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The energy resources of the Arctic region: a view from Russia and Europe

There are some long-term trends in the global energy market: changing geography of hydrocarbons production, displacement of the centers of oil and gas in remote and offshore areas, steady decline in hydrocarbon production in the continental deposits, maintaining a stable level due to increased production from offshore fields. Currently, the share of oil and gas offshore is more than 25% of production in the world. Deterioration of conditions of hydrocarbon production comes with growing demand for oil and gas in the world. According to IEA and BP projections, the global demand for natural gas in 2030 will increase by 40%, oil – by 36%.

The Arctic shelf is the largest and still the only source of undiscovered hydrocarbons. According to the U.S. Geological Survey, the share of the Arctic shelf is about one-fifth of all undiscovered recoverable oil and gas reserves in the world.

The development of the approaches to the continental shelf.

Until the early 20th century there wasn't clear distinction between the continental shelf and the submarine bottom of the seas and oceans. A Coastal State extends its sovereignty over the sea bottom within a three-mile area of the territorial sea. The rapid development of science and technology in the 20th century increased attention of the countries to seabed resources beyond the territorial seas. The first act of a valid claim to the continental shelf from the state was the statement by President Truman in 1945, who declared that the natural resources of surface and subsoil of the continental shelf, located under the waters of the open sea, but adjacent to the coast of the United States, owned by the United States and subject to the jurisdiction and control of the United States.

In 1956, the UN Commission developed a definition of the continental shelf, based on two concepts: 1) continental shelf as a natural underwater extension of the continental territory of the coastal State, and 2) the coastal state can lay claim to the

area of the shelf, which is near, adjacent to its coast, or located outside its territorial sea.

In 1982 the UN Convention adopted the Law of the Sea, according to which the continental shelf of a coastal State comprises the seabed and subsoil of the submarine areas that extend beyond its territorial sea to the outer edge of the continental margin or to a distance 200 miles from the baselines from which the breadth of the territorial sea where the outer edge of the continental margin does not extend that far.

In 1997, Russia joined the international law - the Convention for the Law of the Sea 1982 and unified the basic regulations governing the use of marine space. So, now in the Russian legislation, according to the Federal Law № 187 "About the continental shelf of the Russian Federation", the continental shelf comprises the seabed and subsoil of the submarine areas that are outside the territorial sea of the Russian Federation throughout the natural prolongation of its land territory to the outer edge of the continental margin. The outer limit of the continental shelf is at a distance of 200 nautical miles from the baselines from which the breadth of the territorial sea, provided that the outer edge of the continental margin does not extend for a distance of over 200 nautical miles. If the continental margin extends to a distance of 200 nautical miles of the baselines, the outer limit of the continental shelf coincides with the outer limit of the continental margin as determined in accordance with the norms of the international law.

One of the controversial legal issues using the waters and seabed in the current international practice is establishing the right to use the waters of the Arctic Ocean beyond the 200-mile radius of the coast of Russia. Convention 1982 suggests further extension of the shelf up to 350 nautical miles, if the country can prove that the ridge is an extension of their continental platforms.

To extend the shelf up to 350 nautical miles claimed Russia, Canada and Denmark (through Greenland). Decision on this matter is authorized to adopt the UN Commission on the Limits of the Continental Shelf, where applicants must submit their application and relevant evidence. Russia has made an application to the UN in

2002. However, the Commission did not reject the UN, but also did not satisfy the Russian bid and recommended further research. In 2007 the Russian expedition was sent into the water area of the ridge to clarify the limits of the continental shelf. Today there are ongoing expeditions to collect geological and geophysical data. Re-enroll to the UN plan in 2013.

The modern definition of the continental shelf is based on the geological characteristics of the bottom (methodology of the UN, Convention on the Law of the Sea, 1982). So shelf recognized as a lined area of the continental margin adjacent to the land and it is characterized by general geological structure. The boundaries of the continental shelf are the sea or ocean, and the so-called brow (kink seafloor - the transition to the continental slope). The average depth of the brow is typically 100-200 m, but in some cases it can reach 500-1000 m.

General characteristics of the shelf zone of Russia.

The total area of the World Ocean shelves is about 31 million square km. (8% of the world's oceans territory). The most extensive - shelf of the Eurasian continent, covering 10 million square km. The continental shelf of the Russian Federation is the largest in terms of area; its territory is about 6.2 million square km (20% of the ocean shelf).

Along with the shelf seas also there are the deep seas. In contrast to the shelf seas in deep sea bottom geologically is not associated with the nearby mainland.

All Russian seas of the Arctic Ocean are shelf seas with an average depth of 250 m. Only the northern part of the Laptev Sea, comes on the ocean bed, because of its average depth is about 530 meters.

All Russian seas of the Pacific Ocean are mainly deep seas. In the north-western Pacific Ocean there are no shelves, because along the Kamchatka Peninsula and the Kuril Islands there is deep Kurilsk-Kamchatka Trench, the depth of which is almost 10 km. The average depth of the Bering Sea and the Sea of Japan is 1,500 m. Only in the Sea of Okhotsk average depth is less than one kilometer, because a large part of the sea is on the shelf.

Northern Sea Route is the shortest sea route between the European part of Russia and the Far East. It lies across the seas of the Arctic Ocean. For Russia, it is of strategic importance because it allows to transport hydrocarbon and mineral resources from the Extreme North, as well as to supply these areas with equipment, fuel and food. The Northern Sea Route may serve as the shortest transport route between Western Europe and the Asia-Pacific region. Alternative to the Northern Sea Route - transport routes through the Suez or Panama canals. From St. Petersburg to Vladivostok route through the Northern Sea Route is 14 280 km, through the Suez Canal - 23 200 km. The maximum amount of cargo of the Northern Sea Route was in 1987 - 6.6 million tons, now the Northern Sea Route carries about 2 million tons of cargo per year.

Reserves and resources of the Russian Arctic and Far Eastern shelf.

The structure of the shelf of the Arctic and Far Eastern seas of Russia consists of the following oil and gas provinces: Barents-Kara, the Laptev Sea, East Siberian, Western Chukotka, Okhotsk and South Kara. The last official quantitative reassessment of resources of Western Arctic seas was held in 2002, and the resources of Eastern Arctic and Far Eastern seas - in 1993.

On the Russian's shelf there are more than 13 billion tons of the initial total resources (ITR) of oil or more than 16% ITR Russian oil and more than 80 trillion cubic meters of natural gas or the over 30% of Russia's gas ITR. On the shelf of the Arctic and Far Eastern seas there are about 85% of all offshore oil ITR territories of Russia and more than 95% of the ITR gas. The level of exploration of the Arctic shelf in general is low. The least explored shelf at the Eastern Arctic sector are the Laptev Sea, the Chukchi and East Siberian especially.

The largest share of the initial total oil reserves account for the Western Arctic Sea – the Barents and Kara seas, as well as the Far East Sea of Okhotsk. Significant reserves and natural gas reserves have the Barents and Kara seas - about 75% of the ITR gas offshore Russia. Offshore hydrocarbon deposits of these two seas are a strategic reserve of oil and gas complex of Russia in the future.

Total on the Russian Arctic shelf 18 oil and gas fields were discovered, all of them are located in the waters of two seas: the Barents and Kara. There are 12 fields In the Far East shelf.

The largest oil fields in the Barents Sea are Dolginskoye, Medyn sea Prirazlomnoye. In the Sea of Okhotsk, the largest oil fields are Arkutun Dagi, Piltun-Astokhskoye and Chaivo.

The largest gas field in the Barents Sea is the Shtokman field. In the Kara Sea, the largest natural gas fields are Leningradskoe, Rusanovskoye and Kamenomysskoe-sea. Large gas fields of the Okhotsk Sea are Lunscoe, Chayvo and South Kirinskoye.

On the Arctic and Far Eastern shelf distribution fund is 93% oil and 72% of natural gas reserves.

Hydrocarbon production in the Arctic and Far Eastern shelf.

Oil and gas exploration in the Arctic shelf - in the Kara, Barents, Laptev, East Siberian and Chukchi seas – is not currently implemented. Production of hydrocarbons on the shelf of the Okhotsk Sea was started in 1999 with the project "Sakhalin-1" (the operator - "Exxon Neftegas Limited") and in 2005 for the project "Sakhalin-2" (the consortium "Sakhalin Energy") (Table 1).

The project "Sakhalin-1" includes ExxonMobil (30%), Rosneft (20%), ONGC (20%) and SODECO (30%). The project "Sakhalin-2" includes Gazprom (50% +1), Shell (27,5% -1), Mitsui (12,5%), Mitsubishi (10%).

Table 1

The main Russian deposits of hydrocarbons in the Sea of Okhotsk

| Deposits | Year of putting into operation | Company | Depth of the sea | Distance | Volume of production in 2011 |
|--------------------------------------|--------------------------------|------------------------|------------------|----------|---|
| Piltin-Astohskoe oil field | 1999 | Sakhalin Energy | 32-48 m | 13 km | 5,7 mln tons oil |
| oil gas condensate field Chaivo | 2005 | Exxon Neftegas Limited | 18-32 m | 9 km | 6,2 mln tons oil, 8,8 billion cubic meters of natural gas |
| Lunscoe gas field | 2009 | Sakhalin Energy | 32-48 m | 13 km | 16,2 billion cubic meters of natural gas |
| oil gas condensate field Odoptu-more | 2011 | Exxon Neftegas Limited | 26-32 m | 9 km | 1,7 mln tons oil |

The largest fields of "Sakhalin-1" are Chayvo, Odoptu-Sea Arkutun Dagi, total oil reserves of this fields are 230 million tons. At the first stage of the project "Sakhalin-1" in 2005 started developing of Chayvo field, due to which oil production of the project peaked in 2008 and amounted to 9.6 million tones. Since 2006 oil from the Chayvo goes through the north of Sakhalin Island and the Tatar Strait through the pipeline to the oil terminal near the village of De Castries in Khabarovsk Krai and then is exported. Before 2012, there was reduction in the amount of oil production, but the beginning of production in Odoptu-Sea field since 2011, will support production at 7,9-8,3 million tones by 2015. Most of the natural gas produced in the project "Sakhalin-1" is injected into the reservoir because of the unresolved issue with sale. Since 2014, in the second stage, it is expected to begin development of Chayvo gas reserves and oil reserves of Arkutun Dagi field.

Project "Sakhalin-2" includes production of gas and oil in Lunskoye and Piltun-Astohskovo fields with total oil reserves about 110 million tons. In 1999 oil production started in Piltun-Astohskoe field. Next, the following results were achieved: reaching year-round cycle of production, preparation of hydrocarbons on the onshore processing facility to which attached a marine oil and gas pipelines from three offshore platforms, transportation of oil and gas through land pipelines 800 km from north to south of the island, the production of liquefied natural gas at the LNG plant in the south of Sakhalin Island near the village Prigorodnoye, export of LNG and oil with a specialized dock and oil terminal. The main volume of produced on the Far Eastern seas' shelf gas comes from "Sakhalin-2" - more than 16 billion cubic meters, within which the TransSakhalin pipeline, plant and LNG terminal. In 2011, 10.7 million tons of liquefied natural gas were exported to Asia-Pacific, especially Japan and the South Korea.

In 2011 oil production in the Okhotsk Sea was 13.6 million tons, including the "Sakhalin-1" - 5.7 million tones, "Sakhalin-2" - 7.9 million tons. Natural gas production was 25.0 billion cubic meters, including the "Sakhalin-1" - 8.8 billion cubic meters, "Sakhalin-2" - 16.2 billion cubic meters.

Prospects of development of offshore fields in Russia.

Sea of Okhotsk.

Promising in terms of growth of reserves and increase the production of hydrocarbons are the "Sakhalin-3" - "Sakhalin-9." Existing geological conditions enable to predict the possibility of a source of raw materials in the future projects of the shelf of the Okhotsk Sea "Sakhalin-3" - "Sakhalin-9", which allows to provide in 2020 production of 8 million tons of oil and 17 billion cubic meters of gas, and in 2030 - 14 million tons of oil and 38 billion cubic meters of gas. National oil company Rosneft has licenses for the exploration and production of hydrocarbons in five areas (Magadan-1-3, Lisyansky, Kashevarovsky areas), including 3 areas with a foreign company Statoil. Statoil share in the project is 33.33%.

There are four prospective areas of the Kamchatka shelf, but in the subsurface distribution fund is only one area - West Kamchatka. The license for this area transferred to the company Gazprom by the Federal Government in 2009. The Company is actively pursuing exploration program, the expected result is the growth of reserves, which will provide natural gas production in 2020 at the level of 1 billion cubic meters, in 2025 - 8 billion cubic meters m, in 2030 - 12 billion cubic meters m.

Barents Sea.

The main companies operating in the Barents Sea are the Russian national companies Rosneft and Gazprom and foreign Eni and Statoil. The company Rosneft has licenses for the exploration and production of hydrocarbons in five areas (Central Barents, Fedynsky, Perseevsky, South Russian and Medyn-Varandey), including 3 areas with foreign companies Statoil and Eni. Foreign companies have a 33.33% share in a joint venture with Rosneft. Company Gazprom has licenses for the exploration and production of hydrocarbons in three fields: Shtokman, Prirazlomnoye and Dolginskoye. Starting oil production at Prirazlomnoye field is planned to the end of 2013. The projected level of production is 6.6 million tons per year and will be achieved by 2018.

"Shtokman" project is one of the most promising projects in the Barents Sea. In 2008, joint venture "Shtokman Development AG" consisting of Gazprom (51%),

Total (25%) and Statoil (24%) was founded. The initial plan to begin gas production in 2012 was not implemented. In August 2012 shareholder agreement expired and the project was suspended.

Kara Sea.

Companies Rosneft and ExxonMobil plan to explore the continental shelf of the Kara Sea. The company Rosneft has licenses for the exploration and production of hydrocarbons in three areas (East Privonozemelsky-1-3) in conjunction with a foreign company ExxonMobil, which share in the joint venture is 33.33%. Also companies Rosneft and ExxonMobil have signed an agreement on the establishment of the Arctic research and design offshore development center that will perform a complete cycle of research and design work on the development of offshore fields. The main tasks of this center is system support of all stages of offshore oil and gas development in the Arctic and promoting environmentally sound projects, including through the provision of technical support for environmental monitoring.

According to the forecast of the Russian Ministry of Natural Resources, oil production in the Arctic shelf of Russia in 2030 will be 66 million tons, and gas - 230 billion cubic meters.

Traditionally, the largest share of Russian exports of oil and gas deal with European countries (about 80%). Supply of Russian energy covers a significant part of the European industry and households needs. In 2012, Russia provided about 34% of natural gas imports the EU, 33% - of crude oil imports.

Significant challenges of the development of the Arctic fields are the following: need in more sophisticated and expensive technologies to carry out production and transportation of hydrocarbons in extreme environments, and to provide a sufficient level of environmental safety. To overcome these difficulties, the Russian company Rosneft in 2012 signed an agreement about jointly development the Arctic shelf deposits with foreign companies, ExxonMobil, Statoil, Eni. And in 2013 Russian company Gazprom will start production at the Prirazlomnoye field in the Barents Sea.

In the context of sustainable long-term growth in global demand for hydrocarbons offshore development of the Arctic shelf is a necessary condition for energy supply the global economy. Development of new technologies for offshore production and transportation will boost high-tech industries as well as to expand cooperation in the economic and investment areas with the European countries.

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