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Prediction of the New Tech in the Energy Economics of Petroleum, Gas and Petrochemical (Case Study: National Iranian Petrochemical Co. of Kermanshah, Shazand & Tabriz)

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Abstract

In this paper, a comprehensive concept of the effect of new technology on the energy economics of petroleum, gas and petrochemistryis proposed. The roadmap of development, the tools of the main method, elements, the main challenges and weak points are discussed. The treasury of stock exchange allows the energy economics to have a criterion for the policies of the government, a common landscape for the various beneficiaries, reinforcement of the research and development based upon the new technology of the energy sector. Three case studies (national firm of petrochemical industry of Kermanshah, shazand and Tabriz) from ETF in world market is proposed to illustrate the conceptual approach. This article is under the special attention of researcher, deciders and the commission of studies to promote their policies.

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Introduction

Petrochemical industries are part of the chemical industries which produce chemical products out of raw materials derived out of the petroleum and natural gas. Iran is one of the greatest producers of petroleum and gas of the world. Although developing the capacity of attracting technical sciences is the necessary condition for the transferring of new technology, appropriate planning to exploit the existing attraction capacity of Iran is the adequate condition for the achievement of the transferring policies and developing new technology.

Supporting the producer and contractors of petroleum and gas projects inside Iran, is the important and effective way in which petroleum industry can achieve the policies of resistive economy. Petrochemical products are categorized into two groups: downstream products andbasic upstream materials which include the borderline materials and stuff of the downstream units.

The cornerstone of petrochemical industry in Iran was laid in late 1950s. Owing to the size of the domestic market and the availability of huge hydrocarbon

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reserves, the industry saw rapid development and expansion in the ensuing years. Since its inception, the industry has travelled a long and challenging road from its humble origins to become a major force in global petrochemical markets. The journey is however far from complete as NPC's next goal is to plan for further growth of Iran's current capacities and help build new generation of facilities based on the country's immense gas feedstock. The genesis of petrochemical industry in Iran dates back to 1958 when the Fertilizer Authority was established as part of Ministry of Economic Affairs and Finance. In 1964, the National Petrochemical Company (NPC) was set up to plan for the development of the industry. In the same year, the first Iranian Petrochemical plant, Shiraz Petrochemical Company which was a fertilizer facility, came on stream. In 1965, the Petrochemical Industries Development Act was ratified by Iran's parliament allowing NPC to directly enter into partnerships with local and foreign companies for producing petrochemical products. Since its inception in early 1960s until the advent of the Islamic Revolution in 1979, NPC constructed several petrochemical facilities including Shiraz, Razi, Abadan, Kharg, Farabi, Carbon Iran and Polika producing 1.6 million t/y of products. During this period, expansion projects of Shiraz and Razi were kicked off. Construction work also began on ex-Iran-Japan, currently Bandar Imam Petrochemical Company. After the victory of the Islamic Revolution in 1979, fresh efforts were made to further develop the industry but they were rendered ineffective when Iraq invaded Iran in 1980 and waged a war that continued for the next 8 years. The war badly affected the country's entire economy and the petrochemical sector was not an exception. It brought investment to a halt and crippled many of the petrochemical facilities. Output plummeted to an all time low of 880,000 tons in 1988. The industry, however, quickly rose from the ashes and grew even stronger after the war ended in 1988[1].

The 2nd phase of ammonia and urea project of Kermanshah for the annual production capacity of 396,000 tons ammonia and 660,000 tons urea is on the executive agenda. The project's detailed feasibility studies are completed, and ammonia and urea licensing has been finalized. Namvaran Company is selected as the engineering consultant for ammonia unit and the detailed engineering consultant for urea unit. Nam Avaran Delvar Company is selected as project management contractor and also for complete implementation of logistics. The project is at the stage of procurement of long-term delivery items and has achieved an actual progress of 2.37%[1].

At present, sulfur produced at Tabriz refinery is sold and marketed in bulk form, which in addition to environmental pollution, has limited outlet because of emitting sulfur dust. By installing a granular forming system, the sulfur produced at the refinery will be in granular form at higher added value. The project, implemented at the cost of 220 billion Rials with duration of one year, has reached 46.39% physical progress and is scheduled for completion by the end of March 2015 [1].

Petroleum contracts with the international petroleum firms, financial supporting of the domestic manufacturing of petroleum facilities and guaranteeing the sale market for their production, common investment with the foreign firms for the domestic production of petroleum facilities, developing research institute and other scientific-technical institutes inside the petroleum industry and more transaction of this industry with university is seen as the appropriate strategy of transferring and developing new technologies.

Considering the importance of petrochemical industry and the effect of the technology on it, in this paper, it has been tried to investigate the prediction of new technologies of the energy economics of petroleum, natural gas and petro chemistry (case study: National Iranian Petrochemical Company of Kermanshah, Shazand and Tabriz)

Literature Review

Natural Gas

In addition to the natural gas associated with oil exploration and extraction, an estimated 62 percent of Iran's 32.3 trillion cubic meters of proven natural gas reserves in 2006 were located in independent natural gas fields, an amount second only to those of Russia. In 2006 annual production reached 105 billion cubic meters, with fastest growth occurring over the previous 15 years. In 2006 natural gas accounted for about 50 percent of domestic energy consumption, in part because domestic gas prices

were heavily subsidized. In the 1980s, Iran began to replace oil, coal, charcoal, and other fossil-fuel energy sources with natural gas, which is environmentally safer. The share of natural gas in household energy consumption, which averaged 54 percent in 2004, was projected to increase to 69 percent by 2009. Overall, natural gas consumption in Iran was expected to grow by more than 10 percent per annum between 2005 and 2009 [2].

With international oil prices increasing and projected to continue increasing, international demand for natural gas and investment in production and transportation of natural gas to consumer markets both increased in the early 2000s. Iran set a goal of increasing its natural gas production capacity to 300 billion cubic meters by 2015 while keeping oil production stable. To achieve this capacity, the government has planned a joint investment worth US$100 billion in the oil and gas industry through 2015. In 2004 Iran signed a contract with France and Malaysia for production and export of natural gas and another agreement with European and Asian companies for expansion and marketing of its natural gas resources. In 2005 Iran exported natural gas to Turkey and was expected to expand its market to Armenia, China, Japan, other East Asian countries, India, Pakistan, and Europe. The first section of a new line to Armenia opened in spring 2007, as a much-discussed major pipeline to India and Pakistan remained in the negotiation stage[3].

Petrochemicals

In the early 2000s, an ambitious state petrochemicals project called for expansion of annual output in that industry from 9 million tons in 2001 to 27 million tons in 2013. Output capacity in 2006 was estimated at 15 million tons. The goal of this expansion is to increase the percentage of Iran's processed petroleum-based exports, which are more profitable than raw materials. In 2005 Iran exported US$1.8 billion of petrochemical products (about one-third of total nonoil exports in that year). Receiving 30 percent of Iran's petrochemical exports between them, China and India were the major trading partners in this industry. Iran's domestic resource base gives it a unique comparative advantage in producing petrochemicals when international crude oil prices rise. The gain has been greatest in those plants that use liquid gas as their main input. For FY 2006, the petrochemical industry's share of GDP was projected to be about 2 percent[4].

Iran's petrochemical industries have absorbed a large amount of private and public investment. In the early 2000s, 43 percent of these investments was financed by Iran's National Petrochemical Company, a subsidiary of the Ministry of Petroleum, which administers the entire petrochemical sector. Another 53 percent is owned by foreign creditors (more than 100 foreign banks and foreign companies), 3 percent by banks, and 1 percent by the capital market. Most of the petrochemical industry's physical capital is imported, and the industry does not have strong backward linkages to manufacturing industries. In 2006 new petrochemical plants came online at Marun and Asaluyeh, and construction began on three others[5].

Related Works

Azizi[6] has identified the obstacles of transferring new technologies of the petroleum industry by petroleum projects under the article of "investigating the framework of managing technology transferring". He had also investigated the key issues such as identifying the purposes, strategies, selecting new key technologies such as selecting purposes and strategies, selecting appropriate new technologies and related challenges of transferring technologies under the framework of petroleum contracts and executing such contracts.

In the grand research design named " investigating challenges and obstacles of developing new technologies of the petroleum industry and proposing executional solutions" under the management of JafarTofighi[7], different aspects of the problem, challenges and solutions of transferring and developing new technologies have been investigated elaborately. The results of the research have been codified in the framework of such research design in 37 volumes by the presidential office of new technology collaborations.

Nowrouzi[8] had written an article named "Transferring technology in mutual trade contracts for the development of hydrocarbon fields of Iran. In this paper, he had analyzed the methods, purposes and strategies of transferring knowledge, technical skills in mutual trade contracts by investigating the

changes of mutual trade contracts, and has proposed solutions to optimize the process of technology transferring in the frameworks of such contracts.

Yuri[9] have investigated the importance of petroleum service companies in the development of new petroleum technologies and have emphasized on the broader communication of developing countries with petroleum technical service companies in transferring and developing new technologies.

Derakhshan[10] have proposed an article named "strategic considerations of policy making of upstream policies of the petroleum of the country." The rules of developing and transferring new technology have been identified in addition to the investigating desired features of the petroleum contracts. By investigating the performance of such contracts, it has been shown that foreign petroleum firms have not played an active role in transferring and developing new technology.

Hatami and Karimian[11] have proposed an article named "the rights of foreign investments under the shadow of law and investment contracts". In this paper, they have investigated the mutual trades and analyzed different aspects of the transferring and developing new technologies of such contracts. They have also mentioned the legal ambiguity and execution weakness of such mutual contracts.

Hoshdar[12] have proposed an article named "road mapping approach of new technologies" Different aspects of the essentiality, importance and methods of transferring new technologies of gas, petroleum projects have been investigated. He had used library method and interviewing method in his Ph.D. thesis to draw the road map of new technology of the petroleum industry.

In his paper, Derakhshan[13] transferring and developing technology of upstream sector of the Iranian petroleum industry: have proposed new consideration in concepts, challenges, solutions and requirements. In this paper, it is shown that relying upon foreign investments in the framework of petroleum contracts with international petroleum firms is not an appropriate solution for the transferring and developing the technology of the upstream sector of Iranian petroleum industry) the growth of operational science related to the petroleum industry of the country provide an appropriate circumstance for the attraction of technology and its development. The active attendance of regulatory institutions could have provided appropriate circumstance to exploit the attraction capacity effectively with the purpose of supervision, management and optimization of efficiency in the technology market. It is emphasized that precise recognition of the players of technology market and understanding the weakening of the international petroleum firms and reinforcing petroleum service firms in transferring and developing technology in the upstream sector is the first step to design optimized pattern for the policy making of petroleum technology of the country.

Despite the central priority of contractors in identifying the needs of the chain of petroleum operations in developing proper technologies and transferring them to the technology developers, it is emphasized in this paper that limitation of financial resources for the investment in transferring and developing technology and the weakness of optimum exploitation of attraction capacity requires regulatory institutions of the technology market to be more efficient and play a more effective role in the management of the market.

It is shown that such institutions can redirect the path of technology development and its transferring to a such direction to be aligned with the industrial developing of the country. It can be done by prioritizing the technologies which are compatible with the purposes of the upstream sectors and have an overflow effect on some key industries of the national economy.

Methodology and Materials

National traditions, special features of energy systems and national innovations and other external factors affect the predicting power of studies(including predicting energy technologies (ETF)). The salient feature of developed countries is that they are led toward determining economic gap, technological relation with developed economy and using prediction technology to use technology. We observe that some of them such as Korea and Brazil have advanced so rapidly while others are still banana republic(such as Venezuela).

Previous studies related to the technology predictions of energy economics cover a broad spectrum of various issues. The evolution of the prediction of new technologies in the energy economics of gas, petroleum and petrochemistry have not been considered under different case studies.

Thus, in this research we have investigated the prediction of new technologies in the energy economics of petroleum, gas and petrochemistry(Kermanshah, Shazand & Tabriz).

Industry of Petrochemistry

Industry of petrochemistry is one of the most basic and important industries of the worlds which is seen as the industry mother. Iran can play a prominent role in the world energy due to the great resources of gas and petroleum. It can have an effective role in developing the economy of country considering the upstream and downstream contact of this industry with other industries.

Shaz and Petrochemistry

Shaz and petrochemistry complex is one of the most designs of the country, which is exploited due to the general policies of petrochemical industries development and fulfilling domestic needs of the country and exportation. This complex is close to the Imam Khomeini petroleum refinery of located inside the shazand city in the 22th kilometer of the Arak-Boroujerd road having an area of 523 hectares.

Tabriz Petrochemistry

Tabriz petrochemistry is located in an area of 391 hectares and height of 1362 meters from the sea level on the west south of Tabriz city, and western neighborhood of Tabriz refinery. Performing the design (project) of Tabriz petrochemical complex has been agreed in the budget law of 1987 of Iran country. The outline of the design had been agreed by the management board of the national firm of Iran petrochemical industry of Iran. Designing and engineering activities have been launched by the second half of the 1368. Installations have begun by the 1992. The complex needs heavy and light petroleum and liquid gas which is satisfied by the Tabriz refinery.

"Vahed-ol-fin" has been launched as the mother unit in the December 1996. Polyethylene and polystyrene units came into production stage by 1998. Butadiene extraction units and ASB production was exploited in June 2003 which is seen as the first development design of the complex. Pentane unit was designed in 2004 and resistive 2 polystyrene unit was designed by the 2010 by the experts of the complex. SAN unit (the food of ABS unit) is under the detailed engineering.

Kermanshah Petrochemistry

The complex of Kermanshah petrochemical industry is located in an area of 195 hectares in the west of Iran, in Kermanshah province. The industrial sector of the complex is 62 hectares. 114 hectares of such lands are special for the green space. The Kermanshah petrochemical industry is the first private firm of ammonia and urea producer of Iran which is a public held company. Its stock is offered in the tableau of stock exchange of Iran with the symbol of Kermanshah.

Status of Technology in the Energy Economy

The status of new technologies in the energy economics is quite important. Today, many economic growth ideas are based upon the "new endogenous technologies". According to such ideas, new technologies are developed by the forces that are formed inside the national economy, which are sensitive to the price and costs.

Thus, there is a market for the new technologies which possess several suppliers and demands. "Technical consult institutes" are one of the major players of supplying which help the suppliant institutions of advanced new technologies to acquire new desired technologies. Purchasing "the license of exploiting "is an appropriate tool for the exchange of new technology market specially in countries in which the patent is more common for supporting the patent rights. Thus, an appropriate space is created for pricing the "technical science". Transferring and developing new technologies in the upstream sector of petroleum: problems and challenges.

The subject of this paper is predicting new technologies in energy economics of petroleum, gas and petrochemistry. Thus, our investigation is limited to the fields of discovering, developing and production out of petroleum fields. Effective factors of fulfilling are listed as follows:

1. Recognizing the players of the market of new technology in the upstream sector and paying attention to the changing of the status of international petroleum firms of this market is quite important for the developing countries.

Recognizing changing of the status and the role of international firms in transferring and developing new technologies is quite important as well.

By the beginning of the decade 1980, in which great changes happened during the world market of the petroleum, and the competition increased significantly, great petroleum firms reduced their investment on the research and development of new petroleum technologies.

They replaced the strategy of "purchasing" new advanced technologies to the strategy of making such technologies.

Developing new technologies of petroleum industry is done by recognizing technical needs and trying to answer them in the collaboration space of contractors, manufacturing firms, engineering firms and international petroleum firms.

Petroleum contractors are aware of the technical problems and the essentiality of developing new appropriate technologies to fix such problems.

They transfer such needs to the manufacturer of facilities by related institutions. Manufacturing firms of facilities satisfy the needs of contractors by developing technology units or by collaboration with knowledge-based firms who develop new technologies.

Transferring technical science and accessing advanced technology is easily feasible by collaboration with international petroleum firms under the framework of petroleum contracts.

Two facts have been ignored: 1- The efficiency of collaboration with foreign firms in transferring technical science requires domestic capacity of technology attraction.

2. Essentiality of the compatibility of transferring pattern and technology development with optimum policies of exploiting petroleum reservoir.

Transferring and developing technology in the upstream sector is not a purpose by itself, but a tool to achieve optimum policies of exploiting petroleum reservoirs.

Considering the features of the reservoirs of the country such as the properties of the reservoir stone and the fluid, great volume of the petroleum, the great volume of production stored in the reservoirs, executing plans of increasing the coefficient of recovering of petroleum reservoirs is in priority.

3. Being aware of the fundamental sciences and existence of sufficient capacity to be improved in the upstream sector.

Sufficient recognition of the existing technology in the upstream sector of petroleum and being aware of the fundamental sciences which is the infrastructure of such technologies makes managers to identify the needs of technologies and plan for its transferring. It can be done by considering the conditions.

Domestic manufacturing of the facilities of petroleum industry: solutions for developing technologies and transferring

Domestic manufacturing of the desired facilities is one of the solutions to transfer technology in the petroleum industry and motivating the ministry of petroleum to reduce their foreign purchase and substituting domestic productions with foreign importations. Two considerations are as follows:

1. Domestic production of facilities that require advanced (middle) technology requires heavy investment. Thus private investors must be assured of the selling of non-produced products.

2. Considering high risk of petroleum operations and the heavy responsibility of petroleum ministry, this ministry must use facilities that are globally valid and standard. Thus, domestic purchase

can be done if and only if their products have high enough quality.

Conclusion

It can be concluded that considering the current state of the upstream sector of the petroleum industry, especially potential capacity of petroleum and changing of the petroleum world market under the shadow of world market of energy and the status of Iran, the future purposes of the petroleum industry can be predicted to plan the exploitation of the existing capacity of attracting operational/ fundamental sciences.

This is not feasible without access to the current state, active attendance in regulatory institutions and the improvement of efficiency of market. Cooperation with foreign companies for transferring and developing technology is effective if only the above mechanisms are satisfied whether they are under the petroleum contracts of discovery, drilling, developing, production or manufacturing contracts. Discovering, developing and production of petroleum fields is the most effective solution of transferring technology. It can't be ignored that petroleum contracts can be designed such that to provide a proper space of cooperation with international petroleum firms for transferring and developing technology.

Existence of technical capacity to attract operational science in the upstream sector and existence of proper mechanism for their improvement is the necessary condition of transferring and developing technology under the framework of petroleum contracts.

Subjects such as "Inspecting operational fields and all technical bills of foreign firms before or during the contract", "protecting petroleum resources and using technical methods in exploiting reservoirs", "Nurturing human forces and improving technical skills" is effective if and only if the necessary technical-scientific capacities for the attraction of operational science is created in the upstream sector of the petroleum industry.

Feasibility of such technical-scientific capacity is nothing but an illusion, which is shown in this article in analyzing historical failure of petroleum contracts in transferring and developing technology of the country.

Transferring and developing technology in the upstream sector is not a purpose by itself, but a tool to achieve optimum policies of exploiting petroleum reservoirs. Thus, the policies of upstream sector must be compatible with optimum policies of exploiting petroleum reservoirs of the country. Developing and transferring technology requires heavy investment. Thus, investigating cost-outcome is quite important. The priorities must be identified to design a proper transferring pattern.

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