sea.

Construction of new refineries in Iran

China's Sinopec is in talks with National Iranian Oil Refining and Distribution Company (NIORDC) for collaboration in the construction of 'Hormoz' oil refinery and in 'capacity stabilization' plan of 'Abadan' oil refinery. Sinopec is now busy in the upgrading project of Arak refinery.