Eastern Russia and Northeast Asia: Possible Directions for Energy Exports

Boris G. Saneev
Energy Systems Institute
Siberian Branch of the Russian Academy of Sciences, Irkutsk

Russia's economic and development needs and the country's new geopolitical position necessitate the revision of its priorities in its external economic relations, including its energy policy and cooperation in the energy sector with its neighboring countries. These new geopolitical conditions include, first of all, new economic, political and security realities which emerged after the disintegration of the Soviet Union. Russia lost major ports on the Baltic and Black seas. It encounters major political and economic problems related to its fuel and energy resources transit through the territories of the former Soviet republics. There is also an increasing danger of economic isolation of the Far Eastern region from Russia. Finally, the existing economic and political links between Russia and its Asia-Pacific neighbors are weak and do not reflect the potential economic value of Russia's eastern regions for the future energy security needs and development needs of China, Japan, and the Republic of Korea. These new geopolitical realities make Russia a part of the Asia-Pacific region to a greater degree than was the former Soviet Union.

A comprehensive approach

At present Russia is gradually opening up to economic cooperation and trade links with its eastern neighbors due to both national and international reasons. The external economic relations of Russia with the Asia-Pacific economies, particularly those of Northeast Asia, are extremely weak compared to those with the European countries: 11-12% of the foreign trade volume in Northeast Asia compared to 68-69% in Europe.

Moreover, Russia's links with its eastern neighbors in the energy sector are practically non-existent, despite the fact that Eastern Siberia and the Far Eastern regions produce about 40% of the coal, 21% of the electric power, and 15% of the centralized heat supplies of the national total. Although these regions possess unique reserves of hydrocarbon resources, for the time being there is no large-scale production of oil and natural gas with the exception of Norilsk in the north of Krasnoyarsk krai (5 Bcm a year), the Republic of Sakha (Yakutia), and northern Sakhalin (3 Bcm). In Eastern Siberia and the Far Eastern region oil is produced in commercial scales only in northern Sakhalin (1.5 Mt a year).

The Far Eastern region occupies a very special place among other regions in Eastern Russia (Western and Eastern Siberia) and serves as the" eastern gateway "for the whole of Russia. Traditionally, the Far East has maintained close economic and energy links with both Western and Eastern Siberia that supplied coal, crude oil, and petroleum products. There were also projects under way aimed at the interconnection of electric power systems for parallel operation.

For this reason alone, a comprehensive long-term strategy for the energy sector development that incorporates all the eastern regions of Russia is required. Such a long-term strategy should serve as a foundation for a large-scale energy development program for the Asian regions of Russia that will also incorporate the energy needs and energy security interests of Japan, China, the Koreas, and other countries. On the other hand, the new fuel and energy bases in Eastern Russia will strengthen Russia's own energy security providing vital fuel and energy links among its eastern regions.

In our opinion, a concept or a long-term strategy of energy interaction of Russia and the neighboring countries on the basis of the rapid and large-scale development of energy resources in Eastern Siberia and the Far East should respond to the following key requirements:

- a compatibility with the national energy strategy
- an integrated approach to the fuel and energy resources of Eastern Russia
- flexible scenarios for fuel and energy markets development
- a comprehensive forecast for energy demand in the region and market trends
- energy demand-energy efficiency interaction estimates for different countries.

Even the preliminary estimates given below confirm the expediency of a comprehensive approach to the energy sector development in Eastern Russia, including potential needs and export opportunities related to the Northeast Asian neighbors of Russia. The good news is that new and mutually beneficial ties between Russia and these countries are quite possible due to the complementarity of their interests in the energy sector and long-term energy security needs.

Resources and potential markets

The highest concentrations of explored reserves of hydrocarbons in the region are observed in the fields of the southern areas of the Siberian Platform in Eastern Siberia and the Sakhalin shelf in the Far Eastern region. The initial recoverable reserves (categories A+B+C1+C2) on the Siberian Platform are estimated now at 3,640 Bcm for natural gas and 1,303 Mt for oil, and those on the Sakhalin at 944 Bcm and 433 Mt respectively (Table 1).

Table 1
Resources and reserves of natural gas and oil
(Bcm, Mt)
天然ガスと石油の資源と埋蔵量

Region 地域	Initial potential resources 潜在資源	Reserves in the categories A+B+C1+C2 埋蔵量	Resource Potential in Reserves,% 埋蔵量の中の潜在資源
Siberian Platform (as of 1.01.1995) シベリア台地 1995年1月1日現在			
Total 合計	**43,790 (11,830)**	**3,640 (1,303)**	**8.3 (11.0)**
Krasnoyarskiy Krai クラスノヤルスク地方	**24,940 (6,850)**	**1,200 (779)**	**4.8 (11.2)**
Irkutskaya Oblast イルクーツク地方	**8,420 (2,070)**	**1,100 (261)**	**13.2 (12.6)**
Yakutia (Sakha) ヤクート(サハ)	**10,430 (2,910)**	**1,340 (263)**	**12.8 (8.7)**
Sakhalinskaya Oblast (as of 1.01.1995) サハリン州			
Total 合計	**3,360 (935)**	**944 (433)**	**28.1 (46.3)**
on-shore 海岸	**360 (295)**	**120 (170)**	**33.3 (57.6)**
off-shore 沖合	**3,000 (640)**	**824 (263)**	**27.5 (41.1)**

※左記数字:天然ガス量　　(　)内数字:石油量

There are large explored fields of oil and natural gas within the Siberian Platform and the Sakhalin shelf. Their estimated potential for further increases in reserves provide every reason to believe that a large-scale oil and gas production (80-90 Bcm of natural gas and 50-60 Mt of oil annually) in the area could be possible. This will make it possible to meet the regional demands for hydrocarbon raw materials, including exports to neighboring countries.

Domestic market

Eastern Siberia and the Far Eastern region are large potential consumers of hydrocarbons and petrochemicals. These areas are lagging far behind the western regions of the Russian Federation in using the high-grade fuels, such as natural gas and heavy oil. These fuels share in the total energy supply is between 17% and 25% for various provinces against 70-80% in Western Russia. This negatively affects the costs of energy and leads to high levels of air pollution in many cities and towns in Eastern Russia.

An immediate market for natural gas in Irkutskaya Oblast alone is estimated at 9-10 Bcm a year. A combined immediate demand for natural gas in Eastern Siberia and the Far Eastern region is estimated at 23-25 Bcm, and for crude oil at 28-30 Mt.

The combined capacity of just 4 oil refineries — in Angarsk and Achinsk in Eastern Siberia, and Khabarovsk and Komsomolsk-na-Amure in the Far Eastern region — for refining crude oil amounts to 40 Mt per year.

Markets in Northeast Asia

Natural gas: Japan, South Korea, Taiwan, and also Thailand import natural gas, receiving about 70 Bcm of gas in a liquefied form annually. According to the available forecasts, the natural gas demand of three countries, including Japan, Korea, and China, will reach 108 Bcm in 2000-2005 and exceed 180 Bcm in 2010-2015.

The major portion of increase in the natural gas demand of Japan and Korea will be covered by available long-term contracts with exporting countries. In particular, Japan has long-term contracts for the supply of about 70 Bcm of natural gas and Korea will export 9 Bcm in 2010. In accordance with available estimates, China will not be able to meet a growing demand for natural gas by its own resources. The potential capacity of the Chinese market for Russian natural gas in 2005-2010 is estimated at 10-15 Bcm. Thus, the lower bound for the market capacity of the neighboring countries for Russian natural gas (for the three countries which are the most likely importers of natural gas) in 2010 is estimated at 40-50 Bcm, with capacities of the Korean and Chinese markets being about 25-30 Bcm.

Crude oil: In East Asia only three countries are large-scale producers of oil, including China, Indonesia, and Malaysia. In 1995 the total oil production in these countries amounted to 250 Mt, of which 148 Mt were produced in China, 66 Mt in Indonesia, and 35 Mt in Malaysia.

Japan (262 Mt), Korea (90 Mt), Singapore (20 Mt), Taiwan (33 Mt), China (8 Mt) are large crude oil importers. In China there are no essential reserves to increase oil production. A decrease in oil production volumes is expected in Indonesia and Malaysia. As a

result oil production in these three countries could fall from 250 Mt in 1995 to 230-235 Mt in 2010. The available forecasts demonstrate[1] that the demand for imported crude oil in Northeast Asia could amount to 480-570 Mt in 2010. Based on the achieved volume of imported oil to the region (equal to 414 Mt in 1995) the size of the market for Russian oil could be estimated at 70-160 Mt in 2010.

Production of natural gas and oil

East Siberia and the Far East have a reliable resource base ready for the large-scale use of natural gas and oil in the economy. As has already been mentioned, unique and large fields of oil and natural gas were discovered on the Siberian platform. They can form a base for large-scale production of hydrocarbons.

These fields are Yurubcheno-Tokhomskoye (oil) and Sobinskoye (gas) in Krasnoyarskiy Krai, Verkhne-Chonskoye (oil) and Kovyktinskoye (gas) in Irkutskaya Oblast; Talakanskoye (oil), Srednebotuobinskoye (oil, gas), and Chayandinskoye, Srednevilyuiskoye, Srednetyunguzskoye (gas) in Yakutia. These resources could play an important role in the supply of oil refineries with raw material, and in conversion of industrial and residential/commercial consumers of the region to natural gas.

Kovyktinskoye natural gas and gas condensate field, being the largest on the Siberian platform and occupying an advantageous geographical position, provides the basis for the sizeable export of natural gas to the countries of Northeast Asia. The project work on the field has already started. The export gas pipeline Irkutskaya Oblast—Mongolia—China can also receive gas from the fields in Yakutia and in the future from the fields in the south of Krasnoyarsk krai.

Verkhnechonskoye field can initiate the exports of oil from Eastern Siberia at the initial stage, since at present it is the largest field among those prepared for commercial development. Additional amounts of oil can be supplied from the fields in Yakutia. The Yurubcheno-Tokhomskoye field could considerably increase the export oil potential after completion of its prospecting. Potential future production volumes for hydrocarbons from the explored largest fields on the Siberian Platform could make up more than 30 Mt of oil and more than 60 Bcm of natural gas (excluding northern areas of Krasnoyarskiy Krai) in 2010-2015 (Table 2).

Potential future production volumes for hydrocarbons from the most prospected part of the Sakhalin shelf could also amount to 30 Mt a year of oil and more than 40 Bcm of natural gas within the same time interval (Table 2).

Table 2
Potential Production Volumes of Hydrocarbons
炭化水素物の潜在生産量

	2005	2010	2015	2020
Oil, million tons 石油(百万トン)				
Krasnoyarskiy Krai クラスノヤルスク地方	0.5-3	11-12	13-15	16-20
Irkutskaya Oblast イルクーツク州	3-5	8-10	10-12	12-15
Yakutia ヤクート	0.5-1	4-5	6-7	6-8
Total 計	4-9	23-27	29-34	34-43
Gas, Bcm ガス(十億㎥)				
Krasnoyarskiy Krai クラスノヤルスク地方	8-10	12-15	19-25	25-35
Krasnoyarskiy Krai 's southern areas クラスノヤルスク地方南部	3-5	7-9	14-16	16-25
Irkutskaya Oblast イルクーツク州	7-9	27-30	28-35	30-40
Yakutia ヤクート	2-3	13-14	17-19	17-19
Total 計	17-22	52-59	64-79	72-94
Total, excluding Krasnoyarskiy Krai 's north クラスノヤルスク地方北部を除く計	12-17	47-53	59-70	63-84
Oil, million tons 石油(百万トン)				
Sakhalin shelf サハリン大陸棚	15-17	27-30	24-28	16-21
Gas, Bcm ガス(十億㎥)				
Sakhalin shelf サハリン大陸棚	13-15	24-27	29-33	39-44

Prospects for gas and oil exports

At present the economic authorities and research institutions in Russia have worked out and extensively discussed several different options for natural gas exports from Eastern Russia to Northeast Asia. It is important to underline that these options, as a rule, are not coordinated with one another in prices, volumes, time of commercial production of natural gas and supply options for exports as well as domestic use.

As a result, Russia bears huge material losses and suffers a loss of initiative in international negotiation processes. At the same time, it seems that these processes

[1] APEC. Energy Demand and Supply Outlook. Energy Balance Tables. Asia Pacific Energy Research Center, Tokyo, 1998. - 102 p.

should be controlled at the federal level and coordinated at the interregional and local levels. Indeed, a complex nature and the costs of the large-scale energy projects require a comprehensive assessment of their consequences for international cooperation and domestic needs of the entire country, its regions, and the federal relations.

The Energy Systems Institute has performed a comprehensive evaluation of different projects to do with the Russian natural gas export to the neighboring countries, and the formation of the gas pipeline system in Eastern Russia. This comprehensive evaluation of different options for natural gas exports demonstrates the rationality of the following stages in forming the regional gas pipeline network, including the export gas pipelines:

Stage 1 (2000-2010): formation of the regional gas pipeline network in Eastern Siberia and construction of the main export gas pipeline, Irkutsk Oblast—Mongolia—China—Korea. A proposed resource base includes the Kovyktinskoye gas and gas condensate field, natural gas fields in Western Yakutia, and southern areas of Krasnoyarskiy Krai.

Stage 2 (2010-2015): formation of a regional gas pipeline network in Western Siberia and the construction of the main export gas pipeline, West Siberia—East Siberia—Northeast Asian countries (China, Korea). A proposed resource base includes gas fields in Western and Eastern Siberia.

Formation of the regional gas pipeline network in the Far East and the construction of the main export gas pipeline to Japan and other countries of Northeast Asia (North Korea, South Korea). A proposed resource base includes gas fields of Central Yakutia and the Sakhalin shelf.

Stage 3 (2015-2020): creation of the unified gas pipeline system in the East of Russia and Northeast Asia (Figure 1). A comprehensive evaluation of different options for oil exports also shows that 30-35 Mt of oil can be supplied from Eastern Russia to Northeast Asia in 2010-2015.

Domestic prices and the exports

The efficiency of supplying large volumes of gas and oil from Eastern Russia to the Northeast Asian countries is determined by many factors. There are more than ten new projects for natural gas and oil supply to these countries. Therefore, an access to the gas markets of the Northeast Asia countries is possible, if the projects on natural gas and oil supply to these countries from Siberia and the Far East are superior to the potential competing projects in economic characteristics.

The available estimates demonstrate that in the years 2010-2015 the natural gas price on the internal Chinese market will amount to $140-160 per 1,000k . On the Pacific coast of Japan the natural gas price is estimated at $180-200 per 1,000k . To be competitive on the Asian natural gas market the domestic price of gas from Eastern Siberia and the Far Eastern region should not exceed $70-75 per 1,000k . Only in this case, considering transport tariffs, will the natural gas export projects linked to the Siberian Platform and the Sakhalin be reasonably effective. Moreover, the internal rate of return should be no more than 15-16 %.

The forecasts made on the possible dynamics of the world prices of fuel and energy resources on the Northeast Asian markets show that the dynamics of oil prices will most probably be about $200-205 per metric ton in 2005-2010, and about $220-225 per metric ton in 2015-2020. The estimates of the economic efficiency of different options of the oil supply from Eastern Siberia to Northeast Asia show that if oil price is $220 per metric ton the exports to China and Korea will be highly efficient. Construction of the export oil pipeline with an annual capacity of 20-25 Mt will make the project reasonably efficient if the internal rate of return is above 15% and the oil price on domestic market is below $175-180 per metric ton.

Development of the hydrocarbon resources in Siberia and the Far East will increase the share of high-grade fuels in the fuel balance of these regions, and, hence, will radically improve the environmental situation in urban and industrial centers of these regions by substituting coal with natural gas. The efficiency of the hydrocarbon resources development projects in these regions could be additionally improved, if both the basic and associated components such as helium, ethane, other hydrocarbon gases, and gas condensate are utilized.

Finally, the estimates obtained for individual regions reveal that the export-oriented energy development projects in these regions could provide about a 10-15% increase in receipts to the regional budgets and bring about an improvement of economic characteristics.

Prospects for electric power exports

A large electric power production base created in Eastern Siberia and the Far East accounts for about 22% of the total national installed capacity of power plants, 21% of the combined electric power production, and 15% of the national centralized heat output. Three electric power systems of Krasnoyarskiy Krai, Irkutskaya Oblast, and Amurskaya Oblast have excess power supply. In Irkutsk power system 15-16 billion kWh of electricity will remain unutilized even in 2005-2010.

After the completion of the Boguchanskaya hydropower plant (3 million kW installed capacity) and with the Berezovskiy-1 power plant fully operational (6.4 million kW) about 10-15 billion kWh additional electric power will be excessive in the Krasnoyarsk electric power system.

This excess power from Irkutsk and Krasnoyarsk regions together with the underutilized power in the electric power systems of Chitinskaya Oblast (after completion of the Kharanorskiy power plant) could reach 25-30 billion kWh. This could further rise up to 40-50 billion kWh with the construction of a cascade of the Uchursk hydropower plants in Yakutia.

High-voltage (HV) transmission lines to China, Korea, the Far Eastern domestic markets, and even Japan could transmit a large volume of electric power generated in Eastern Russia. Installation of the HV transmission line from Eastern Siberia — Far East to Northeast Asian countries will allow the integration of the interconnected electric power systems of Siberia and the Far East for

parallel work. This will improve also the reliability of the power supply to consumers in these regions and create proper conditions for formation of a regional electric power system in Northeast Asia.

Preliminary calculations of the economic efficiency of electric power exports from Eastern Siberia are quite convincing, considering that the forecasted production price is likely to be about 2.5-3.5 cents per kWh. This may prove to be absolutely competitive price at the regional electric power markets, considering that prices in 2005-2010 are estimated at 7.0-7.5 cents per kWh in China, 8.3-8.5 cents per kWh in Korea, and 14.0-16.0 cents per kWh in Japan.

Conclusions

The new situation formed in Russia after the disintegration of the Soviet Union determines the strategic value of the eastern geopolitical direction for it.

The fuel and energy potential of the Asian regions of Russia, Eastern Siberia and the Far Eastern region in particular, should be considered as an important tool for deepening the economic integration of Russia and the countries of Northeast Asia.

A complex long-term strategy for the energy interaction of Russia and the NEA countries, and mechanisms for its implementation should be worked out on the basis of rapid and large-scale energy development in the Asian regions of Russia.

This strategy can be elaborated only by joint efforts of research and design institutes of the concerned countries, with the constant attention and support of the national governments, regional authorities, banks, etc., and in close cooperation with fuel and energy companies.

The Energy Systems Institute (SEI) belongs to the Siberian Branch of the Russian Academy of Sciences. It is a leading energy center in Eastern Russia ready to take an active part in international projects on the strategy for energy co-operation in Northeast Asia.

東ロシアからのエネルギー輸出の展望（抄訳）

エネルギーシステム研究所　ボリス・G・サニーエフ

ロシア経済とその発展、および新しい地政学的位置を考えるためには、エネルギー政策とエネルギー部門での近隣諸国との協力を含む対外経済関係の優先順位を見直す必要がある。

現在、国内外の理由から、ロシアは東側にある近隣諸国との経済協力や貿易関係を徐々に開きつつある。ロシアのアジア・太平洋諸国、特に北東アジアとの対外経済関係は、欧州諸国と比較して非常に弱く、対欧州貿易額がロシアの総貿易額の68～69%にも上るのに対して、対北東アジアは11～12%でしかない。

さらに、東シベリアと極東地域がロシア全国の石炭の40%、電力の21%、熱供給の15%を生産しているにも関わらず、エネルギー部門における東側の国々とのつながりは全く存在しない。

ロシア東部地域全体のエネルギー部門開発のための包括的な長期的戦略が必要である。こういった長期的戦略は、ロシアのアジア地域のための大規模エネルギー開発プログラムの基礎となるものである。また、これらの開発プログラムは日本、中国、朝鮮半島などのエネルギー需要とエネルギー安全保障を組み込むのに役立つ。一方、ロシア東部の新たな燃料及びエネルギー基地は、その地域に不可欠な燃料及びエネルギーの連携をもたらし、ロシア自身のエネルギー安全保障を高めることになる。

シベリア台地やサハリン大陸棚には既に探査済みの大規模な石油・天然ガス田がある。これらの埋蔵量を推計すると、この地域で大規模石油・ガス生産（年間で天然ガスが800-900億k 、石油が500-600万トン）が可能であるとみられる。これで、近隣諸国への輸出を含め地域内の炭化水素原材料需要を満たすことが可能となろう。

東シベリアと極東地域は炭化水素および石油化学製品の巨大な消費者となる可能性があることも明記しておく必要があろう。天然ガスや重油といった高級燃料の利用に関しては、この地域はロシア連邦の西側地域にはるかに遅れをとっている。総エネルギー供給に占めるこれらの燃料の割合は、ロシア西部の70～80%に対して、その他の地域は17～25%となっている。このことがエネルギーのコストにマイナスの影響を及ぼし、ロシア東部の大気汚染にもつながる。

現在、ロシアの経済関係当局や研究機関は、それぞれにロシア東部から北東アジアへの天然ガス輸出についていくつかのオプションを検討し、計画を立案している。しかし一般的には、これらのオプションは価格、量、商業生産の時期、輸出及び国内用の供給オプションといった点でそれぞれの組織が別々に考えており、調整はなされていない。結局ロシアは物質的にも損失を抱えている上に、国際的な交渉の場でもイニシャチブを失っている。また、このようなプロセスは連邦レベルで管理し、地域間や地元のレベル