

# Actual Problems of the Gas Industry at the Current Stage

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**Abstract.** Today, the Russian Federation has a leading position in the world in terms of gas reserves and gas production, is one of the largest suppliers to the world market of energy resources. The authors analyzed the domestic gas industry as a component of the global energy market. Recently there has been increased competition due to the commercial development of new types of energy in the global energy market, which results in the structure change and reduction in exports for the domestic gas industry. However, the share of Russian reserves of hydrocarbons, which are located in remote areas with poor infrastructure, away from the end user, as well as low-rate reserves, increases every year. The solution to these problems is to increase energy efficiency and the production of marketable products, their processing with high added value.

**Keywords:** oil and gas complex, natural gas, liquefied natural gas, synthetic liquid fuel, methanol.

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Russian gas industry is one of the key sectors, on which the proper functioning of the national economy and social sphere depends, and not only national, but to a large extent the world's energy security. The Russian Federation ranked second in the world in natural gas production and first in terms of global gas reserves. It is one of the largest suppliers of energy resources to the world market, occupying a leading position in the world in gas export. Today, Russia exports over 40% of energy resources, accounting for 16% in the structure of the global inter-regional energy trade.

Currently, the share of gas in the fuel balance of Russia is 62%, but if we consider only the European part of Russia, it will reach 86%. Domestic gas industry provides about 10% of the national gross domestic product, up to 25% of revenues to the government budget. The contribution of the foreign exchange component of natural gas exports accounts for about 15% of the total foreign exchange earnings of the Russian Federation (Mirovaya energetika na rubezhe 2015 goda..., 2015).

According to the Ministry of Economic Development regarding the intention of the EU to reduce its dependence on Russian gas imports at the expense of other types of fuel, gas exports to non-CIS countries in 2016 will decrease by 0.8% compared with 2015 to 184 billion cubic meters. Gas exports in 2016 is expected to reach 184 billion cubic meters, in 2017 – 188.7 billion cubic meters, in 2018 – 190 billion cubic meters, in 2019 – 189.4 billion cubic meters. Average contract price for gas to the far abroad in 2016 are planned at the level of 159.2 dollars per 1 thousand cubic meters, in 2017 to 167.2 dollars, in 2018 – 159.1 dollars, in 2019 – 174.8 dollar, and for CIS countries – in 2016 to 152.5 dollars per 1 thousand cubic meters, in 2017 – 160.1 dollars, 2018 – 152.1 dollars, in 2019 – 168.2 dollars.

Thus, in the near future it is expected to reduce revenues from the export of gas to the government treasury. To maintain its leading position on gas export of Russia, it is necessary to study the trends in the global energy market and to find new gas markets and trade its products.

The past 2015 for the global energy economy has been linked not only to the volatility of oil prices, changes in transport infrastructure development plans and the adjustment of trade flow directions. It is also characterized by the continuing depletion of easily accessible deposits of conventional oil and gas, energy shortages in some regions of the world, strengthening of measures to improve the efficiency of natural resources, reduction of anthropogenic load on the environment. In 2015, a number of countries of the Organization for Economic Cooperation and Development (OECD), in particular Japan, South Korea, Germany, Britain, France, Italy and Spain, reached the upper limit of power consumption (Mirovaya energetika na rubezhe 2015 goda..., 2015).

In the past few years, the structure of demand for primary energy (oil, gas, coal, and electricity produced by hydro and nuclear energy stations) has been subjected to minor changes.

Figure 1 (Razvitie neftegazovogo kompleksa..., 2014) presents the world's primary energy consumption structure by the end of 2014.

Currently, oil continues to dominate, accounting for about 33% of global primary energy demand and, in spite of the price crisis, the growth rate of production of this raw material is not slowed down. The share of gas is stable – at 24% of total energy consumption, and a similar figure for coal, competitiveness of which increased (due to a lower price per unit of calorific value), exceeded the level of 28%, despite attempts to curb its use for environmental reasons.

One of the consequences of the accident at the “Fukushima-1 nuclear power plant” was to reduce the generation of nuclear power, which share in the expenditure part of the global energy balance has declined from 6% in 2003 to 4.4% in 2013. At the same time, the share of electricity generated by hydropower has gradually increased and reached in 2014 approximately 6.7% of the world total. In 2013-2014, in some countries progress has been notable in the application of renewable energy sources (RES biomass, solar, wind, water, earth, waste energy), but on a global scale, estimated by the corporation British Petroleum, the

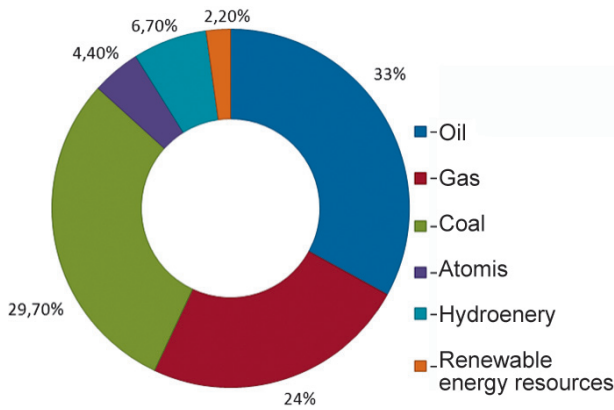


Fig. 1. The structure of the global primary energy consumption, 2014.

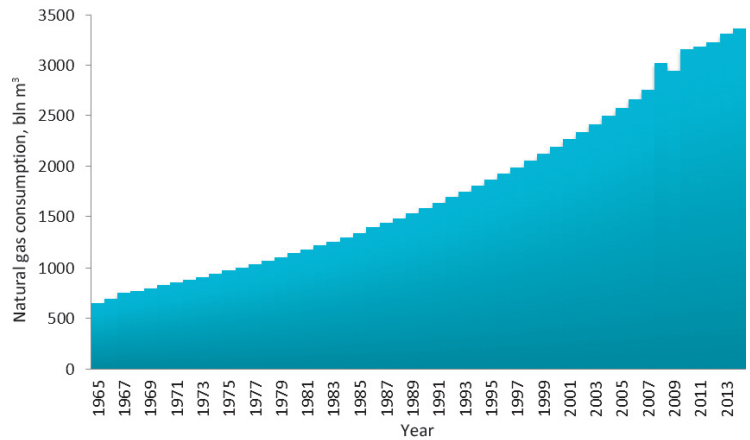


Fig. 2. Dynamics of natural gas consumption (BP Statistical Review of World Energy, June 2014).

importance of these energy sources remains low (2.2%) (Mirovaya energetika na rubezhe 2015 goda..., 2015).

In the near future we can expect that the trend of natural gas share of growth will only be strengthened. Experts attribute this fact to several factors, among which are the more favorable environmental properties of the gas compared with oil and coal; the rapid development of gas chemistry, which has long been very much behind the petrochemical industry in terms of growth; a revolution in the field of gas transport, namely the rapid spread of technology of liquefied natural gas (LNG) and its transportation by sea worldwide (Mayorts, Simonov, 2013).

And finally, today power plants are actively being replaced, operating on liquid and solid hydrocarbons to the gas turbine power plant of combined cycle, which are currently the cheapest (in terms of the unit cost of power generation units), efficient and environmentally friendly energy sources.

Along with the growth of energy consumption in the global energy balance the share attributable to natural gas increases.

Figure 2 shows a retrospective dynamics of natural gas consumption. The diagram in Fig. 3 shows that the main consumer of gas is the United States. It is followed with a considerable margin by Russia, China and Iran.

Russia ranked first in the world at the beginning of 2015 for the volume of proved natural gas reserves (50 trillion m<sup>3</sup>), which corresponds to 26.7% of the world reserves (209.3 trillion m<sup>3</sup>) (Fig. 4).

It should be noted that in the years 2005-2014 gas reserves have grown in all regions of the world, but mostly in North America, where growth amounted to 58% at the expense of the US and Canada, while reducing gas reserves in Mexico. Multiple increase of gas reserves in Turkmenistan offset their decline in the Netherlands, the United Kingdom and Norway, with the total growth in a decade at 32.5%. For the Pacific region, representing another growing region of gas reserves, this period is associated with an increase in Australia by 54% and 1.5 times in China.

At the end of 2014 global gas reserves have also increased by 0.5%. In addition, by 2015, China for the first time made the list of top 10 countries in terms of

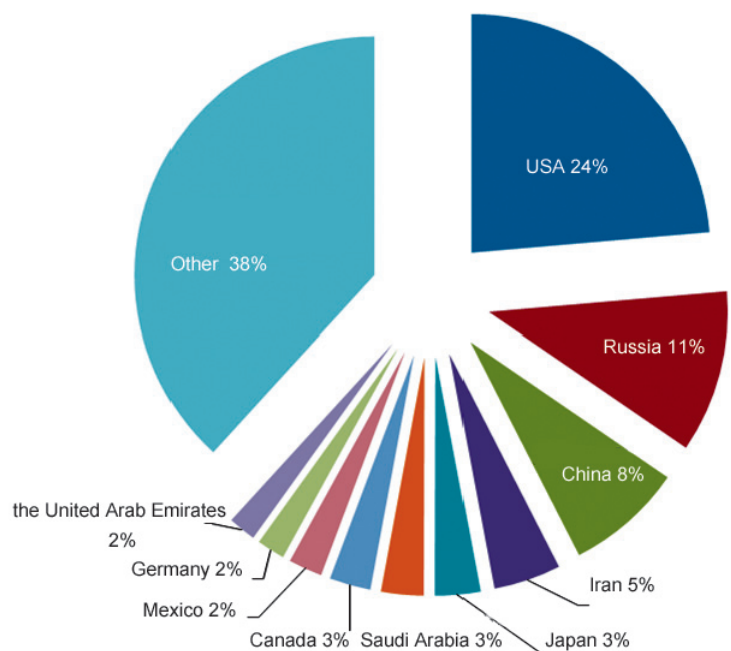


Fig. 3. Gas consumption by countries, 2014 (BP Statistical Review of World Energy, June 2015).

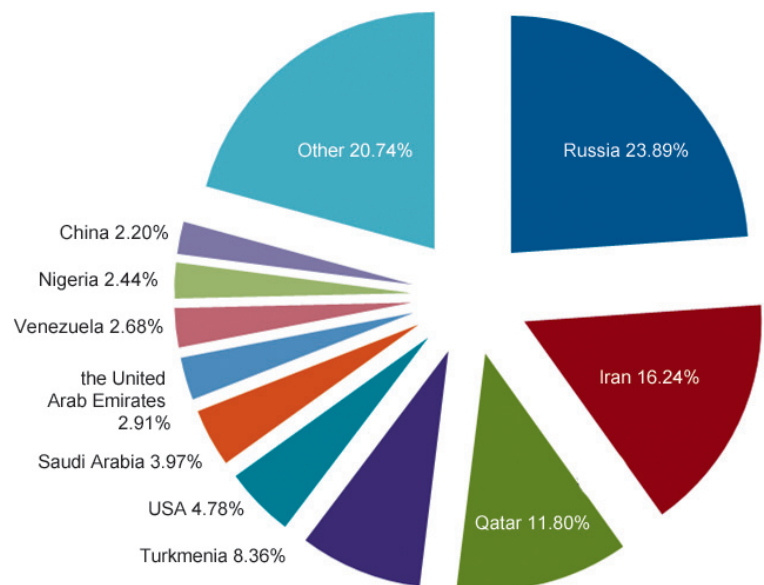


Fig. 4. The total volume of proved natural gas reserves by countries. (BP Statistical Review of World Energy, June 2015).

natural gas reserves, replacing Algeria from this position. The discovery of new offshore fields near the coasts of East Africa and the Eastern Mediterranean and their development of a high degree of probability will help to tighten competition in the growing LNG regional markets, both European and Asian.

Fig. 5 shows countries with maximum growth/reduction of gas reserves at the end of 2014 (Mayorts, Simonov, 2013).

Leaders of gas reserves growth in 2014 were the United States, Russia, China and Iran. The maximum reduction is shown for Australia. The share of the top ten countries in the global gas reserves increased during the year to 79.3% (Fig. 6).

Table 1 presents data on the production of natural gas in Russia and in the world in 1970-2014 years. (Razvitie neftegazovogo kompleksa..., 2014; Razmanova et al., 2015.).

Against the background of growing demand for energy in 2010 there was an increase in gas production in the CIS countries, with the result that the share of CIS countries deliveries exceeded 28% of the world supply. At the same time, gas production in Kazakhstan increased from 32 to 37 billion m<sup>3</sup>, in Azerbaijan from 14.8 to 16 billion m<sup>3</sup>, in Ukraine from 19 to 21 billion m<sup>3</sup>, in Turkmenistan from 64.4 to 75.1 billion m<sup>3</sup> (Mirovaya energetika na rubezhe 2015 goda..., 2015; Ananenkov, Mastepanov, 2010).

In general, the gas production in the CIS countries amounted to 861 billion m<sup>3</sup> in 2010, which is a record in the history of the gas industry in this area. At the beginning of the 1990 gas production in the USSR exceeded 800 billion m<sup>3</sup> (Table 1). Then it was more than 40% of world production, while in Russia 641-643 billion m<sup>3</sup> of gas was produced per year (more than 32% of the world), though at the expense of fields in Western Siberia – more than 580 billion m<sup>3</sup> (Mirovaya energetika na rubezhe 2015 goda..., 2015).

Almost 90% of Russian gas production is concentrated in West Siberia (West-Siberian Federal District), in the first place in Yamalo-Nenets Autonomous Region – in excess of 80% (Fig. 7). The main gas producing regions of the European part, which accounts for about 7% of national production – is the Orenburg region (the Volga-Ural region), Astrakhan Region (Caspian region) and the Republic of Komi (Timan-Pechora region). In recent years, the development began of the Okhotsk province (the continental shelf).

Over the past two decades, there is a reduction of Russia's share in global gas production, indicating the slowdown in the Russian gas industry, due to the active operation of the main gas fields of Western Siberia in the last quarter of the century.

As a result of restrictions of gas supply and increasing demand for it, the economy could face unprecedented challenges. In this regard, the role of unconventional gas reserves increases in order to compensate the decline in conventional gas production and thus ensure the economic security

of the country. This is an important area, but in the shortest time it will not be able to fully compensate for a deficiency of the mineral resource base, in connection with what is currently at the stage of formation and pilot development.

Improving the energy efficiency of production and the use and processing of natural gas is the key to economic efficiency and increase of commercially viable oil reserves and improvement of the financial performance of production companies. An example of the successful implementation of energy efficiency programs is OJSC "Gazpromneft", which in recent years managed to reduce

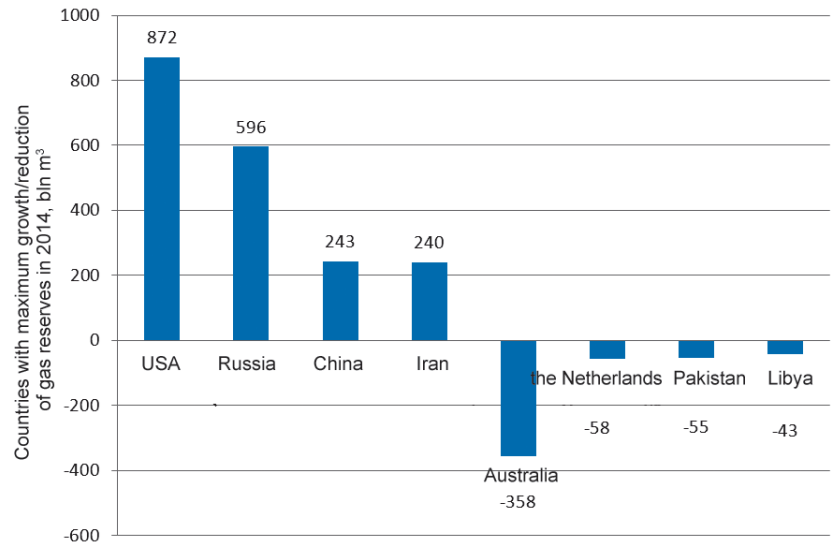


Fig. 5. Countries with maximum growth/reduction of gas reserves in 2014.

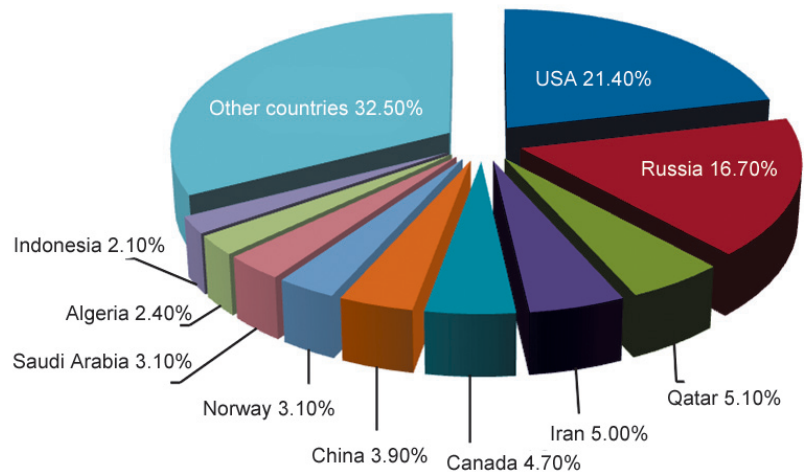


Fig. 6. The share of 10 largest gas-producing countries in the world production in 2014 (BP Statistical Review of World Energy, June 2015).

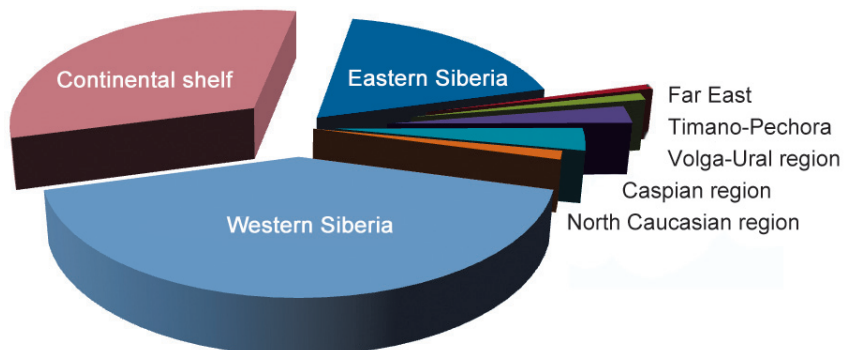


Fig. 7. Gas reserves distribution of gas producing regions of Russia.

production energy costs and thus increase the production of gas. (Sokolov, Iskrikskaya, 2015).

Despite the fact that the Federal Law No, 261-FZ about the increasing energy efficiency was adopted in 2009, there is still no single methodology of its definition, as in the financial statements there are no indicators that take it into account. The production companies use indicators of energy efficiency, but at the same time, often having similar names, they are different in content. Development and application of methods of financial analysis, taking into account energy efficiency indicators reveals the reserves to reduce operating costs at the enterprises of the fuel and energy complex.

Thus, the example of an integrated energy and financial analysis of OJSC "Yakutsk Fuel and Energy Company" has proved this method and found ways to increase the profits of the enterprise (Steblyanskaya, Feng, 2016).

The basis of increasing the economic efficiency of development of natural gas fields is an integrated approach, when there is the possibility of expanding the range of commercial products, obtained during the extraction and processing of raw materials.

At the moment, the major gas companies consider options to diversify natural gas supplies, access to new gas export markets and opportunities to reduce dependence on market supply pipelines.

Given the fact that Russia has a leading position in the global natural gas market, as well as the unique geographical location, which allows the country to supply gas to all major trading exchanges and major regional markets, gas trade development and production of gas chemical complex is one

of the priority export destinations of the Russian Federation.

The Draft of Energy Strategy of Russia for the period up to 2035 "provides for the diversification of energy export trade structure", including due to the increase in its share of LNG. According to the Draft, Russia's share in world LNG trade is expected to increase with the level of 2% (about 11 million tons) to 12% (55.1 million tons) in 2020, and 19.3% (87 million tons) in 2025 (Energeticheskaya strategiya do 2035 goda, 2015).

Currently, more than 65% of Russian gas exports destined for Western and Central Europe, which goes by pipelines through Ukraine and Belarus, and the Baltic Sea. With the transportation infrastructure of natural gas supplies, created in the last quarter of the last century, today, unfortunately, problems are associated such as dependence of Russia on gas transit through the territory of third countries and the lack of geographic diversification of Russian gas supplies. Of course, Russia is interested in ensuring the reliability of gas exports, and is forced to consider other options for transportation of natural gas, including LNG.

Today, supply diversification options include the already constructed gas pipeline "Nord Stream", laid under the Baltic Sea from Russia to Germany, as well as promising pipeline "Power of Siberia", "Nord Stream-2", as well as LNG projects. Transport of LNG by marine gas carriers will also enable Russia to escape from the problems of transit through a third country.

Russia plans to significantly increase capacity for the production of liquefied natural gas and expand its presence in the global LNG market, including in the Asia-Pacific Region (APR). However, competition of LNG suppliers in foreign markets, lower prices for energy, sanctions imposed on Russian companies by Western countries, and a number of other problems complicate the implementation of the task. But, despite all the difficulties, work continues for a variety of project.

As a promising area for processing of natural and associated gas GTL-product is now considered, which means not a synthetic oil as a semi-finished, but an end products of its processing – diesel fuel and motor fuels. Thus in the structure of the final product diesel predominates. The long-term market for the FTGTL products of possible future Russian FTGTL plants, located in Eastern Siberia and the Far East, are the EU countries, South-East Asia and the west coast of North and Latin America.

Petrochemical industry can be confidently called a multiplier of the value. Moving up the supply chain, from raw materials to petrochemical intermediates, petrochemicals, polymers and products made from polymers, in the petrochemical industry the cost is building up to 8-15 times of the original cost of raw materials (Khorokhorin, 2015). Gas chemical industry is part of the petrochemical industry. Its existence is obliged to expand of petrochemical material base, and use of natural

Year	World, bln m <sup>3</sup>	USSR (before 1990), CIS		the Russian SFSR (before 1990), Russia			
		bln m <sup>3</sup>	Share of world, %	Total, bln m <sup>3</sup>	Share of world, %	Western Siberia	
						bln m <sup>3</sup>	Share of Russia, %
1970	1021	198	19,4	83	8,1	3	3,2
1980	1456	435	29,9	254	17,4	140	55,3
1985	1676	643	38,4	462	27,6	389	84,2
1990	2000	815	40,8	641	32,1	574	89,6
1995	2141	707	33	595	27,8	545	91,5
2000	2436	710	29,1	584	24	533	91,3
2001	2493	712	28,6	581	23,3	532	91,6
2002	2531	728	28,8	595	23,5	545	91,5
2003	2617	761	29,1	620	23,7	574	92,6
2004	2694	784	29,1	634	23,5	590	93,1
2005	2778	799	28,8	641	23,1	594	92,7
2006	2876	820	28,5	656	22,8	604	92,1
2007	2945	833	28,3	653	22,2	611	93,6
2008	3066	857	28	665	21,7	610	91,7
2009	3045	789	25,9	582	19,1	517	88,7
2010	3060	861	28,1	650	21,2	575	88,5
2011	3115	820	26	685	23,6	580	90
2012	3211	870	29	690	24,2	590	93,6
2013	3316	865	30	700	25	570	91,2
2014	3460	880	31	715	26	540	90

Table 1. Natural gas production in Russia and in the world in 1970 -2014 years.

gas as direct raw material, as well as processed products of natural and associated petroleum gas (ethane, propane, butanes, fractions of gas condensate) (Arutyunov, 2013; Razmanova, Machula, 2016).

Methanol is one of the product that most important for the gas chemical industry. Over the past few years, many changes have occurred in the methanol industry – production technology significantly improved, new plants for the synthesis of methanol were put into operation; the volume of its consumption rapidly increased and continues to increase.

In coming years, Asian countries, mainly China will be performing as growth driver on the methanol market. If European demand by 2019 is expected to reach 10 million tons, the Chinese will reach 70 million tons. In general, the global consumption of methanol in 2019 will be about 100 million tons (an increase of 47% compared to 2014). According to the expert (Looking to the future, 2015), this jump is due to a change in consumption patterns (mainly in China): the proportion of MTO, formaldehyde and methanol as the fuel itself will increase. Growing demand will be satisfied by new industries. If the integrated MTO projects (mostly Chinese, with aggregate capacity of 12.3 million tons in the period up to 2017) will affect mainly on the olefin segment, the non-integrated market will give the world an additional 4.6 million tons of methanol (Looking to the future, 2015).

Varied use of methanol in fuel elements, in the pharmacy industry, in the chemical industry for the production of solvents, methylmethacrylate, methylamines, dimethyl terephthalate, methyl formate, methyl chloride, acetic acid resins indicates the need to increase production capacity (Konov, 2009). Given the forecast expansion of its consumption in the EU and the Asia-Pacific region, Russia is advantageous to produce methanol for export, with its production so as the shipping costs would not be significant.

Today, Russia needs to go to the higher added value of product market, since it is obvious that the production and sale of petrochemical products of higher added value in the long run is more cost effective than the production and subsequent sale of hydrocarbons. Analysis of the current status and trends of development of the gas industry indicates that for the solution of the problems standing in the way of its successful development, it is necessary: to react promptly to changes in the global energy market, to compete for new markets for export, to create in the domestic market manufactures of profound processing of gas with its subsequent delivery to the foreign market; to improve energy efficiency of the production processes and gas processing in order to reduce operating costs and increase the profits of enterprises.

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