



Prospects for the Development of the Oil and Gas Industry in the Regional and Global Economy

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ABSTRACT

Problems of energy efficiency, along with increasing environmental safety of production and increasing social responsibility, are becoming a central object of research. Therefore, the main goal of the work is to analyze the prospects for the development of the oil and gas industry. It was established that innovative technologies play an important role in the development of energy. In the structure of public administration, the definition of the place in the close relationship with commodity-money relations, mediating its implementation. But refusal of oil resources will lead to negative consequences. It is established that the maximum production of conventional oil in the world in the amount of 4.5–4.8 billion tons per year will be achieved in 2020–2030. Major areas of conventional oil production in this period will be oil and gas basins of the Persian Gulf, Western and Eastern Siberia, the Caspian Sea, the Atlantic shelves of Africa and South America. The achieved level of oil production can be maintained by large-scale involvement in the development of non-traditional sources (bitumen and shale oil). According to the raw material base, the leaders of unconventional oil production should be Venezuela, Canada, Russia and the United States.

Keywords: Environmental Policy, Oil Production, Forecast, Coal-fired Power Plants, Economic Crisis

JEL Classifications: L100, Q400, Q430

1. INTRODUCTION

The development of the world's energy in the early 21st century. Will be determined by the complex impact of many economic, natural, scientific, technical and political factors. Estimating the long-term growth of energy consumption, based on the anticipated rate of development of world energy, leads to the conclusion that the average annual growth to 2030–2050. Will probably be 2–3%. In developing countries it will be much larger (Antipin and Grigorieva, 2005; Litvinenko, 2011).

The development and implementation of an innovative idea should begin with a solution to the problem of cash advance, which is determined by the venture nature of innovation, that is, the

presence of high risks of creating and implementing innovations (Lin and Makarov, 1998; Litvinenko et al., 2011). According to statistics, on average, the success of the innovative idea embodied in the new product is just over 8%, that is, out of thirty ideas of mass production will reach no more than two (Panfilov, 2012). According to the American expert in the field of innovation, the risk of failure of its implementation reaches 90%, and therefore only 10% of innovative projects can achieve commercial success. Thus, we obtain from innovation, the return on capital employed may not fully provide for the payment of dividends or interest on the loan. Despite the fact that in case of success such return can become as large as possible, the risk of unsuccessful completion cannot be leveled (Volkov et al., 2010; Nikulitskaya and Nahratova, 2016).

In Russia today formation of the innovatively oriented power complex is defined by the Power strategy which has established not only the purposes and tasks, but also actions for their achievement for each participant (Ivanter et al., 2007). In accordance with the document, the second stage of implementation of the strategy (which began this year) is connected with the transition to innovative development and the formation of appropriate infrastructure (Keating et al., 2012; Elizarova et al., 2017).

The strategy also highlights the risks of implementing the stage, which may be associated with the lagging of the Russian energy sector from the accelerated post-crisis development of other countries or the absence of the necessary conditions for the subsequent transition to innovative energy by the end of the stage.

An analysis of world energy trends shows that the key factors are the reliability of energy supply, energy security, energy efficiency and environmental harmonization. At the same time, increasing energy efficiency is a strategic direction in reducing the energy intensity of the economy (Chizhankova et al., 2017; Baynova et al., 2016).

A key role in the successful development of energy, including meeting the growing demand, improving the reliability of energy supply and improving the state of the environment, will be played by innovative energy technologies.

2. THEORETICAL OVERVIEW

State regulation of innovation activity is associated with the state intervention in the economy, in this regard, it is necessary to distinguish three systems of state regulation (Vavilov and Trofimov, 2015b; Frolova, 2013):

- A system for which state intervention is justified by absolute necessity;
- A system focused on the maintenance of independent market relations;
- An “intermediate type” system characterized by the use of indirect methods of public influence, which is characterized by a high degree of coherence between the interests of the public and private sectors.

The concept of the need for active state intervention is now common in countries such as Japan and France. And for the US and the UK, maintaining market relations is the most typical (Kalyuzhnova et al., 2016). If the first system is focused mainly on the use of direct methods of state regulation, the other two are more likely to use indirect methods (Prisyazhnyi et al., 1994).

Taking into account the above systems of state regulation in the field of innovation, the most common are administrative-departmental and program-target regulation (Collins, 2007; Buley et al., 2016).

State regulation in the form of administrative and departmental is carried out by means of subsidized financing of innovative organizations in accordance with the adopted special laws (Chun, 2009). For example, in the 80s of XX century in the United States

was adopted the law “On technological innovation,” called “the law of the Stevenson-Vidler,” which provided several basic types of measures of stimulation of innovative activity, including:

- Creation by Executive authorities of the special organizations which activity is directed on research of innovative potential;
- Creation of conditions for effective exchange of qualified personnel between scientific and educational organizations;
- Fiscal incentives for individuals and businesses, making the greatest contribution to the development of innovative activities.

According to the law adopted in the USA, already at the end of 80-ies the Institute of industrial technologies was created at the University of Michigan, the main task of which was to develop advanced systems of production automation (Chernomzav et al., 2008). Until the mid-90s of the XX century, about half of the total funding of scientific research was allocated from the US state budget.

3. RESULTS AND DISCUSSION

Based on the proposed method of forecasting supply, including calculating demand separately for different types of energy, differentiated by countries and regions was carried out assessment of prospects for oil consumption in Europe. Thus, according to the calculations, oil consumption in Europe in the coming decades will gradually decline, which reflects the trend of the last decade. The main reasons for the decline in oil consumption are the rise in energy prices and the tightening of environmental policy (Klimenko et al., 2016). This contributes to the development of new energy-saving technologies, the widespread use of hybrid vehicles. According to forecasts, oil consumption in 2020 will decrease to 608 million tons, in 2030–610 million tons (Table 1).

For the European countries, the main factor that will determine the value of oil production in the future is the level and structure of reserves. The basic forecast of oil production in Europe, on the basis of which the needs for oil fuel in this region were further calculated, is based on the forecasts of oil departments of the largest oil and gas producing countries of the European continent, as well as on the forecasts of the world’s largest energy agencies. The baseline forecast also includes oil production trends over the past 30 years in relatively low-production countries.

Given the depletion of base fields in major oil and gas producing basins and the absence of significant increases in liquid hydrocarbons in the region, further decline in oil production in Europe is expected. It is expected that oil production in Norway will be reduced from 114 million tons in 2012 to 87 million tons in 2020 and 70 million tons in 2030. For comparison, the authors analyze the oil reserves in the Organization of the Petroleum Exporting Countries (OPEC). Figure 1 shows that 81% of the world’s oil reserves are in the OPEC countries.

Europe is the largest oil refining center in the world. A significant number of processing capacities have been created here, which exceed the real level of demand for oil products in the region. The drop in oil production in Europe will be carried out more rapidly compared to the decrease in demand for raw materials. As

a result, the demand for external supplies may increase slightly in the next 5 years. In the future, oil imports may increase to 630 million tonnes in 2020 and 664 million tonnes in 2030 (Losev and Ananicheva, 1999; Lukiyanova, 2014).

Russia has a good chance of maintaining the current level of exports to Europe and has a certain potential to increase it.

The forecast of demand for oil in the Asian-Pacific region shows that in the coming decades this region will remain the fastest growing in terms of oil consumption dynamics. This is due to the existing low level of per capita oil consumption and demographic trends, rapid growth in the number of vehicles and the formation of road infrastructure, as well as a number of other factors. The authors analyzed the use of various energy resources. The data are shown in Figure 2.

The automotive industry has been developing rapidly in the region: since the 1960s-in Japan, since the 1970s - in South Korea, since the 1980s-in China. Over the past 15 years, the fleet of trucks in South Korea has increased by more than 2.5 times and that of cars by 3.5 times. The number of motor vehicles in China has increased since 2000, more than three times. Currently, China is the largest producer of cars and trucks in the world, surpasses the figures for the USA, Japan and Germany. China is one of the most promising automotive markets in the world, so the world's leading automotive companies are actively placing their production here.

The most important factor in the growth of oil demand is the increase in the population. The population of Asia-Pacific region in 1995–2010 increased by 335 million people, which exceeded 56% of the population growth in the world. The increase in India's population was more than 198 million people, China-about 133 million people, Pakistan-29 million people, Indonesia-almost 35 million people, Bangladesh-about 44 million people, Philippines-14 million people (Mikhaylov et al., 2016).

As a result of rapid population growth, most Asia-Pacific countries did not experience a significant increase in per capita consumption of oil and petroleum products. Over the past decade, per capita oil use has increased by only 70 kg per year in the region, reaching about 500 kg per year, more than twice the world average, almost 10 times lower than in North America and five times lower than in Europe (including Eastern Europe).

It is expected that oil consumption in the region will increase to 1.6 billion tons in 2020 and 1.8 billion tons in 2030, the Rapid increase in oil consumption is not accompanied by a corresponding increase in the volume of oil production (Table 2). This is due to the limited resource base and a long history of exploitation of liquid hydrocarbon deposits, especially in countries such as Indonesia, Malaysia.

Analysis of long-term trends in energy consumption, the structure of the fuel and energy balance, population dynamics, major

Table 1: Forecast of oil production, consumption and import to Europe till 2040, million t

Indicator	Fact					Forecast				
	2001	2005	2010	2012	2015	2020	2025	2030	2035	2040
Consumption	768	782	719	674	655	648	634	625	614	603
Extraction	322	268	196	165	148	135	122	110	105	98
Norway	163	139	99	87	83	74	73	70	71	69
Britain	117	85	63	45	38	34	27	22	19	17
Denmark	17	18	12	10	8	8	6	4	3	2
Other	26	26	22	23	19	19	16	14	12	10
Export	102	104	102	95	97	95	96	95	95	95
Import	547	618	625	604	604	608	608	610	604	600

Figure 1: Oil reserves in the organization of the petroleum exporting countries countries

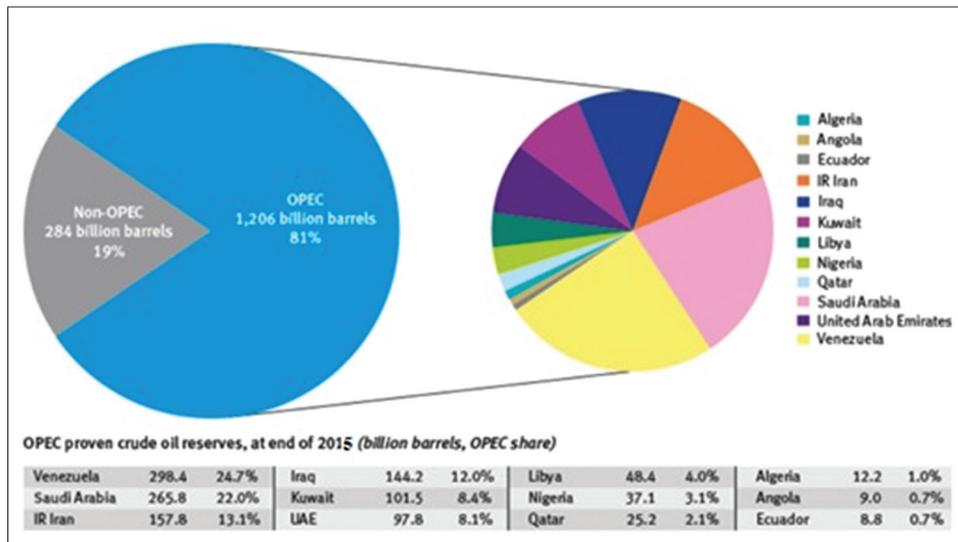
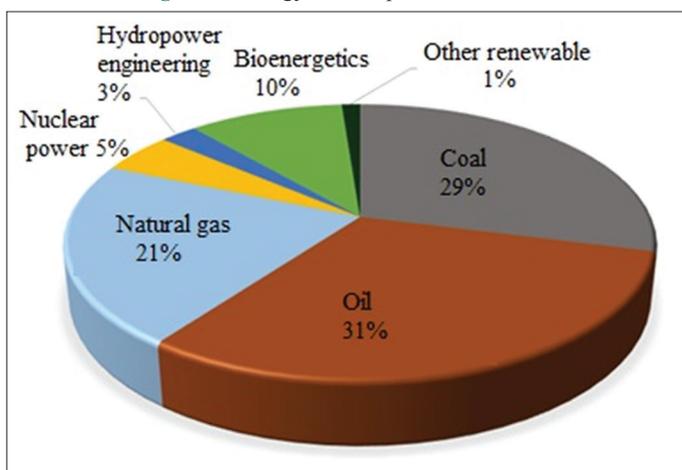


Table 2: Forecast production, consumption and oil imports in the Asia pacific region up to 2040, million t

Indicator	The fact				Forecast					
	2001	2005	2010	2012	2015	2020	2025	2030	2035	2040
Consumption	1001	1147	1290	1389	1494	1586	1710	1844	1986	2097
Extraction	380	383	402	397	395	392	378	370	355	350
China	164,8	181,4	203,0	207,5	212,0	217,0	219,5	220,0	225	230
Indonesia	68,2	53,7	48,6	44,6	38,6	28,6	18,6	11,0	7	6
India	36,1	36,6	40,8	42,0	45	48	48	50	50	48
Malaysia	32,5	34,6	32,0	29,7	27	24	22	19	14	11
Australia	34,7	24,2	25,4	19,9	18,4	16,9	15,4	13,9	10	10
Other	43,2	52,8	52,4	53,5	54	57	55	55	49	45
Export	166	160	351	338	310	300	300	300	200	100
Import	788	924	1239	1330	1408	1494	1632	1774	1831	1847

Figure 2: Energy consumption in the world

technological changes in energy consumption efficiency made it possible to calculate gas consumption in Europe. After the negative dynamics of the late 2010's, gas consumption in the coming years will begin a gradual restoration of its positions at a rate significantly inferior to the growth of recent decades (Pedraza, 2015). In the context of Europe's tight environmental policy and high oil prices, the increase in natural gas consumption is due to lower greenhouse gas emissions, as well as higher efficiency and energy efficiency. Thus, the demand for gas in Europe is expected to increase in 2020–525 billion cubic meters, in 2030–570 billion cubic meters. The amount of energy consumed, as a percentage, is shown in Figure 3 (Morozova and Klimenko, 2014).

Norway's active exploration activities in the North of the Norwegian Sea and the Barents Sea have made it possible to increase a significant amount of natural gas reserves in recent years. As a result, Norway will be able to significantly increase gas production in the coming decades. At the same time, production will continue to decline in the Netherlands, the UK and other countries. This leads to the fact that in the coming decades, Norway will be able only partially to offset the decline of production in other regions increasing their own extraction from the subsoil of gaseous hydrocarbons. As a result, gas production in Europe will fall to 240 b cm in 2020 and 215 b cm in 2030 (Table 3).

The main driver of the growth in demand for gas in the world are the APR countries, primarily developing ones. Restrictions on increasing coal and oil consumption and China's plans to

replace them in the structure of energy consumption with more environmentally friendly energy carriers force the active use of various sources of energy, including gas. According to calculations, the demand for gas in the APR countries will increase to 880 billion cubic meters in 2020 and 1350 billion cubic meters in 2040. Forecast of oil production in Russia is shown in Figure 4.

China, Australia and a number of other countries have good prospects for increasing gas production capacity in the Pacific region, while other countries as a whole stabilize the production level without significant raw materials capacity to increase it. Thus, thanks to the development of new gas fields, as well as the development of unconventional gas production from coal seams, China plans to increase its own gas production by 2.5 times by 2035 (Nazarov, 2015). The increase in natural gas production in India is planned due to the further development of the gas basin Krishna Godavari, as well as through the extraction of gas from coal seams and other unconventional sources, which is stimulated by the rapidly growing domestic demand. As a result, the production of gas in Asia Pacific will increase in 2020 up to 620 billion cubic meters, in 2030 - up to 775 b cm.

The greatest differences in the assessment of volumes of consumption of oil relate to the period 2012–2015 that is due to the different assessment of the economic situation in the unstable conditions following the financial and economic crisis. The forecast of the American EIA agency stands out from the General trend: According to the forecast, oil consumption in Europe will increase by 3.6% in the period 2015–2035 (Table 4). This is due to the high growth in demand for liquid fuels from the transport industry and the skeptical attitude towards technological progress and the development of energy-saving technologies.

Despite the expected growth of oil production in the world, all forecasts under consideration, except for OPEC, predict a systematic decline in oil production in Europe. Currently, the main oil fields in the North Sea are at a falling stage of production. At the same time, no new large deposits are expected to be commissioned in the period under review to compensate for declining production.

The European international energy agency (IEA) gives the most pessimistic forecast, according to which by 2035 oil production in Europe will decrease by 55% compared to the level of 2012. Traditionally, the most favorable forecast for oil production is provided by OPEC: Thus, according to their forecast, the level of

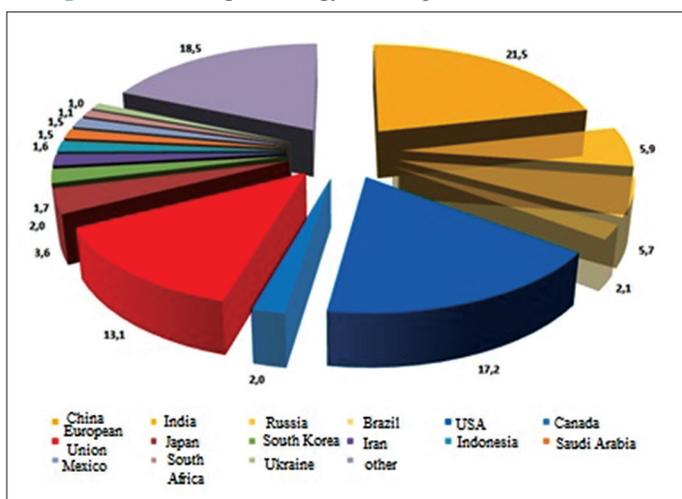
Table 3: Forecast of gas production, consumption and import in Europe up to 2040, b cm

Indicator	Fact					Forecast				
	2001	2005	2010	2012	2015	2020	2025	2030	2035	2040
Consumption	474,3	530,4	549,9	498	505	525	545	570	590	600
Extraction	289,6	300,4	289,2	268	255	240	220	215	210	205
Norway	53,9	85,1	107,7	114,9	117	117	117	116	113	112
Netherlands	62,4	62,5	70,5	63,9	58	53	44	42	40	38
Britain	105,8	88,2	59,7	41,0	36	31	25	23	21	19
Other	67,4	64,6	51,3	48,0	44	39	34	34	36	36
Net imports	184,7	230,0	260,6	230,7	250	285	325	355	380	395

Table 4: Forecast of consumption of oil in Europe up to 2040, million t

Indicator	Fact			Forecast				
	2010	2012	2015	2020	2025	2030	2035	2040
Ippg	719	674	655	648	634	625	614	603
OPEC	719	674	666	656	642	623	605	
EIA	719	674	637	648	650	654	660	
IEA	719	674	668	641	614	587	566	
BP*	903	887	863	860	850	824		

OPEC: Organization of the petroleum exporting countries, IEA: International energy agency

Figure 3: Percentage of energy consumption in the world, 2015

gas consumption in Europe in the next three years is based on the assumption of a high rate of recovery of the European economy after the financial and economic crisis. In 2035, according to IEA data, about 594 billion cubic meters of gas will be used in Europe, which is 37.9% higher than in 2012 (Pantskhava and Pozharnov, 2006).

The growth of demand for natural gas in developed countries, as well as in the fast-growing economies of Asia-Pacific countries requires an increase in the volume of gas extracted. However, during the forecast period, the growth of production will mainly be in developing countries. Currently, almost all European countries are at the stage of falling production. The exception is Norway, which is increasing gas production. However, the projected average annual growth rate of production in this country to 2030 it will not exceed 1.6%, and its share in production is about 35%, which slightly smooths, but does not change the overall tendency to reduce gas production in Europe.

oil production in Europe throughout the period under review will vary slightly and will remain at the level of 2012.

Unlike oil, whose consumption in Europe is limited by high prices and strict environmental policies, the demand for gas will grow steadily. This is facilitated by lower volumes of greenhouse gases emitted, high efficiency and energy efficiency. Growth in demand for natural gas is expected, first of all, from the power industry through the transfer of coal-fired power plants to gas fuel (Nies, 2011). Also, additional demand for gas may be caused by the ambiguous attitude of European countries to nuclear power and possible reduction of energy production at nuclear power plants.

All organizations present similar forecasts regarding the dynamics and future level of gas consumption in Europe. In General, for the period 2012–2035, the average annual growth of gas consumption in Europe is projected at 0.7–1.2%. The most optimistic scenario was presented by the European Agency IEA. According to their forecast, gas consumption will grow to 535 billion cubic meters by 2015, which is 7.3% higher than in 2012. Such a high growth in

Thus, Poland is currently creating favorable conditions for attracting companies to explore shale gas fields, in addition, a number of countries are studying the possibility of extracting gas from coal seams. As a result, according to the forecast of the us agency, by 2035 the share of shale gas in the total volume of produced gas in Europe can significantly increase and ensure stable growth of production in this region (Vavilov and Trofimov, 2015a). Thus, according to the EIA forecast, gas production in Europe will grow by 16% in the period 2025–2035. The ratio of shale gas reserves in Europe is shown in Figure 5.

The Asia-Pacific region, which includes the fastest growing economies of countries such as China, India, Indonesia, etc., have the largest contribution to the growth of oil demand in the period under review. Thus, the high growth rates of industry and vehicles in the region, according to various forecasts, will provide an average annual growth rate of oil consumption from 1.3 to 1.8% to 2035, Despite a slight decrease in oil consumption in developed countries, such as Japan, annual oil consumption in the region

Figure 4: Forecast of oil production in Russia before 2050

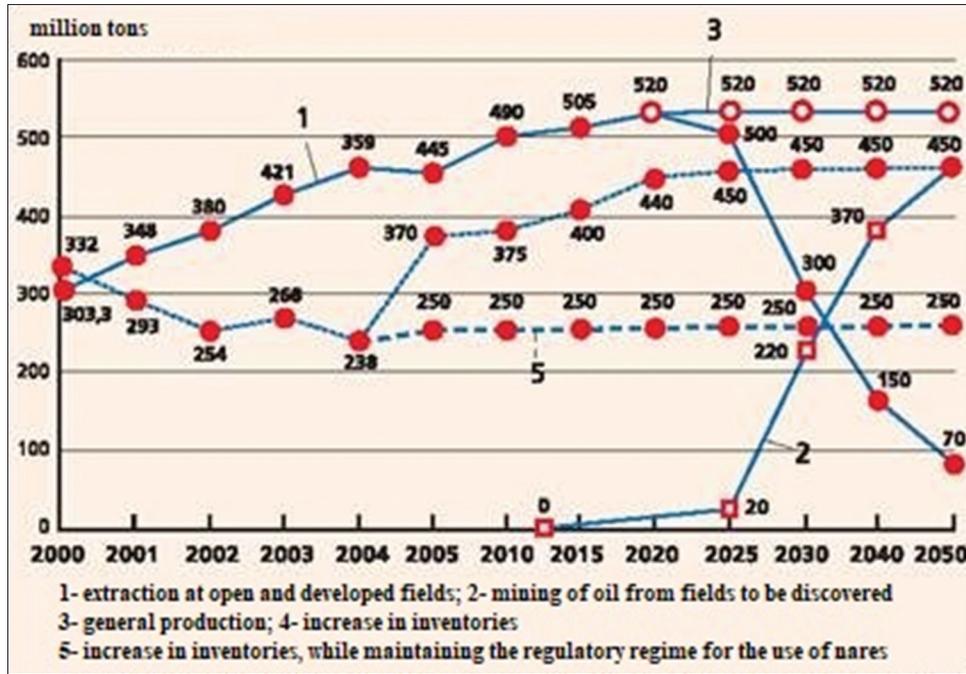


Figure 5: Shale gas ratio in Europe



for the period 2012–2035 will increase by 530–770 million tons (Korppoo and Spencer, 2012).

In General, all forecasts presented by five different organizations show a General trend towards rapid growth in oil consumption, but differ somewhat in the assessment of growth dynamics. The most optimistic forecast of oil consumption growth in the region is traditionally presented by OPEC. Thus, in the period 2012–2035, and this is projected growth of consumption of oil in the region from 1389 million tonnes to 2160 million tons Forecast provided by BP, is almost completely consistent with the EIA forecast. The average annual growth rate of consumption will be about 1.7%, and the level of consumption by 2030 will grow to 1934 million tons. The lowest growth in oil consumption is predicted by the European Agency IEA, according to which in 2035 crude oil consumption in the APR will amount to 1920 million tons.

The forecast of ingg SB RAS is closest to the data of IEA, however, a more confident growth in oil consumption is predicted with an average annual rate of 1.6%, with a production level of 1986 million tons in 2035 and 2097 million tons in 2040 (Table 5).

Despite the fact that the region consumes almost a third of all oil resources, its share in world production is only about 10%. At the same time, in the absence of new large fields capable of maintaining the production level, most organizations predict stagnation or a tangible decrease in the volume of oil produced in the region.

The most optimistic forecast of oil production in the Asia Pacific region represented by OPEC. In the period 2012–2020 is expected to increase oil production from 397 million tonnes to 417 million tonnes Then, after a decade of decline, to 2035, the expected recovery of oil production at the level of 433 million tonnes, the Largest contribution to production growth, according to the forecast, makes the development of new deposits in China.

The least favorable forecasts for oil production are presented by the European Agency IEA and BP, according to which production in 2035 will be respectively no more than 61% and 75% of the level of 2012.

Unlike other energy agencies in the EIA believe that the rapid growth of gas consumption in the region are impossible until 2015. After 2015, the projected strong growth in the gas consumption with an average annual growth rate of about 3%, which corresponds to the range of the other forecasts. As a result, natural gas consumption will increase to 1211 billion cubic meters by 2035 (Table 6).

According to all forecasts, a significant increase in natural gas produced over the entire period is expected. At the same time, the

Table 5: Forecast of oil consumption in APR until 2030, million t

Indicator	Fact			Forecast				
	2010	2012	2015	2020	2025	2030	2035	2040
Ipgg	1290	1389	1494	1586	1710	1844	1986	2097
OPEC	1290	1389	1510	1691	1857	2008	2160	
EIA	1290	1389	1485	1645	1795	1935	2096	
IEA	1290	1389	1475	1561	1679	1802	1920	
BP	1290	1389	1478	1646	1811	1934		

OPEC: Organization of the petroleum exporting countries

Table 6: Forecast of gas consumption in APR until 2030, billion cubic meters

Indicator	Fact			Forecast				
	2010	2012	2015	2020	2025	2030	2035	2040
Ipgg	560	625	725	880	1010	1140	1290	1350
EIA	560	625	671	781	913	1058	1211	
IEA	560	625	759	924	1039	1178	1335	
BP	560	625	753	935	1075	1210		

average annual growth rate in the period 2012–2035 is estimated at 2.3–3.5%. The main countries providing production growth are China, India and Australia.

Thanks to the development of new gas fields, as well as the development of unconventional gas production from coal seams, China plans to increase its own gas production by 2.5 times by 2035. The growth of natural gas production in India is expected due to the further development of the Dhirubhai field in the Krishna Godavari gas basin, as well as through the extraction of gas from coal seams and other unconventional sources, which is stimulated by rapidly growing domestic demand. Australia is actively developing gas production on the Northwest shelf in the Camarvon basin, as well as gas production from coal seams (Zhuplev, 2012).

Identified sustainable patterns of development of global oil and gas industry:

- Production growth of oil and gas by developing unconventional petroleum resources (tar Sands, shale oil, etc.) and gas (shale gas) in North America (USA and Canada), active preparation for development in the Asia-Pacific region (China) and Latin America (Venezuela);
- Build up reserves dobychnyh and export capabilities of traditional natural gas in the Gulf countries (Qatar, Iran), Asia Pacific (China, Australia), Central Asia (Turkmenistan);
- Continuing active role in oil supply of the world economy by OPEC countries, primarily the Persian Gulf;
- Reduction of hydrocarbon production in traditional regions, primarily in Europe (except for gas in Norway);
- Structural shifts in the global structure of hydrocarbon consumption associated with the stagnation of their use in Europe and the United States, and an intensive increase in consumption in the APR countries, as well as at least the Persian Gulf.

4. CONCLUSION

The paper proposes a methodological approach to the analysis of production and export opportunities of large regional suppliers,

based on the resource base. The dependence between the rate of selection of reserves of current production and the share of accumulated production in the NSR by country is established. The optimal average rate of current production reserves selection is set, which allows determining the potential opportunities for increasing production and shows the degree of development of the oil and gas industry within the country under consideration.

Maximum production of conventional oil in the world in the amount of 4.5–4.8 billion tonnes per year will be reached in the 2020–2030 Major areas of conventional oil production in this period will be oil and gas basins of the Persian Gulf, Western and Eastern Siberia, the Caspian Sea, the Atlantic shelves of Africa and South America. The achieved level of oil production can be maintained by large-scale involvement in the development of non-traditional sources (bitumen and shale oil). According to the raw material base, the leaders of unconventional oil production should be Venezuela, Canada, Russia and the United States.

The state of the resource base, and recent trends suggest that in 2040–2050-ies gas production will reach 5 trillion cubic meters of Gas can become the second role in the world energy balance and to compare this indicator with coal or even slightly exceed it. In the coming decades the world will be formed quickly to develop major new centers of production in the traditional gas - Russia (Yamal, Gydan, Kara and Barents sea, Eastern Siberia), middle East (Iran, Qatar), Central Asia (Turkmenistan, Kazakhstan), Asia Pacific (Australia), etc.

Taking into account the proposed methods of forecasting supply and demand for major energy resources, the prospects for the development of the world's major energy markets (European and Asian-Pacific) are analyzed (Teleuyev et al., 2017).

The relatively minor prospects for increasing gas consumption in Europe, and overall stagnation of its production is expected to stabilize the import of gaseous hydrocarbons in the region with a slight increase, particularly after 2020, In 2020 non-regional gas imports in the APR may increase to 270–290 billion cubic meters, in 2030 - up to 440–470 billion cubic meters In connection with

the projected growth in gas demand in Asia-Pacific countries will increase the role of non-regional LNG suppliers in the region.

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