INTERNATIONAL EXPERIENCE IN PRODUCING SYNTHETIC LIQUID FUELS USING GTL TECHNOLOGY AND PROSPECTS OF ITS DEVELOPMENT

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Annotation: The article shows the main events in the production of synthetic liquid fuels, the scale and dynamics of its development. A comparative analysis of the conversion of gas into liquid fuels with other methods of gas monetization, such as the production of liquefied natural gas, and with technologies for converting coal and biomass into liquid fuels was carried out, which made it possible to draw some conclusions and recommendations about the significance, prospects and necessity of using such technologies in Russia

Keywords: Efficient use of energy resources, gas monetization, synthetic liquid fuels

Modern trends in the world economy are such that oil prices, albeit with slight fluctuations, are constantly growing. In addition, the accumulation of oil reserves occurs at the expense of fields with more complex geological and economic conditions. Most of the oil importing countries are tied to supplies from the OPEC member countries, some of which are far from stable. The aforementioned prerequisites contribute to an increase in the costs of oil production and transportation and generate significant risks; at the same time, according to the forecast of the International Energy Agency, the volume of world oil consumption will increase. It should be noted that in many countries of the world requirements for the quality of fuels have sharply increased in terms of their environmental safety. Under these conditions, Russian energy companies should pay attention to the possibilities of producing synthetic liquid fuels (SLF). There are many technologies for converting gas (gas-to-liquids, GTL), coal (coal-to-liquids, CTL), or biomass (biomass-to-liquids, BTL) into liquids. The accumulated experience of using such technologies in other countries, and especially the dynamics of commissioning new capacities, allows us to draw certain conclusions and forecasts of the potential for their application, both in the world and in Russia.

Within the framework of this work, the author would like to highlight the main events in the field of production of liquid lubricants, to show the scale and dynamics of its development. Also, to carry out a comparative analysis of the conversion of gas to liquid fuels with other methods of gas monetization, such as the production of liquefied natural gas (LNG), and with technologies for converting coal and biomass into liquid fuels, which will make it possible to draw some conclusions and recommendations about the significance, prospects and need for application. such technologies in Russia.

It should be noted the existing complexity with the calculations, the reason for which lies in the difference in interpretations of the concept of GTL and, accordingly, the difference in statistical data. In the Russian literature, along with SLF, there are numerous concepts:

alternative fuels or artificial liquid fuels, which are based on complex mixtures of hydrocarbons obtained from raw materials of non-oil origin. In addition to the above-mentioned GTL, CTL and BTL technologies, tar sands of Venezuela and Canada and oil shale are also used for the production of GTL. For the period from 2000 to 2007. the share of non-conventional fuels production tripled to 5% of total global fuel production, equivalent to 182.5 million tonnes per year[1]. Since 2007, significant capacities have been commissioned, which are several times larger than the already existing factories. One of the clearest examples is Shell's GTL GTL plant in Qatar, Pearl. The total production capacity of the plant is 240,000 barrels per day, 140,000 of which are from GTL. The plant began operations in June 2011 and plans to reach full capacity by mid-2012. The capacity of previously built plants in South Africa, Malaysia and Qatar ranges from 14,000 to 36,000 barrels per day. It can be assumed that with the accumulation of experience in the implementation of large industrial projects, the rate of capacity expansion will only become higher. According to experts, in the period from 2010 to 2020. GTL market will double.

The main GTL products are:

- Synthetic oil (has a very low sulfur content and a favorable ratio of hydrocarbon components, outperforms the main brands of oil: Arabian, Brent, WTI).
- Base oils (intermediate product for the production of lubricants for engines; Shell is the world monopoly manufacturer of GTL technology).
- Paraffins and ceresins (used for the production of synthetic detergents, and they can replace similar paraffins produced at refineries from scarce kerosene fractions of oil refining).
- Gas oil (used to produce high quality diesel fuel that is practically free of sulfur and has a low content of aromatic hydrocarbons).

The determining factor in the profitability of the use of GTL, CTL and BTL technologies is the price of oil. So for GTL production, the difference in prices for oil and natural gas is important. After significant volumes of natural gas production from shale rocks in the United States and a general reduction in gas consumption due to the financial and economic crisis of 2008-2009. and the resulting surplus of LNG gas prices have dropped significantly. The use of GTL technologies provides a unique opportunity for energy companies with gas resources to diversify their revenues by entering the oil products and liquid fuel markets. Shell, having spent about $ 19 billion on the construction of the Pearl GTL plant, plans to receive about $ 90 billion in profit from the project. According to the company's calculations, even before the start of production at an oil price of $ 70 per barrel, the project's profit will be $ 6 billion per year[4]. Considering that since the commissioning of the refinery from June 2011 to the present, prices for WTI crude oil have fluctuated between $ 80 and $ 105 per barrel, it can be assumed that the profit will be significantly higher. It is believed that GTL technologies are economically viable if the oil and gas spread is more than three. It turns out that in addition to the beneficial effect on the environment and energy security, the use of GTL technologies is also a profitable business.

With the rise in oil prices, interest in the products of GTL technologies is only increasing. Shell is actively marketing its products, supplying the diesel cut from the Malaysian plant as an enhancement additive to traditional diesel fuels. This diesel fuel is already sold in South Africa, Thailand, Greece, Germany and other countries under the name V-power diesel and contains 5% GTL diesel. As the reserves of conventional oil are depleted, the market will begin to change more dynamically: subject to high world oil prices and relatively low prices for natural gas, the production of synthetic fuel will only grow.

The cost of a barrel of final production is different for each GTL plant. In 2008, when oil prices hit records of $ 147 a barrel, Sasol officials talked about the price of a barrel of GTL production at $ 88. StatoilHydro, speaking at a conference in 2009, referred to a US $ 92 barrel of GTL product versus a US $ 73 barrel of refined product, based on a crude oil price estimate of US $ 55. But, do not forget that GTL products are highly efficient and more environmentally friendly than refined products. In addition to the cost of raw materials, the scale and possibilities of reducing costs depending on the volume of products are of great importance. With the current level of technology development already on an industrial scale comparable to Pearl GTL, some people write about the cost of a barrel of GTL production at 35 USD per barrel (CTL - 50-60 USD, and BTL - 85 USD per barrel) [5]. The location of production and the presence or absence of transport and other infrastructure also have a significant impact. Not the least role is played by the conditions provided by the state in which the project is being implemented, namely: the presence of an investment agreement, tax regime, possible exemption from customs duties on the import of equipment and much more. If we compare capital expenditures with each other and take the GTL technology costs per unit, then for CTL the coefficient will be 1.5 and higher, and for BTL it will be more than 2[6].

The volatility of natural gas prices increases the risks of trading gas at a pre-fixed price. Manufacturing products using GTL technology allows gas companies to enter a more global and liquid market, in which, due to the large number of sales and purchases, the agent can be flexible, thereby reducing his risks. GTL products can be sold under short-term contracts, which reduces the relationship between buyer and seller and meets the modern conditions of gas market development and the requirements of European partners. The liberalization of gas markets (for Russia this is especially important in the context of difficulties in the process of trade negotiations with the European Union countries) makes the conclusion of long-term contracts an increasingly difficult goal.

GTL technology can be used for the utilization of associated petroleum gas (APG), significant amounts of which are flared, as well as for the utilization of low-pressure gas and natural gas from small fields, which will contribute to the socio-economic development of the regions of Siberia and the Far East. An increase in the share of added value of products, the possibility of diversifying exports, the prospect of conquering new market segments and an increase in budget revenues will only have a positive effect on the country's economy.

If the GTL direction of gas processing in Russia is not developed, the following consequences are inevitable: damage to the ecology of the regions, lost socio-economic benefits (jobs, tax deductions), loss of valuable energy raw materials (APG flaring), increasing technological backwardness of the industry and excluding the possibility of forming a new drivers of growth of the national economy.

In addition to Gazprom, which undoubtedly has the greatest financial and technological capabilities for the development or application of technologies already patented by GTL, it is expected that Russian independent gas companies operating small fields remote from gas pipelines, or experiencing difficulties with gas supplies to Gazprom's main pipelines.

In addition to the considered effects of the use of GTL technologies on the socio-economic and environmental spheres of human life, it should be assumed that a positive impact will be exerted on politics and international relations. Throughout the twentieth century, oil was of particular importance, showing itself not only as an energy raw material in the process of economic development, but also in the political arena. The uneven distribution of such an important resource has become the cause of political and military conflicts. The creation of

OPEC, the Gulf War and the invasion of Iraq had consequences that went beyond the borders of the countries participating in these events. With the widespread use of GTL technologies and production of GTL, one can expect a reduction in political tensions associated with the possession of oil resources, due to a decrease in the level of dependence of countries on imports and diversification of energy sources.

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