

The Analysis of Russian Oil and Gas Reserves

Yulia Grama

Department of Diplomacy, National Chenchi University, Taiwan.

Email: 97253504@nccu.edu.tw

ABSTRACT: This paper devotes to the analysis of Russian oil and gas reserves. Currently, Russia holds world's leading positions in oil and gas supply, but there is uncertainty for how long the country would be able to maintain it. After analyzing the situation in this industry, studying oil and gas fields and governmental policy towards hydro carbonates production and supply in Russia, the author will provide her projection about the future development of Russian oil and gas supplies to the global market.

Keywords: Russia; Oil and gas reserves; Energy supply; Energy policy

JEL Classifications: Q31; Q47; Q48

1. Introduction

Energy is one of the most important factors for the survival of humanity. It provides heat, light and mobility, the fuel of the economy. This is why the possession of energy is a dominant issue in the politics of every country (Wirth et al., 2003). Matthews (2008) made a good description of the importance of energy in the world: "Energy is the lifeblood of economies around the world. Global economic growth depends on adequate, reliable and affordable supplies of energy. Key foreign policy objectives, including support for democracy, trade, sustainable economic development, poverty reduction and environmental protection rely on the provision of safe, reliable and affordable energy supplies".

There is no other substitute to oil and gas for energy production both now and in the future. Alternative ways of producing energy will play only a minor role in the energy balance of countries. The stable and reliable supply of oil in gas is of key national interest to the states.

Russia is not only the biggest country in the world; it is also one of the world's richest countries in terms of raw materials, many of which contribute a significant amount of input to an industrial economy. Russia holds the world's largest natural gas reserves and the eighth largest crude oil reserves (U.S. Energy Information Administration, 2011). That is the reason why Russia plays the leading role in the world's energy supply and also why the development of the world's economy substantially relies on Russia to provide their supply of oil and gas.

This article will provide the analysis of Russia's oil and gas reserves and perspectives for its future development.

2. Russian Oil Reserves

Russia has huge territory and geological conditions for oil are favourable. There are seven oil-bearing basins in Russia (Figure 1). The biggest three oil basins are the following:

i) The Western Siberia Basin

Recently, almost all of Russia's production increases have come from the Western Siberia basin in the Khanty-Mansiysk Okrug region. 75 % of Russia's oil production comes from this region and 2/3 of Russia's oil reserves are located there (Websurveys, 2011). The region consists from Tomsk and Tyumen regions and there are 270 other fields in this vast region. The most important oil fields are Samator, Ust-Balyk and Salym (Ivanenko, 2007). Pipelines transfer oil for export to the Black sea, Baltic Sea and Pacific coast.

Figure 1. Main oil basins in Russia

Source: IEA

ii) The Volga - Ural Basin

The basin is located along Yaik (Ural) and Volga rivers. It is also known as “Second Baku” and has an area of around 70 million square kilometres. The building of the basin was first started during World War II and from the mid 50s to mid 70s; it was the largest oil production area in the USSR. From an exploration point, the basin is much matured. Since 1960s only two oil fields with reserves of more than a million barrels of recoverable oil were found. Before that time there were seven with more than 2 billions barrels each, and the largest – Romashkino field with stocks of more than 17 billion barrels (Grace, 2005). From 1978, the West Siberian basin took leading position and the oil production in Volga/Ural basin decreased year by year. But still the basin holds reserves of 1.2 – 1.5 million tons and this accounts for 1/5 of all oil production in Russia.

The basin is located in economically developed regions, therefore, crude oil processing and petrochemical industry are also very developed there. There are more than 10 refineries with total processing capacity of 150 million tons of crude oil per year. The developed pipes infrastructure allows the crude oil to be transported to other regions of Russia and for export (Grace, 2005).

iii) Timan – Pechora Basin

The basin is located in the Northeast European part of Russia. It is difficult to estimate the total oil resources of the above-mentioned basin, because some of the areas are still in the early stages of exploration, but according to the information provided by Russian oil giant – Lukoil, the total reserves in 2000 were 10.7 billion of crude oil and by 2015, the explored reserves are estimated to be 20 – 25 billion of crude oil (Fedun, 2011).

The Timan-Pechora basin is considered as the third biggest oil producer of Russia, and there is great development potential in the area. According to the information provided by the Science Communications – Arctic Center about the reserves of Timan – Pechora basin “if the ...oil reserves

are compared world-wide, they are equivalent to Norway's North Sea reserves" (Arctic Center, 2011). During the past few years, the region has attracted the interest of several western oil companies.

In 2010, Russia was the world's largest oil producer with production of 10.1 million barrels daily amounting to 12.9 % of the world's total oil production. The figure was 2.2 % higher than in the previous year, 2009. The annual average share of oil export was 42.5% in 2010 (Soldatkin, 2010).

Russia's exports of crude oil and refined products in 2010 totalled about 7.5 million barrels per day, up from 6.7 million barrels per day in 2008, 6.5 million barrels per day in 2007 and 6.35 million barrels per day August 2006.

This is compared with 5.05 million barrels daily in August 2002, 3.425 million barrels daily in August 1998 and 2.35m million barrels daily in September 1994. The rise in 2010 is due to an increase in the capacity of Russia's export outlets and increased production of crude oil and condensate (APS Review, 2010).

According to the governmental document called "Energy Strategy Of Russia for the period up to 2030", which analyzes the future energy development of the country, exports of crude oil, condensate and refined petroleum products are expected to rise to 530 - 535 million tons per year (IES, 2011).

As for oil reserves Russia holds 8th place in the world. In 2009, British Petroleum (BP) in its annual report estimated Russian oil reserves as 10.2 billion tons which amount to 5.6 % of the world's oil reserves (British Petroleum, 2010). Saudi Arabia (19.8%), Iran (10.3%) and Iraq (8.6%) are the three countries with the largest oil reserves in the world.

It was calculated that if Russia maintains its existing production volumes, proven oil reserves will peter out within 21.3 years and reserves of natural gas, within 81 years.

TBP report found that all the data about oil and natural gas reserves are independent evaluations based on available information. Official information about reserves of Russian hydrocarbon raw materials are classified as secret information. According to Article 5, item 2 of Russian Federation Law #54-85-1 "About State Secret" dated 21st of July 1993 all information about reserves, extraction, production and consumption of strategic raw materials in the Russian Federation, including balanced oil reserves is classified as a State Secret..

BP's report received a negative response in Russia. In Russia there is no common opinion about the evaluation of oil reserves. Different sources provide different prognosis.

According to auditors, who know the situation in Russia well, the evaluation provided by BP is based only on the surface layers of oil. Auditors of the company "DeGolyer & MacNaughton"¹ made an analysis of proven reserves in Russia and their figures showed 150–200 billion barrels (Promyshlennye vedomosti, 2011).

Head of Russian Ministry of Energy, Sergey Smatko also opposed the information published by BP. He said that current industrial reserves of oil are 22 billion tons which guarantees the existing production level for 40 years (Vzglyad, 2010).

The main reason for such different evaluations is that geologically proven reserves and the volume of reserves that can be commercially extracted differ a lot.

Russian companies have gradually started to implement new technologies of oil extraction, for example, horizontal boreholes and computerized systems of reservoirs' management. Thus, the evaluations of extractable oil reserves keep changing. Because of new technologies that allow oil to be extracted even from depleted oil fields, Russian oil companies managed to increase oil extraction for 50%.

According to Martin Viverovsky, senior Vice President of Moscow's representative office of "DeGolyer & MacNaughton", "the most important is that new technologies started to be implemented in Western Siberia. Results are already very obvious" (Rossii, 2011). According to the company evaluations of "DeGolyer & MacNaughton" in 2012, in Western Siberia, oil production can reach 10 million barrels per day. With the development of new technologies the oil production in Western Siberia will increase accordingly. Also the volume of proven oil reserves will grow together with exploration of new regions such as The Arctic, Caspian Sea and mostly Eastern Siberia.

Aside from this, the Russian and Western methods of estimation and classification of reserves are different. The Russian experts have divided the oil and gas resources into six classes: A, B, C₁, C₂,

¹ The company is registered in Dallas, USA. Among its clients were Gazprom and former Yukos.

D₁ and D₂. Class A represents proven reserves and B provable reserves. C₁ represents the reserves estimated by means of drillings and individual tests, and C₂ is estimated by means of seismic exploration. Classes D₁ and D₂ represent hypothetical and speculative reserves. The distribution of ABC1 and C2 reserves in Russia is shown at the Table 1 and 2 (Milov, 2006).

Table 1. The regional distribution of ABC1 oil reserves in Russia

| Region | % |
|-----------------|----|
| West Siberia | 74 |
| Volga – Ural | 10 |
| Timan – Pechora | 7 |
| East Siberia | 4 |
| Far East | 2 |
| Other regions | 3 |

Table 2. The regional distribution of C2 oil reserves in Russia

| Region | % |
|-----------------|----|
| West Siberia | 61 |
| Volga – Ural | 14 |
| Timan – Pechora | 14 |
| East Siberia | 5 |
| Far East | 3 |
| Other regions | 3 |

According to the Energy Strategy of Russia for the period up to 2020, which was first adopted by the Russian government in 2003, trends and basic indexes of oil exploration were the following: “In perspective the levels of oil exploration in Russia are mainly defined by the following factors: demand for liquid fuel and world’s prices, development of transport infrastructure, tax conditions, technological achievements and the quality of proven raw materials base. Long-term volumes of oil production in Russia will substantially differ in accordance with socio-economic development of the country. With favourable conditions and under good socio-economic situations, oil production in Russia can reach 490 million tons in 2010 and grow to 520 million tons in 2020. With moderate variation of socio-economic development of the country, the predicted level of oil production in 2020 will be 450 million tons. With negative situation the growth of oil production, it will increase for only 1- 2 years, and after will decline to 360 million tons in 2010 and to 315 million tons in 2020. Nevertheless, with any dynamics of oil production the strategic targets of the industry will be the provision of necessary reserves, gradual increase of production with its stabilization for long-term prospective” (European Commission, 2010).

As the development of the real situation has demonstrated, for the 7 years since the Strategy 2020 was implemented, the production of oil in Russia has grown in 2009 from 421 million tons to 494 million tons. Even the oil prices were very favourable during this period - such growth can not be possible without sufficient reserves.

In November 2009, the new energy strategy of the Russian Federation until 2030 was adopted. The new document was made in accordance with “current trends and new systematic changes of energy development” (IES, 2010). This document shows that oil production in Russia will develop with positive trends. At the first stage (2013 – 2015) it is planned to produce 486 – 495 million tons of crude oil, at the second stage (2020 – 2022) – 505-525 million tons and at the third stage (till 2030) – 530 – 535 million tons. The increase of oil reserves shall be accordingly 1854, 5597 and 5122 million tons (Kozhurbaev et al., 2008).

The project “Strategies of oil industry development in Russia for coming decades” presented by Russian oil experts Kozhurbaev et al., (2008), provided analysis of four possible scenarios of oil production development in the country. According to the authors, “the oil production in Russia can reach 510 million tons in 2010 and then increase to 582 - 590 million tons in 2020. The oil production will reach its maximum in 2021-2025 and will slightly decrease in 2030. In 2030 it could reach 591

million tons (optimistic scenario) and 560 million tons (favorable scenario)” (Kozhurbaev, Eder and Sokolova, 2008).

Conditions to such substantial increase of oil production shall be the increase of geological works (deep drilling, geophysics) by 4 - 5 times.

Because the historical maximum of oil production, of 624 million tons was reached in Soviet Union in 1988 (565 million tons was produced in Russia), the prognosis about the production in 2025 looks very optimistic.

Other specialists consider that it is possible to produce 540 million tons of oil in 2020 and then keep this volume to 2050.

This forecast is based on the calculation of oil production in different basins and oil fields in the country till 2050.

Oil production in the Volga – Ural basin will decrease. Oil production in the East Siberia and Republic Sakha will increase from 17 % to 30 % of the total country’s oil production in 2050. West Siberia will keep the leading position and will be the main oil production region for the long term perspective.

In West Siberia, Volga – Ural, Timan – Pechora, North Caucasus, East Siberia and Republic Sakha could produce up to 19.3 billion tons of crude oil till 2050.

This will be achieved not only at the expense of already proven reserves, but also provable and estimated reserves. In order to maintain the oil production level of 520-540 million tons per year, provable and estimated reserves shall be involved in production after 2020.

In conclusion it is worth mentioning that different estimations and prognosis about oil reserves are based on current geological, economic, technological and political factors.

Calculations provided in this section are done in accordance with real situation at the first decade of the 21st century. Nowadays, the condition of potential reserves of oil in Russia mean they can afford to maintain production of more than 500 million tons annually until the middle of the century.

In order to achieve this figure it is necessary to implement new ways to search and explore new oil fields, improve current technology and technical base, etc. Such measures will require substantial state and private investments and improvement of the current legislation.

If Russia could successfully achieve the above mentioned goals the country will become of great strategic importance in enhancing the world’s energy security. The country still holds substantial oil reserves and with a well-considered approach to oil production, will keep playing a lead in the oil supplying role for decades.

3. Russian Reserves of Natural Gas

According to the International Energy Agency in 2030, the consumption of natural gas will be 90% more than it is now, and gas will be the second most important energy recourse after coal. Thus, the portion of natural gas for the world’s energy structure will increase from 21% in 2005 to 25% in 2030 (IEA, 2011).

Russia holds the world’s largest natural gas reserves, with 1680 trillion cubic feet (Tcf), and Russia’s reserves account for about a quarter of the world’s total proven reserves. The World’s top proven natural gas holders are indicated at Table 3 (EIA, 2011).

Russia is not only the holder of the biggest gas resources, it is also the biggest exporter in the world, contributing more than 40 % of the overall world’s gas export.

Initial summarized gas reserves in Russia are estimated as 248.6 trillion cubic meters, land reserves are 174.8 trillion cubic meters, shelf reserves 73.8 trillion cubic meters. The most substantial reserves are located in West Siberia (132.2 trillion cubic meters), East Siberia (37.9 trillion cubic meters), Far East (14.5 trillion cubic meters), and North-East region of Russia (26.4 trillion cubic meters). The resource base of Russian gas industry is shown in Figure 2 (Energyland.Info, 2011).

Table 3. World’s top proven natural gas holders

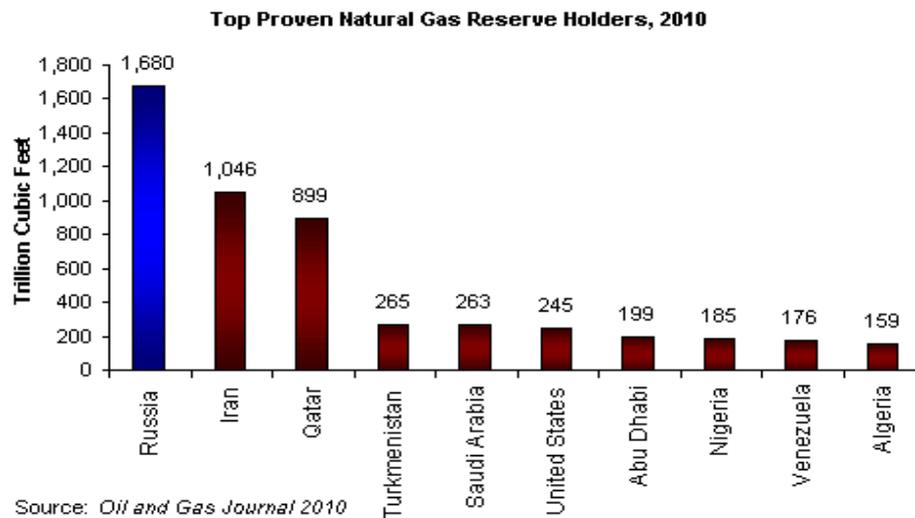
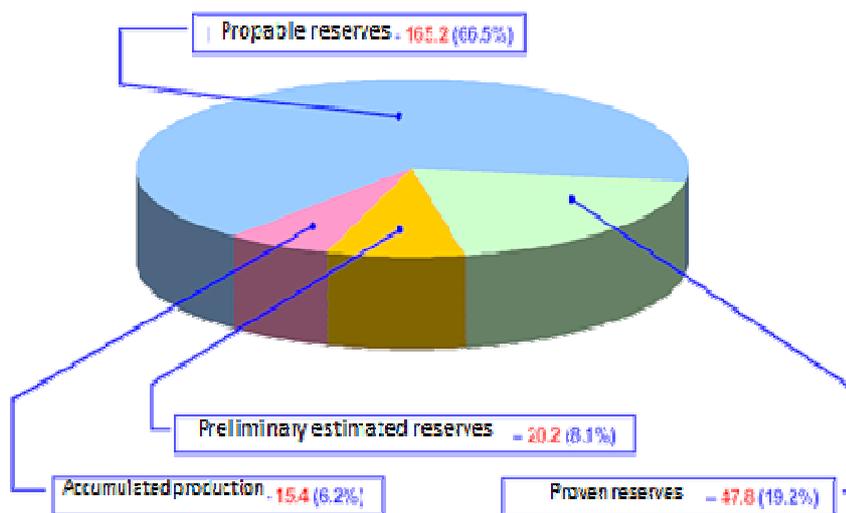


Figure 2. The resource base of Russian gas industry (billion cubic meters)



Russia owns two-thirds of the largest gas fields in the world. The list and reserves of these fields are shown in Figure 3 (Energy Tribune, 2007).

The majority of these reserves are located in Siberia, with the Yamburg, Urengoy, and Medvezhye fields alone accounting for about 45 % of Russia’s total reserves. More than half of all reserves are located in Siberia. Significant reserves are also located in northern Russia. The detailed analysis of each of these fields will be provided below.

Urengoy gas field

The Urengoy gas field in the northern West Siberia Basin is the world's second largest natural gas field after South Pars / North Dom Gas-Condensate field. The gas field has over ten trillion cubic meters in total deposits. It lies in Yamalo-Nenets Autonomous Okrug in Tyumen Oblast of Russia, just south of the Arctic Circle and was named after the settlement of Urengoy. The field was open in June 1966 and production started in 1978. From January 1984, gas from Urengoy field started to be exported to Western Europe.

Figure 3. Largest gas fields in the world

| Rank | Field | Reserves | Location |
|------|-------------------------|----------|------------|
| 1 | North Dome | 1,200 | Qatar/Iran |
| 2 | Urengoy | 275 | Russia |
| 3 | Yamburg | 200 | Russia |
| 4 | Orenburg | 200 | Russia |
| 5 | Shtokman | 200 | Russia |
| 6 | Umm Shaif/Abu el-Bukush | 175 | Abu Dhabi |
| 7 | Zapolyarnoye | 150 | Russia |
| 8 | Kharasevey | 150 | Russia |
| 9 | Bovanenko | 125 | Russia |
| 10 | Medvezh'ye | 100 | Russia |
| 11 | Hassi R'Mel | 100 | Algeria |
| 12 | South Pars | 100 | Iran |
| 13 | Panhandle-Hugoton | 80 | U.S.A. |

Yamburg gas field

The Yamburg gas field is the world's third largest natural gas field located 148.5 kilometers north of the Arctic Circle in the Tazovsky and Nadymsky districts in Yamalo-Nenets Autonomous Okrug, Tyumen Oblast, Russia. The Yamburg gas field was discovered in 1969. Development of the field started in 1980 and production in 1986. The total geological reserves are estimated at 8.2 trillion cubic meters of natural gas (Gazprom Dobycha Yamburg, 2011) from the field started to be exported to Western Europe in January 1984. It continues to produce over two hundred billion cubic meters of gas per year.

Orenburg gas field

This field was discovered in the Volga-Urals region in 1967 and is the largest Russian gas field outside of West Siberia. It had initial reserves of 1.77 trillion cubic meters of gas and is now under production.

Shtokman gas field

The Shtokman field was discovered in 1988 to the east of Murmansk. It lies 555 kilometres from land, in 350m of water. The field covers an area of 1,400 square meters and lies inside the Arctic. The estimated reserves of the field are 3.8 trillion cubic meters, and it will be the main source for the Nord Stream, a gas pipeline to link Russia and the European Union via the Baltic Sea.

Shtokman Development was set up in February 2008 (Swiss registered) and the ownership is divided as follows: Gazprom (51%), Total (25%) and Statoil Hydro (24%). When Phase One is complete, Total and Statoil Hydro are expected to transfer their shares to Gazprom.

Shtokman field was expected to come on-stream by 2013 - 15. The first gas was expected in 2013 and first LNG was expected in 2014. However, in February 2010, the project development schedule was postponed for three years due to a decrease in demand for gas in European markets. Gas production from the field will now start in 2016. The first LNG production has also been postponed until 2017 due to changes in the targeted US LNG market. (Hydrocarbons Technology, 2011).

Zapolyarnoe gas field

Zapolyarnoe gas field was discovered in 1965 and lays at Yamalo-Nenets Autonomous Okrug, 80 kilometers to the east of Urengoy gas field. It has 2.6 trillion cubic meters of gas reserves. It is the fifth largest gas field in the world (Ministerstvo Energeticheskogo Razvitiya Rossiyskoi Federatsii, 2011).

Zapolyarnoe gas field is one of the most successful projects of Gazprom. The field reached the project capacity of 100 billion cubic meters of gas per year in 2004 and this substantially increases the total gas production in Russia.

Kharasavey gas field

Kharasavey gas field is located at the west coast of Yamal peninsula and one third of its area lies under the water. Proven reserves of the field are 1.9 trillion cubic meters, but there are also some areas under water which are not well explored, thus, potentially reserves of the field could be much higher.

Gazprom owns the license for the field's development. The estimated production volume is 32 billions cubic meters per year and all gas will be in LNG form. Considering the specific conditions of the North and the absence of the infrastructure and manpower in Yamal, the LNG plant's production lines and isothermal gas storages will be constructed at the Severodvinsk shipyards on the White Sea and shipped to Yamal by sea.

Bovanenko gas field

Bovanenko gas field is located at the north-western shore of the Yamal peninsula and its area more than 1000 square kilometers. The field holds substantial reserves, ABC1+C2 reserves are estimated as 4.9 trillion cubic meters. The forecasted production of gas will be 115 billions cubic meters per year with an increase of 140 billions cubic meters as the long-term perspective (IAA Regioni Rossii, 2011).

Nowadays, 95 test boreholes are drilled and the gas will come to the Russian gas supply system at the 3rd quarter of 2012. The start of production was put on hold until 2012 because of the global financial crisis and the decreasing demand for gas in Russia and abroad.

Medvezhye gas field

Medvezhye has been the first in a group of gas fields located in Tyumen Oblast (Russia) to begin commercial operation. Over 80 % of its initial reserves have been recovered. The field is now at the final stage of development. But reserves of the field are estimated as 1.5 trillion cubic meters and the field will be developed until 2030 (Gavrilov, 2005).

It is obvious that there are enough gas reserves in Russia to provide internal and export demand. With current reserves it will be enough to produce annually 700 billion cubic meters for 60 to 80 years.

Russia is the world's largest exporter of gas due to several factors.

First, and the most important, is that the country holds the world's largest proven gas reserves, which is equal to almost one-quarter of global reserves. Second, Russia is the world's second gas producer, accounting for one-fifth of global production. Third, domestic demand still allows for gas exports, even Russia's home market consuming around 70 % of the national gas production. Fourth, Russia's wide pipeline network enables the re-export of imported gas from Central Asia.

Two features of Russia's gas exports, from around 15 year ago, will be pointed out: The usage of only one type of transportation (pipeline) and the orientation of the export to one region, Europe (including countries that used to belong to Soviet Union), since the 1940s. During this time, Russia's gas production was more or less stable as the increased production of one major gas field and some smaller ones compensated for the declining production of three major, but old fields. Since the mid 1990s the situation has been changed. The Russian government decided to diversify its gas export to mainly Asia-Pacific countries and the central question for this decade is as to when new major gas fields like the Yamal Peninsula can be brought into production.

According to Energy Strategy of Russia for the period up to 2030 there are few crucial projects in gas industry to be completed till 2030 (Table 4).

The current situation and perspectives of incremental reserved gas capacities, together with proper investments and a favourable situation in domestic and world's markets, allowed gas production to increase to 681 billion cubic meters per year in 2010 (Table 5). It also predicts that by 2020 this will increase to 890 billion cubic meters per year, and by 2030, 910 billion cubic meters/ per year (Kontorovich and Kozhurbaev, 2007). This will be possible due to the implementation of new gas fields.

In order to provide the claimed level of gas industry development, the required increment of proven reserves for the period 2008-2030 will need to amount to 20 trillion cubic meters, i.e. in West Siberia 7 trillion cubic meters, European regions 1.7 trillion cubic meters, East Siberia and Far East 3.3 trillion cubic meters and the Arctic shelf – 14.0 trillion cubic meters (Energyland.Info, 2011).

If so, it will satisfy not only domestic demand for gas and increased gas export to Europe but also new sustainable export directions such as to China, Japan and the USA.

Table 4. Crucial projects of Russia's gas industry until 2030.

| Project | Goals | Lead time | Investments, (Billion USD, (estimated)) |
|---------------------|---|------------------------|---|
| Yamal exploration | Compensation of decreasing volumes at old fields | 2015-2030 | 150 - 170 |
| Shtokman | LNG supply to European and American markets | 2017-2018 (1 stage) | 25 – 30 (1 stage: 12-15) |
| North Stream | Increase stable supply of gas to Europe | 2011 (1 stage) | 12-14 (1 stage: 5-7) |
| South Stream | Increase the stable supply of gas to Europe | 2015-2020 | 34-35 |
| Eastern gas program | Diversification of export, gasification of Siberia and Far East | 2015-2030 | 80-90 |
| Total | | | 560 - 590 |

Table 5. Forecast of gas production in Russia by regions, billion cubic meters

| Region | 2010 | 2015 | 2020 | 2025 | 2030 |
|------------------------------|------------|------------|------------|------------|------------|
| Yamal-Nenets Autonomous Area | 570 | 590 | 634 | 634 | 635 |
| Khanty-Mansi Autonomous Area | 33 | 32 | 28 | 28 | 27 |
| Tomsk region | 7 | 8 | 8 | 8 | 8 |
| European Russia | 40 | 52 | 80 | 88 | 90 |
| East Siberia and Yakutia | 11 | 85 | 115 | 117 | 120 |
| Far East (Sakhalin) | 20 | 23 | 25 | 30 | 30 |
| Total | 681 | 790 | 890 | 905 | 910 |

4. Conclusion

The analysis of Russian oil and gas reserves shows that Russia holds huge potential for oil and gas export not only in usual markets such as CIS countries and Europe, but also to satisfy the demand of fast growing Asian markets in future decades. In order to achieve its goals the government of Russia needs to focus effort on the modernization of the sector and its innovative development. Russia must also overcome structural disproportions, improve its legislative base and strengthen overall control. These goals are ambitious, but achievable. The proper implementation of the Energy Strategy, substantial investment and active geological exploration will allow Russia to hold a stable and considerable place in the worlds market of energy recourses and the world's economic and political arena.

Acknowledgements

The author would like to thank Prof. Liou To-hai from National Chenchi University, Taiwan for his research assistance and comments.

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