

KoRus PNG - Pipeline Natural Gas For Korea

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Introduction

The KoRus Natural Gas pipeline Project is a proposed 2,300 Kilometer pipeline from Sakhalin Island in Russia to the Republic of Korea. The project has been initiated by FSI Energy of Bryn Mawr, Pennsylvania, USA, in cooperation with the U.S., ROK and DPRK governments and in partnership with several corporations in the Republic of Korea and the Russian Federation. The economic and political benefits of the KoRus pipeline will reverberate throughout Northeast Asia.

Pipeline Route

The KoRus Natural Gas Pipeline will connect Sakhalin Island in Eastern Siberia to the Republic of Korea (ROK) by way of the Democratic Peoples Republic of Korea (DPRK). It will provide new markets for Russian natural gas. Currently, the ROK imports over 85 % of their

energy¹, and natural gas is its fastest growing fuel source. Virtually all of the ROK's natural gas is currently imported as liquefied natural gas (LNG) from Indonesia, Malaysia, Brunei, Qatar, Oman and others². Pipeline natural gas (PNG) is less expensive to process and transport, and therefore potentially cheaper than LNG. Developing pipeline gas to the ROK will free up LNG supplies to be sent to other markets in the world.

Sakhalin Island, Russia is 2,300 kilometers from the Korean markets. Significant amounts of Sakhalin gas are controlled under production sharing agreements by multinational oil companies including ExxonMobil, Royal Dutch Shell, ChevronTexaco, BP, Mitsui and others³. Rosneft, the largest State owned oil company is the dominant Russian participant.

The proposed route of the KoRus pipeline is from Lazarev on the Russian mainland southwest to Khabarovsk, then south to Vladivostok. From Vladivostok, the pipeline will cross into the DPRK, and continue south along an existing railroad right of way through Wonson to the DMZ and border with the ROK. Since this railroad transitway crosses the Chiuga-



Rhyong volcanic field and rift zone⁴, the exact routing of the pipeline will require further study. This railroad right of way is currently being improved under a recent agreement among Russia,

¹ Korea Energy Economics Institute, Fourth Quarter 2002 Energy Outlook, Seoul Korea

² Korea Gas Corporation, Report to GIIGNL General Assembly Meeting, Nagoya, Japan, October 2001

³ Sakhalin related web sites; www.sakhalin1.com, www.sakhalinenergy.com, www.rosneft.ru

⁴ Wm. Lettis and Associates, Inc. Hazard Evaluation for KoRus Pipeline, March 6, 2003

the DPRK and ROK to reconnect the railroad from the ROK through to the Trans Siberian Railroad and on to Western Russia and Europe.

The ROK is an excellent market for natural gas and is reachable by land. However, approximately 600 kilometers of the pipeline will transit the DPRK. This political challenge has been a significant obstacle to building a Russia – ROK pipeline. FSI has an agreement with the DPRK for this transit, providing rights and guarantees to KoRus Pipeline Development Co.

The DPRK's energy needs are profound. Gas could be the DPRK's least costly and cleanest source of energy. Gas fired combined cycle generation, which can be constructed quickly and operated cleanly, could provide needed electricity to the DPRK, and in particular to the free trade zone in Gaesong. It is a cleaner, faster and cheaper form of energy for the DPRK than any alternative form of electric power, including nuclear. The DPRK is motivated to allow the construction of a pipeline through their territory. They need access to energy, but lack the resources to build a project such as this on their own. This pipeline is attractive to Russia, the DPRK, the ROK and the United States for numerous strategic reasons. There is growing support for KoRus from numerous constituencies, including those within the ROK government.

Participants

FSI Energy of Pennsylvania, USA, along with ROK engineering and gas consuming companies have formed the KoRus Pipeline Development Company to develop the pipeline. These companies bring complimentary experience, skills and relationships that assure the successful completion of this major new energy resource for northeast Asia. FSI has a Memorandum of Understanding regarding this pipeline development with Hyundai Corporation of ROK, and has preliminary agreements with other ROK gas consumers. Together we represent sufficient gas demand to make the project economically viable. We appreciate the invitation to

present the KoRus Pipeline to the Natural Gas Society of Korea, which represents a broad cross section of Korea gas consumers.

FSI has experience developing and financing major energy projects with industrial partners in the United States, Europe and Asia. These include over 700 MW of gas fired cogeneration, air separation and energy efficiency projects. FSI has strong relationships in Russia, the DPRK and ROK. FSI's relationship with the DPRK provided the basis for negotiating and executing the agreement with the DPRK that provides FSI with an exclusive right to transit the DPRK for purposes of natural gas transmission.

FSI's relationships in Russia provide the basis for negotiating and involving major Russian energy companies in this effort. Russian energy companies are looking for markets for their Siberian gas, and this transmission pipeline provides economic access to developed markets for natural gas in Asia. FSI is already involved in Korea operating a combustion improvement technology with LG-Caltex Corporation.

There are several other participants in studies for the KoRus project. The Russian Federation Ministry of Transportation and the Federal State Educational Institution of the State Naval University in Vladivostok will provide the lead for the Russian portion of the study. Ace Engineering of Seoul will coordinate the ROK and DPRK portions of the study. Wm. Lettis and Associates, Inc., an experienced US geological engineering firm will provide hazards evaluation for the total project along with FSI. Pipeline engineering will be provided by US and Korean engineering firms.

Sakhalin Gas Supply Overview

| <u>Project/Ownership</u> | <u>Operator</u> | <u>Reserves</u> | <u>Fields, Water Depth</u> |
|-------------------------------|-----------------|---------------------|---|
| <u>Sakhalin 1 Project *</u> | | | |
| Exxon Mobil 30% | Exxon Mobil | Oil, mm Tonnes: 340 | Chaivo, 30 - 50 Meters |
| Sodeco 30% | Exxon Neftegas, | Gas, 485 BCM | Arkutun-Dagi, 30 - 50 Meters |
| ONGC 20% | Limited | | Odoptu, 30-50 Meters |
| NK Rosneft 20% | | | |
| <u>Sakhalin 2 Project **</u> | | | |
| Shell 55% | Shell | Oil, mm Tonnes: 140 | Piltum-Astokhskoye |
| Mitsui 25% | Sakhalin Energy | Gas, 550 BCM | Lunskoye |
| Mitsubishi 20% | Investment Co. | | |
| (Diamond Gas Sakhalin) | | | |
| <u>Sakhalin 3 Project ***</u> | | | |
| Exxon Mobil 33.3% | | Oil, mm Tonnes: 624 | Kirinsky Block, 300 Meters |
| Texaco 33.3% | | Gas, 730 BCM | |
| NK Rosneft 33.3% | | | |
| Exxon Mobil 66.6% | Exxon Mobil | Oil, mm Tonnes: 70 | East-Odoptu, 500 Meters |
| NK Rosneft 33.3% | | Gas, 30 BCM | |
| Exxon Mobil 66.6% | Exxon Mobil | Oil, mm Tonnes: 97 | Ayashsky, 500 Meters |
| NK Rosneft 33.3% | | Gas, 40 BCM | |
| <u>Sakhalin 4 Project ***</u> | | | |
| British Petroleum, Rosneft | | Gas, 100 BCM | Astrakhanovskaya offshore. 30 Meters |
| <u>Sakhalin 5 Project ***</u> | | | |
| NK Rosneft 51% | NK Rosneft | Oil, mm Tonnes: 600 | East Shmidt Ovs kaya, |
| British Petroleum 49% | | Gas, 600 BCM | 140 meters |
| <u>Sakhalin 6 Project ***</u> | | | |
| Petrosach, Rosneft | | Oil, mm Tonnes: 300 | Border shelf sector |

*Source: Sakhalin 1 Consortium (www.sakhalin1.com/em/)

** Source: Sakhalin Energy Investment Company, Ltd.

*** Source: Rosneft (www.Rosneft.Ru)

ROK Benefits

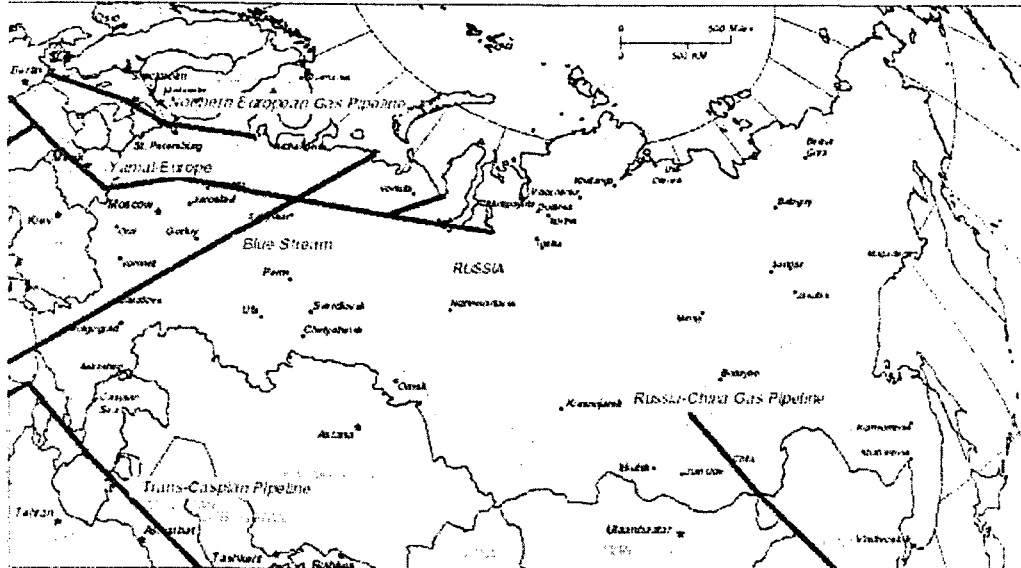
South Korea will be the greatest beneficiary of the KoRus pipeline. They will have a new source of natural gas supply that is both more elastic and more economical than LNG delivered by ocean shipping. The pipeline supply of natural gas is easily expandable as demand dictates, and is less capital intensive than LNG. The KoRus pipeline along with the recently reconnected rail system will provide one more tangible form of integration between the Koreas. South Korea is interested in eventual reunification with North Korea, but that will be impossible unless the economy of North Korea can be significantly improved. Energy integration will provide increased security for both Koreas. The potential for armed conflict is greatly reduced when countries rely on each other for essential resources. North Korea will not generate transit tariffs that provide needed energy supplies unless they provide gas to South Korea. Likewise, South Korea needs the economic supplies of gas that KoRus will provide.

European and Russian Gas Pipeline Experience

Russia has an extensive network of domestic pipelines as well as international pipelines linking it to export markets. Three pipelines, the Brotherhood (*Bratsvo*), Progress, and Union (*Soyuz*), deliver gas to Europe via Ukraine. A fourth pipeline, the Yamal, transits Belarus to reach European markets. A fifth, the Northern Lights, transits both Belarus and Ukraine en route to Europe. Gas markets in Finland are served by the Volga/Urals-Vyborg pipeline. A new pipeline slated to serve markets in Turkey via the Black Sea, the Blue Stream Pipeline, is currently under construction.⁵

⁵ Energy Information Administration, "Country Analysis Brief: Russia," www.eia.doe.gov (October 2001).

Figure 45. Proposed Natural Gas Export Pipelines from Russia



Source: F. Trafalgar, "Boom for Russia's Gas-Export Pipelines," *The Russia Journal* (November 23-29, 2001), p. 8

Western Europe contains less than 5% of the world's natural gas reserves, but consumes 17% of the world total gas demand, setting a precedent for countries and regions relying on pipeline networks for a significant amount of their primary energy needs with great reliability. Currently Europe imports 40% of their natural gas, but the import percentage is forecast to rise to 70% by 2020.⁶ Worldwide, gas reserves to production ratio stands at 60 years, providing assurance of supply.⁷

Europa (2002) Communication 488 calls on the European Parliament to adopt a directive concerning security of gas supply to assure:⁸

- Supply continuity
- Guarantee adequate stocks

⁶ Europa: The European Union On-Line, Energy: Internal Market in Energy: www.europa.eu.int/scadplus

⁷ BP p.l.c, BP Statistical Review of World Energy 2001 (London, UK, June 2001)

- Diversify supplies
- Provide incentives for diversification
- Provide for failure of single largest source
- Develop internal markets and cross border cooperation.

Chinese Market Considerations

Natural gas provided 23 percent of world energy demand in 1999 but in China only 3 percent of energy demand was met by gas. Natural gas consumption in China is projected to increase by 10 percent per year from 1999 to 2020, raising the natural gas share of China's energy consumption to 9 percent by 2020.⁹ This increase in demand in China will have a significant impact on markets throughout Asia, but it provides impetus for Korea to segregate its supply sources and contracts to assure dedicated supply for the Korean peninsula. One notes that the proposed Irkutsk pipeline is referred to in the public press as the Russia – China Pipeline. This begs the question, “How much gas will be left for the Korean market after the voracious Chinese demand has been satisfied?”

Environmental concerns in China are prompting movement toward gas and away from coal and oil. Energy security concerns are promoting the development of domestic gas supplies and the expansion of China's gas infrastructure. In early 2001, China's State Council approved a huge, \$12 billion project to develop gas reserves in the remote western part of the country and move the gas east by pipeline to Shanghai and other Yangtze Delta cities. This created the longest single gas pipeline project in history, and caused many western observers to question the economics of such a pipeline.

⁸ Europa: The European Union On-Line, Energy: Internal Market in Energy: www.europa.eu.int/scadplus

⁹ Energy Information Administration, “Country Analysis Brief: China,” www.eia.doe.gov (October 2001).

While China is promoting the expansion of domestic gas supplies, the development of an LNG import facility in Guangdong province is also proceeding. BP Amoco won the right to build the terminal but not necessarily the right to supply LNG to the facility. The supply contract for Guangdong is rumored to be the lowest price ever quoted for long term supply of LNG.

Korean Gas Market

The ROK has a well developed existing natural gas distribution system. In 1999, they consumed 739 billion cubic feet (bcf), or 20,700 million cubic meters (mcm) of natural gas¹⁰. The ROK will consume an estimated 959 bcf, or 27,200 mcm of natural gas in 2003.¹¹ ROK gas consumption is increasing at an estimated rate in excess of 10% per year, or about 2,700 mcm per year.¹² Over the last decade, ROK natural gas consumption has increased at over 10% per year. Currently, this is supplied as LNG, primarily from Malaysia, Indonesia, Qatar, Oman and Brunei under long term commitments.

In the ROK significant amounts of new gas fired generation have been announced or are under construction. This capacity will be fueled by natural gas and will again increase gas demand. Since pipeline natural gas will be cheaper than LNG, it is reasonable to assume that electricity growth will also be fueled by pipeline natural gas rather than LNG. This could add at least 1 bcf / day, or 28 mcm / day of gas over that same 10 year period. Thus, a total demand of approximately 10 billion cubic meters (bcm) per year in 2006, growing to 30 bcm in 2015 is expected to be delivered to ROK. This does not include additional demand from North Korea.

Technical Aspects of the Pipeline

Preliminary analysis indicates that a 42 inch pipeline would yield the best project economics. This size pipe would transport between 10 and 15 BCM per year as currently

¹⁰ US Department of Energy, Energy Information Agency, www.eia.doe.gov, March 14, 2003

¹¹ Korea Energy Economics Institute, Fourth Quarter 2002 Energy Outlook, Seoul Korea

designed, and capacity could be increased by adding compressor capacity. This is estimated to cost \$3.5 billion depending on the source and the route¹³. A number of variables will affect the final construction cost, such as terrain, labor and material supply considerations. Conceptual engineering will resolve many of these issues.

Alternatively, if future demand growth warrants additional capacity, a parallel pipeline could be built. Its size would be based on demonstrated demand. If demand grows as expected, or if an extension of the Korean gas distribution system is connected to Japan, then the parallel pipeline could be as large or larger than the initial pipeline.

Conceptual Engineering

The overall engineering study schedule will require approximately 26 weeks. Satellite Map Analysis for Route Planning will require approximately 6 weeks. The detailed route layout can begin after approximately 4 weeks. Detailed Layout will require approximately 12 weeks in Russia. Russia will have 5 crews working on detailed layout, and will require the longest of any section. Both ROK and DPRK segments will be completed in less time than the Russian one. Pipeline engineering and cost analysis can begin after approximately 6 weeks of detailed layout and will require 10 to 12 weeks in total.

Political Considerations

The KoRus Natural Gas Pipeline (KoRus) will serve both regional and global interests, at a time when its political and strategic benefits are urgently needed. Regionally, Northeast Asia requires the capability to redistribute its energy assets from asset rich Siberia to demand dense Korea and Japan.

¹² Korea Energy Economics Institute, Fourth Quarter 2002 Energy Outlook, Seoul Korea

¹³ FSI Energy estimate

Markets for both Russian and American owned gas in Siberia that has heretofore been “stranded” will be developed. The governments of the DPRK, ROK, Russia and USA support KoRus because it will provide a stabilizing influence serving the political, economic and energy needs of the entire region. KoRus is urgently needed. It will supply gas to fuel the energy growth of the ROK and Japan, the two largest importers of LNG in the world, and will promote peace through economic development.

Conclusion

The KoRus pipeline provides multiple benefits for the region:

Russia –

- New market for Siberian natural gas
- Strengthens Russia’s relationship with both Koreas
- Improves Russia’s trade balance with ROK

ROK –

- Provides improved relations with Russia
- Provides improved relations with DPRK
- Provides supply diversity for ROK natural gas industry

DPRK -

- Provides trade relationship with ROK, improves political relationship with ROK
- Provides employment for DPRK workers
- Provides foreign exchange for DPRK
- Improves electricity supply for DPRK

The KoRus Pipeline project is essential to the economic and political security of Northeast Asia. It is the least expensive gas supply option. It promotes regional security, energy and economic integration, as well as providing an environmentally friendly fuel for growth.