

Petroleum Industry Diversification in the Middle East and Its Policy Implications for Korea in the Era of Energy Transition

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I. Introduction

The GCC oil exporters including Saudi Arabia and the UAE are under strong pressure to prepare for decreasing global oil demand in the era of energy transition and carbon neutrality. To overcome these challenges, they need to diversify their industrial structure and develop low carbon technologies such as green hydrogen and CCUS (Carbon Capture, Utilization and Storage). This research is aimed to examine various mid-to-long term plans, industrial policies, and business cooperation cases to promote diversification in the Middle Eastern petroleum industry, suggesting policy proposals for cooperation between Korea and the Middle East and business opportunities in the region.

II. Global Trend of the Petroleum Industry Diversification

Over the past few years, the global oil industry has become insecure and unpredictable due to the oil price fluctuations. This has been complicated by emerging needs for energy transition in response to climate change. Especially, the volatility of oil prices has been expanded by the underlying oil demand and supply shocks. On the demand side, global oil consumption has decreased due to the slowdown in emerging market economies such as China and India, and the recent outbreak of COVID-19.

Meanwhile, the supply side of the oil market has been hard hit by the drastic decline in shale oil production in the United States since May 2020. Moreover, the balance between oil sup-

ply and demand has been exacerbated by the disagreement among OPEC over the oil production limits. Furthermore, as more international efforts are made to reduce carbon emissions, more emphasis is being placed on finding ways to ensure sustainable and viable growth in the oil industry.

In the face of these recent global trends, the global oil industry has been experiencing various diversification policies. The trend in diversification shows increasing investment in the petrochemical sector and natural gas production, developing hydrogen and carbon reduction technology, and adopting digital technology into the operations.

In the petrochemical sector, the United States is focusing on ethylene production using ethane derived from shale gas. China is continuing its efforts to expand facilities and diversify feedstocks to improve its production capacity. In the area of hydrogen and carbon reduction, European countries such as Norway and Germany, along with the United States, China, and Russia, are increasing investments in hydrogen utilization and green hydrogen technology development. In addition, in an effort to keep the system operating effectively, digital oil field technology has been introduced in the fields of exploration and development, transportation, and storage by multinational oil companies in the United States and Norway.

III. Strategies and Competitiveness of Petroleum Industry Diversification in the Middle East

Saudi Arabia and the UAE are engaged in various mid- to long-term plans and strategies aimed at reorganizing the structure of the oil industry, recognizing it as a key industry that is overly biased toward the upstream sector. First of all, the two countries are investing in the petrochemical sector, which is expected to increase in demand even in the era of carbon neutrality. Saudi Arabia is expanding its production capacity of basic and intermediate chemicals through various investments, including the establishment of joint ventures with foreign companies. The UAE has a relatively low production capacity for feedstock and basic chemicals, but has the advantage of diverse products such as plastics and fertilizers.

Saudi Arabia and the UAE are also expanding their blue and green hydrogen production capabilities in line with the global demand for green energy. In particular, the Saudi government intends to move early into the hydrogen market by pushing for blue hydrogen exports through Aramco while also advancing the possible production time of green hydrogen. The UAE is still focusing on expanding the production of blue hydrogen, but it has the advantage of having high price competitiveness in green hydrogen and the capacity to produce pink hydrogen using nuclear power. In addition, Saudi Arabia and the UAE are actively

promoting the introduction and utilization of digital services or solutions for the digital transformation of the oil industry. However, due to the lack of overall technology to diver-

sify the oil industry in both countries, cooperation with foreign companies is necessary to secure competitiveness and develop technologies.

Table 1. Petroleum Industry Diversification Strategies of Saudi Arabia and the UAE

		Saudi Arabia	UAE
Similarities		<ul style="list-style-type: none"> • Expansion of natural gas production • Increase in petrochemical production capacity & advancement of the industry • Promotion of blue hydrogen production, development of green hydrogen linked to investment in renewable energy, and construction of green hydrogen production facilities in future cities (Neom City, Masdar) • Digital transformation in connection with the 4th industrial revolution including digital oil fields 	
Characteristics and competitiveness of Saudi Arabia & UAE	Petro-chemicals	<ul style="list-style-type: none"> • Relatively large petrochemical production capacity & price competitiveness compared to UAE • Limited products line centered on basic and intermediate chemicals • Various joint venture experiences with foreign companies 	<ul style="list-style-type: none"> • Low production capacity • Various petrochemical products such as fertilizers • Borouge, a joint venture with Borrealis, an Austrian firm, leads the petrochemical industry.
	Hydrogen & CCUS	<ul style="list-style-type: none"> • Blue hydrogen export experience, price competitiveness in green hydrogen • Low technology compared to high marketability related to carbon capture 	<ul style="list-style-type: none"> • Based on high price competitiveness, focusing on expanding the production of blue hydrogen (currently 300,000 tons → 500,000 tons) • Production of pink hydrogen through nuclear power plants is possible.
	Digital transformation	<ul style="list-style-type: none"> • Introduction and utilization of digital services or solutions in the oil sector of foreign companies 	<ul style="list-style-type: none"> • Fostering domestic companies and industries related to digital technology
Implications		<ul style="list-style-type: none"> • Regarding the expansion of basic and intermediate chemical products in the UAE and Saudi Arabia, it is necessary to expand the production of high value-added products for Korean petrochemical companies. • The introduction of hydrogen made in the Middle East is necessary considering its price competitiveness. • In terms of carbon reduction and digital transformation era, it is necessary to establish a Korea-Middle East joint venture company or a joint research platform. 	

IV. International Cooperation

Cases for Petroleum Industry Diversification in the Middle East

Saudi Arabia and the UAE are increasing petrochemical or oil refining projects jointly promoted by establishing joint ventures in major overseas export base countries to stably export oil and create added value. Saudi Arabia has acquired stakes in major overseas oil refiners and petrochemical companies or expanded joint investments to secure a stable market for its own crude oil, and has also pushed for equity investments and joint ventures in Korean companies. The UAE is promoting entry into promising overseas markets in the petrochemical sector, while focusing on attracting foreign companies into its domestic market.

In addition, both Saudi Arabia and the UAE are actively developing hydrogen based on abundant natural gas and renewable energy. The two countries are promoting cooperation with a focus on exporting hydrogen, based on the price competitiveness of hydrogen produced in their own countries. As major crude oil importers of the two countries, Korea and Japan have been important partners of this cooperation.

In the introduction of digital technology, cooperation with US and European companies has been remarkable. Saudi Arabia and the UAE are found to be mainly utilizing solutions for production optimization, integrated supply

chain management, asset monitoring and predictive analysis, and safety and efficiency improvement through US and European companies. The two countries plan to foster their own industries and increase job creation by establishing local joint venture companies with global companies and expanding joint R&D.

V. Concluding Remarks

Although Korea and Middle Eastern oil exporters have different industrial environments in the sector, they pursue the same policy goal to attain carbon neutrality. This is the common foundation on which both regions could establish a new energy security cooperation regime. We need to consider collaboration projects as follows. First, stable supply and demand of low carbon energy resources such as hydrogen should be established between Korea and Middle Eastern oil exporters for carbon neutrality and hydrogen economy. For this, both regions need to establish long-term supply contracts on the condition that Korean companies construct the hydrogen production facilities involved. Establishing a Korea-Middle East carbon neutrality fund would ease the financial burden for construction projects.

Second, new energy businesses responding to the electrification of energy should be promoted to enhance energy efficiency in national power systems. Consulting projects to establish master plans for efficient power infrastructure and demonstration projects to evaluate consulting results should be conducted, as

infrastructure remodeling consumes large amounts of financial resources. Moreover,

these projects will require government-to-government cooperation based on mid-to-long term mutual interests.

Table 2. International Cooperation of Saudi Arabia and the UAE in the Petroleum Industry

		Saudi Arabia	UAE
Similarities		<ul style="list-style-type: none"> Expanding external cooperation across industries, including oil field exploration, production, refining and sales, with the aim of increasing influence in the global oil market In relation to hydrogen development, cooperation with European and Asian countries is actively promoted, especially Korea and Japan, which are major crude oil importers of both countries. Active cooperation with US and European companies in the introduction of digital technology 	
Characteristics of Saudi Arabia & UAE	Petro-chemicals	<ul style="list-style-type: none"> Active promotion of expansion to Asia In terms of securing a stable market for domestic crude oil, acquiring stakes of major overseas oil refineries and petrochemical companies and expanding joint ventures 	<ul style="list-style-type: none"> Focusing on establishing an ecosystem for the petrochemical industry and using it as a base for investment and corporate attraction
	Hydrogen & CCUS	<ul style="list-style-type: none"> Expand cooperation focusing on projects to build hydrogen production facilities and supply chains by utilizing the technology of US and European companies 	<ul style="list-style-type: none"> Promote CCUS-related cooperation with global energy companies such as ENI and TOTAL
	Digital transformation	<ul style="list-style-type: none"> Promote cooperation with China regarding the utilization of 5G technology in the oil industry 	<ul style="list-style-type: none"> Emphasizing AI technology and seeking cooperation between domestic and foreign companies
Implications		<ul style="list-style-type: none"> It is possible to consider ways to secure an overseas hydrogen supply chain by promoting the establishment of a hydrogen economy and utilizing the current energy network. Based on overseas oil exploration experience, cooperation such as joint research and development and commercialization of CCUS and hydrogen technologies can be promoted. In the digital technology sector, it is necessary to explore areas that can enter based on customized technologies rather than providing integrated solutions. 	

Third, technology collaboration between the two regions should be advanced to attain carbon neutrality. More technological breakthroughs in the sectors of hydrogen production and carbon reduction need to be obtained for future cooperation. Joint study agreements for technology development and a joint research platform should be established for active interaction and mutually beneficial assistance between the two regions. This could be developed into a joint venture for production and sales. **KIEP**