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## Analysis of the state of the fuel market of the Russian Federation and its development prospec

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**Abstract.** The article presents an analysis of the state of the Russian fuel market, discusses the quality of fuels and their impact on the environmental situation in large cities, as well as the prospects for the development of the fuel market. The constraints and competitive advantages of transport to gas engine fuel are described. It has been established that the development of the market requires not only the creation of a developed infrastructure and the improvement of gas utilization technologies, but there is also a need to improve legislation in the fuel industry in order to create effective mechanisms for its state regulation.

According to the Russian Federal Statistics Service (Rosstat), in 2017, the production of light petroleum products increased by about 3.5% compared to 2015 and amounted to about 180 million tons. The dynamics of reducing fuel consumption compared to 2015-2016 stabilized and remains in the range of 85 million tons. Fuel exports grew by about 15% and amounted to about 95 million tons. The reduction in domestic fuel consumption is primarily due to the economic situation, people bought fewer new cars and, in principle, drove less due to lower real incomes. In 2017, this situation stabilized and changed for the better.

According to the analytical agency "AUTOSTAT", automobile transport in Russia consumes about 64 million tons of fuel. More than 70% of fuel is consumed by motor transport in the European part of Russia. About 6% of consumption falls to the Far East, and Siberia occupies 13% of the market. Approximately 47% of the fuel used by passenger cars, 39% by freight transport, 15% by light commercial traffic, and about 5% by bus [1].

Gasoline accounts for 60% of the total amount of fuel consumed.

Today, there are 32 large refineries and about 230 mini-refineries in the Russian Federation. The depth of oil refining is about 75%, the modernization of production continues with an increase in secondary refining processes and an increase in refining depth of up to 85%. All this is quite costly and difficult, since the imprint of the previously existing production strategy was aimed at the primary refining processes, where the main product of refining was fuel oil. In addition, a significant depreciation of fixed assets of production, as a result, the incomplete loading of production volumes affects the quality of the produced fuels.

Refinery reconstruction will be completed by 2020 and it will affect only large refineries. Significantly large problems are associated with the quality of products produced by small refineries.



The low quality of fuels is not only a problem of the plants themselves, but a sign of the imperfection of the oil products market in Russia.

The International Fuel Quality Center carried out an inspection and compiled a list of countries with the highest quality gasoline and diesel fuel.

According to experts, the best diesel fuel was in Sweden, Germany was in second place, and Japan was third.

Following the top three, there is a comfortable group of countries where the quality of fuel is at an enviably high level: Finland, Denmark, Hungary, Luxembourg, the Netherlands, Australia, Austria, Belgium, etc.

It is worth mentioning that the International Fuel Quality Center does not attempt to assess the quality of the fuel in the complex, out of its sight are a wide variety of counterfeit fuel options, etc. The criterion for evaluating the quality of gasoline and diesel fuel for experts of the International Fuel Quality Center is one of the positions characterizes the chemical stability of the fuel and its sulfur content. For example, according to the Euro-5 standard, the sulfur content in gasoline should not exceed 10 ppm, Euro-4 - 30 ppm. In the world of gasoline, such parameters are valid only in the European Union, Japan, South Korea, as well as Chile.

Russia is in the third of four groups of countries in which the level of sulfur content in diesel fuel is 300-500 ppm. This group includes China, Indonesia, South Africa, India, Mexico.

The quality of diesel fuel produced in Russia is estimated at 44 places in this rating, and gasoline at 84. The slide shows data indicating the total average value (54th place).

The authors of the ratings of the International Center for Fuel Quality take into account local legislation on sulfur content in gasoline and diesel fuel, as well as some other features.

The quality of fuel at the gas station excites every driver, because the engine resource and the amount of harmful emissions into the atmosphere depend on it. In addition, poor-quality gasoline affects the dynamics of the car, fuel consumption increases, there may be difficulties when starting the engine.

In 2015, in a straight line, the President of Russia was informed that there are many complaints about the quality of motor fuel, both gasoline and diesel. After that, the President of the Russian Federation ordered the Prosecutor General's Office and Rosstandart to check the quality of the fuel at the gas stations. After the checks, it turned out that about 34% of the taken fuel turned out to be disturbed (most often this excess of the mass fraction of sulfur, at some gas stations exceeded the norm by 30 times). Moreover, the quality of fuel at refineries does not cause complaints, most often they cheat at a gas station! Now rarely underfill gasoline at gas stations, where it is safer and more profitable to sell bad gasoline, increasing its octane number with the help of low-quality additives that can be easily purchased in Russia.

In 2017, the rate of substandard fuels at Russian gas stations is 18%. What is the reason for this phenomenon? Of the more than 25,000 petrol stations registered in the Russian Federation, 45% belong to the VIOC, the remaining 55% belong to independent owners. The petrol stations of the VINK are supplied first of all at the selling prices of the refineries, which are lower than the exchange prices, while the rest of the filling stations are forced to be content with what remains at market prices. Hence the connection of suppliers of low-quality fuels and the network of gas stations that implement it.

According to experts, the annual turnover of counterfeit fuel in the country can reach 10 million tons. According to the analytical agency Avtostat, for 72% of motorists, the brand refueling matters. Judging by polls in 2015, the most popular brand of gas stations is Lukoil, Rosneft is in second place, and Gazpromneft closes the top three. In other words, this rating shows which gas stations have the highest quality gasoline, otherwise these brands would not choose.

The quality of gasoline at gas stations can be determined using laboratory studies, but most often choose the gas station on the reviews.

Automobile exhaust gases are the main source of air pollution in the developed countries of the West. In Russia, the greatest amount of harmful emissions is due to heat and power engineering (thermal power plants and boilers). The second place in terms of the emission of harmful substances into the atmosphere of the Russian Federation is occupied by enterprises of ferrous and nonferrous metallurgy. Motor

transport is struggling with objects of the chemical and pulp and paper industry only for third place in the list of key sources of air pollution in Russia. However, our million-plus cities stand out from the general ecological picture of the country. In them, the situation is the same as in western megacities: the share of pollution by motor transport is 70-80% of the total amount of emissions of harmful substances into the atmosphere. The greatest damage to car exhaust is caused by the ecology of Moscow, St. Petersburg, Samara, Nazran, Nalchik, Elista, Krasnodar, Rostov-on-Don, Stavropol, Sochi, Voronezh and Kaluga. I do not name Krasnoyarsk in this list, as there is no accurate assessment of the effect of exhaust gases on the overall pollution picture, but I think that it is significant.

It would seem that there is nothing terrible in that the pollution by exhaust gases in Russian metropolitan areas covers the emissions of all industrial enterprises, since there is a similar story in the West. But in fact, in European, American and Japanese cities there are 2-3 times more cars, and the ecology is in most of them better than ours. Hence the conclusion: car emissions in megacities of the Russian Federation are several times more toxic than foreign ones.

One of the main causes of excessive pollution by the exhaust gases of our megacities is the extremely low quality of automotive fuel

The second reason for the intense poisoning of the air of large Russian cities with exhaust gases with a high concentration of pollutants is old cars. Emissions of such cars are several times more toxic than modern cars equipped with exhaust gas neutralizers.

The third reason for the excessive pollution of the atmosphere of our megacities by automobile emissions lies in one of the main ills of Russia - roads. Due to the fact that they are too narrow, and even with many intersections and traffic lights, cars often have to stop, stand in traffic jams for hours. At every traffic light and in places where traffic jams occur, the amount of car emissions is too high, since during idle and speed settings, the maximum volumes of exhaust gases are emitted.

As a rule, the central, most densely populated metropolitan areas are the most polluted by motor transport. As a result, the health of hundreds of thousands of residents of each large city in Russia suffers from automobile pollution. Exhaust gases are the most dangerous for young children, since the height of automobile emissions does not reach even 1 m.

Russian cities today are not able to withstand 300 cars per 1000 inhabitants.

However, with strict observance of instructions to reduce the amount of harmful automotive emissions from our cities, there will be a chance to catch up with the exemplary Japanese cities.

To reduce the amount of harmful automobile emissions into the atmosphere, a whole range of methods is used [2, 3]:

1. Continuous improvement of engine models and reduction of car bodies in order to minimize their fuel consumption.

2. The use of environmentally friendly fuels.

3. Supply of exhaust pipes of automobiles with neutralizers. In developed countries, cars are forbidden to appear on the roads without these "filters" for cleaning exhaust gases.

4. The introduction of automated traffic control systems in order to reduce the time of operation of automotive engines in idle mode and set speed.

5. Creating a zone of greenery along the roads. This measure allows one to half reduce the harmful effects of automotive emissions on the environment. One tree per year absorbs the volume of exhaust gases emitted by the average machine for 25,000 kilometers.

6. Transfer of vehicles to GMT.

Increasing the level of motorization also contributes to an increase in the negative impact of transport on the environment; the environmental problem is becoming more and more widespread. Only the domestic fleet emitted more than 14 million tons of harmful substances, which account for 40% of the total emissions to the atmosphere, in megacities, they reach 90%. That is why the question of the use of alternative fuel is becoming increasingly important. To date, there is a huge variety of alternatives to oil as an energy source; however, in my opinion, gas-engine fuel is the most promising.

Natural gas is a worthy alternative to oil in the fuel industry. As a motor fuel, gas is used in several types - in the form of liquefied hydrocarbon gas (LHG), liquefied natural gas (LNG) and compressed natural gas (CNG), which is the cheapest of all types of motor fuel [4].

According to the Energy Strategy of Russia, and also according to experts in the field of the gas industry, the development of the gas engine fuel market is one of the strategic objectives in the field of fuel energy. Gas engine fuel is high quality, with improved environmental performance that meets international standards.

The specialists of PJSC Gazprom and VNIIGaz conducted a study, as a result of which it was found that the use of liquefied natural gas is much more profitable than compressed natural gas. Thus, there is a decrease in specific capital investments for production in the amount of 25-30%, the cost of fuel production is reduced by 40%, the total costs for production, delivery and distribution are reduced by 10-30%.

In recent years, the development of the liquefied natural gas market has been more active, the demand for this type of fuel is constantly increasing, which leads to the construction of new plants for its production.

The advantage of using gas engine fuel is the low level of harmful emissions into the atmosphere and the relatively low cost of producing motor fuel.

The current Euro 5 standard limits carbon dioxide emissions to 0.8 grams per kilogram; however, when using compressed natural gas and liquefied natural gas, these emissions are only 0.1 grams, nitrogen oxide emissions are reduced in comparison with gasoline 2 times, hydrocarbon emissions are 1.9 times less. Greenhouse gas emissions from using gas engine fuel are also reduced by a quarter. Today, compressed natural gas and liquefied natural gas are the most environmentally friendly fuels. It is worth noting that the compression of associated petroleum gas in oil fields and its beneficial use also leads to an improvement in the environmental situation by reducing the volume of gas flared on flares.

Reducing the cost of fuel when using gas is possible due to lower gas prices in comparison with refined petroleum products. The average cost of gas in Russia is 50% lower than the cost of gasoline AI-92, while the energy efficiency is almost the same. The transition to the use of gas engine fuel is beneficial not only for private car owners, but also for legal entities, due to its cost-effectiveness, which in turn leads to a significant reduction in the costs of its own, corporate or public funds.

According to the Gazprom Gazenergoset Group of Companies, the average retail price for liquefied petroleum gas, for example, at gas stations varies between 14-19 rubles.

Gas engine fuel is widely used in public transport in localities and intercity traffic, which is why the use of gas engine fuel is interesting not only for commercial enterprises, but also for state ones [5, 6].

Gas fuel consumption in Russia is steadily growing. Today, the network of automobile gas filling compressor stations (AGNKS) in Russia consists of more than 270 stations. The volume of sales of compressed natural gas to Gazprom in 2017 compared to the previous year increased by 8% and amounted to more than 450 million cubic meters. A large-scale program for the construction of new CNG filling stations is being implemented. As a result, an increase in gas consumption by 11% is expected, up to 480 million cubic meters [7]. The state supports manufacturers of vehicles operating on GMT [8].

To date, liquefied natural gas is most in demand in the main freight, railway transport and agriculture (for heavy agricultural equipment). With the gradual development of the market, consumption by 2020 could reach 10.4 billion cubic meters.  $\text{m}^3$ . The state supports the manufacturers of vehicles operating on GMT.

The ratio of transport operating on CNG to other types of transport in 2020 can reach:

- public transport and equipment for housing and public utilities - 50%; commercial transport, freight transport for intracity traffic - 30%;
- personal transport - 10%;
- agricultural machinery - 20%.

However, the steady growth in gas consumption still does not allow it to compete with other types of motor fuels. Thus, the level of consumption of CNG in Russia is only 0.5% of all types of fuels, gas as a whole - 2.2%, and the loading of CNG filling stations is on average only 25%.

This is facilitated by a number of reasons:

1. The high cost of conversion. The deterioration of some of the technical characteristics of the car. And here is the answer immediately. We solve this question. It is necessary not to adapt the existing ICE to HMT, but to create engines whose main fuel will be gas. Not to retool the existing motor transport for GMT, but I have already cited creating a new one and examples of this.

2. Lack of a developed network of gas filling stations for gas filling stations (AGNKS). In my opinion, with regard to the city of Krasnoyarsk and the Krasnoyarsk Territory, here we need a willful decision to build them. Sooner or later, the "big" gas will come to the edge. It is impossible, as the people say, "to be their tail." There will be a refueling network of gas stations, gas stations - there will be a consumer. It is profitable, economical and environmentally friendly.

3. The low level of development of technology and technology for the use of natural gas as a motor fuel. At all times, technology and technology moved forward when production and science were closely connected. And this is the main point. Setting tasks for the scientific community, their solution and introduction into production gives rise to a high-tech product. The state is waiting for this, and we must solve these issues and tasks.

Thus, environmental problems in the production and consumption of fuel, as well as the limited proven reserves of oil, dictate the need for the development of alternative fuels, in particular gas-engine fuel, the use of which has great prospects today. At the same time, despite a number of advantages of using gas as fuel, the development of the market requires not only the creation of a developed infrastructure and the improvement of gas utilization technologies, which requires significant investments, but there is also a need to improve legislation in the fuel industry to create effective government regulation. In his speech in Vladivostok at the Eastern Economic Forum 2017, President of the Russian Federation V.V. Putin paid special attention to the expansion of the SMT as the most promising, cost-effective and environmentally friendly type of fuel. However, the main factors hindering the development of the gas motor fuel market today are: high investment cost of projects, dependence of project implementation on the state, limited offers to provide specialized equipment.

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