Siberian Oil Pipeline and Its Implication for Northeast Asia[1]

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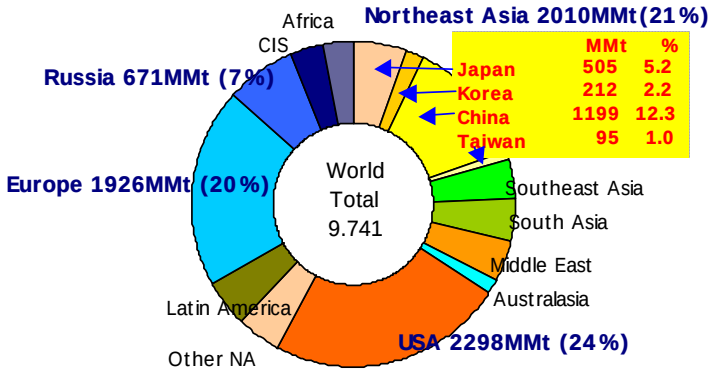
1. Energy Outlook of Northeast Asia

Today, Northeast Asia ranks as one of the three major energy markets of the world together with North America and Europe; the sub-region shares more than 20% of the world energy consumption. Asian energy consumption is expanding rapidly driven by high economic growth of China. In 2003, the world energy consumption grew by 2.3% while China recorded 13.6% increase, other Asia 2.1% and the rest of the world only 1.4%. Same trend is seen in oil consumption; while the world average growth was 2.1%, China recorded 11.5%, other Asia 1.7% and the rest of the world only 1.3%. Thus, securing stable energy supply has become an important policy objective of Asia in sustaining its economic development. In this section, we briefly go through characteristics and outlook of energy in Northeast Asia.

Figure 1: World Energy Consumption



Source: BP Statistical Review of the World Energy 2004

In Northeast Asia, energy demand will be moderately leveling off in Japan, as its economy has reached a matured stage and its population will start decreasing within several years. Korea recorded substantial increase of energy consumption in 1990s, but it may become moderate in the coming years as its economy will be shifting to hi-tech, less-energy-use structure. In contrast, China will continue rapid increase in energy consumption driven by high economic growth. With vast land and big population, China's taking-off takes time and consumes energy. Then, increase of China's energy consumption in absolute volume will be also huge. IEA forecasts in its world energy outlook 2004 that energy consumption of Asia will overtake that of North America in 2020s.

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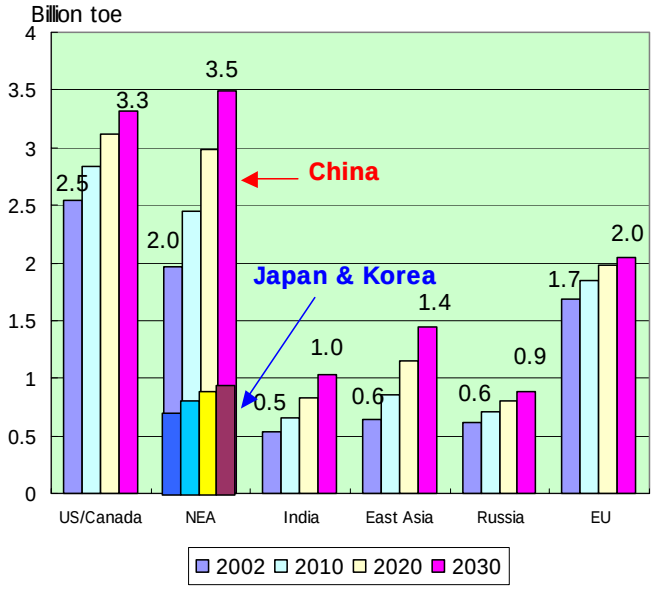
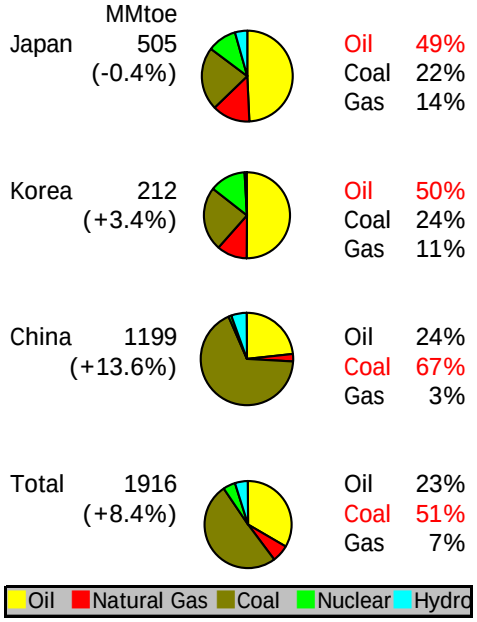
[1] Gist of this paper was presented at the ICEED 32nd Annual International Energy Conference held on April 18-20, 2005, in Boulder, Colorado. Power point presentation is listed on IEEJ homepage. Please visit http://eneken.ieej.or.jp

Figure 2: IEA World Energy Outlook 2004



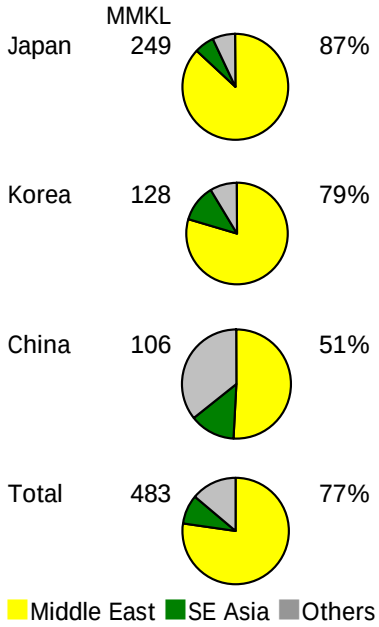
Regarding the energy structure, Japan and Korea heavily depend on imported energy with oil and gas playing major roles. In contrast, coal dominates in China. China is the world largest coal producing country and hence China's import dependence is only 10%. But heavy use of coal is causing serious environment problems in the country. Although oil shares only one quarter of the country's energy use, its oil import is increasing rapidly. One serious concern is that the region as a whole depends upon the Middle East over three quarters of the crude oil import.

Figure 3: Primary Energy Supply of Northeast Asia (2003)



Source: BP Statistical Review of the World Energy 2004

Figure 4: Crude Oil Import Sources of Northeast Asia (2003)



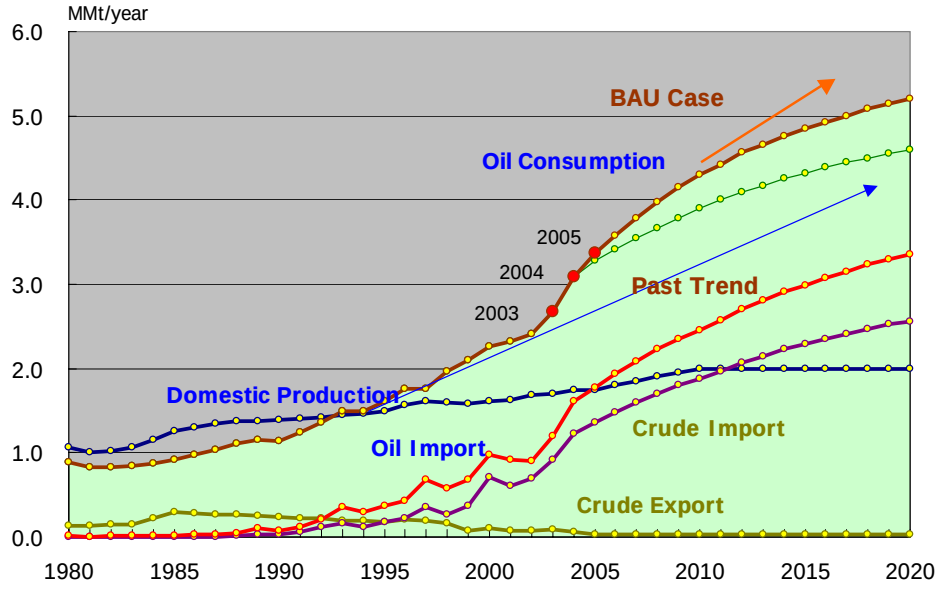
Source: National statistics of sited countries

China's oil consumption exceeded that of Japan in 2003, to make her the world second largest oil consuming country after the United States. It jumped another 35% in 2004. In China, three quarters of petroleum products (excluding petrochemical feedstock) are consumed in the transportation sector. Oil demand is expanding fast reflecting high economic growth and rapid increase of motor vehicles. Given that the current trend might continue, a business as usual (BAU) case simulation run by IEEJ indicates that China's oil consumption would reach 590 million tons by 2020. With energy saving efforts, slowing down of economic growth[2] and improvement in mileage, general forecast such as reference cases of IEA and IEEJ suggests over 500 million tons in 2020.[3] On the other hand, China's domestic oil production will be leveling off as major oil fields like Daqing are maturing, despite intensive exploration efforts and several sizable findings. As a balance, China's oil import may more than double in the next two decades. IEA's alternative scenario says that, enhancing energy conservation and introducing alternative energies, oil demand could be curbed by 10%. Then, China's oil import will still double in the same period. Figure 5 shows author's forecast of major indicators.

[2] China recorded real GDP growth of annual 8.4% for 1971-2002. While Chinese politicians advocate to quadruple real GDP in two decades from 2000 to 2020 and its economy is running at around annual 9% during the first half of 2000s, IEA assumes in its Outlook 2004 that Chinese economic growth would slow down to 6.4% for 2002-2010, 4.9% for 2010-2020 and 4.0% for 2020-2030.

[3] IEA's reference scenario projects 503 million toe for 2020 and 606 MMtoe for 2030, while alternative scenario 464 MMtoe for 2020 and 559 MMtoe for 2030.

Figure 5: Petroleum Outlook of China



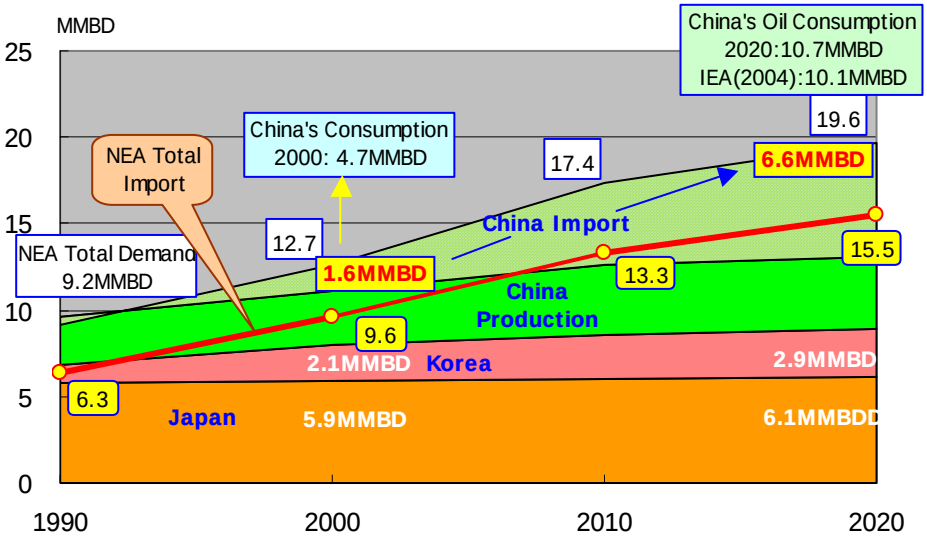
References: IEA World Energy Outlook 2004

IEA Monthly Oil Market Report

Koichi Ito "Asia/World Energy Outlook" (IEEJ, March 2004, http://eneken.ieej.or.jp)

In summary, oil consumption of Northeast Asia will reach almost 20 million barrels per day by 2020. Net oil import will exceed 15 million barrels per day, increasing five million barrels per day from now. This is something like that another Japan, the world second largest oil importing country, is emerging in the region. To accommodate large increase of import, the region's Middle East dependence will go up further. Watching the unstable situation in the Middle East, this is the region's great vulnerability.

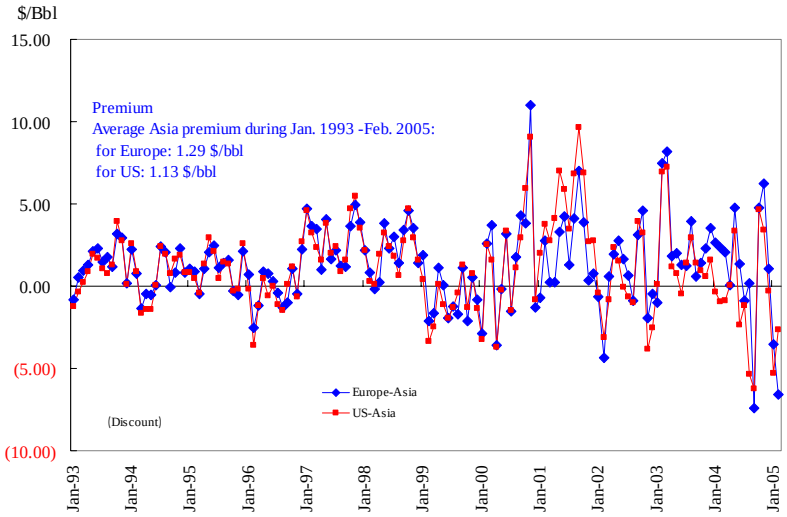
Figure 6: Petroleum Outlook of Northeast Asia



Foregoing backgrounds are reflected in pricing of Middle East crude for Northeast Asia in the international market, resulting in Asian Premium and expanding light-heavy spread. Historically,

Middle East crude oils have been priced about one dollar per barrel higher for Asia than for Europe and America. Although the spread became negative in the past six months, this may be temporal phenomenon caused by abnormal expansion of light-heavy spread in the Atlantic basin as explained below. Since the Middle East is the only reliable source as mega-supplier for the sub-region, upward price pressure will continue to exist as China and India keep increase oil import. Then, ultimate cure to Asian Premium will be to develop new supply sources other than the Middle East.

Figure 7: Asian Premium of Middle East Crude Oil



Source: IEEJ compilation from various oil price reports

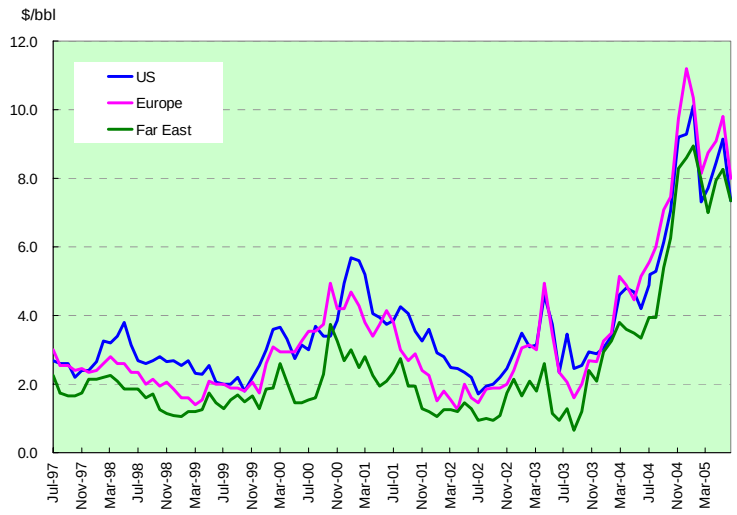
As quality differential of light and heavy crude oils is generally thought to be about $2-3/Bbl in terms of cracking and desulfurization cost and this has been the trend in the international market, it started to expand extraordinary in 2004. Expanding light-heavy spread suggests lack of sufficient cracking and desulfurization facilities to meet demand pattern. In 2004, China and America were scrambling for lighter crude oils in the Atlantic basin, as both of them were in short of secondary facilities in the downstream. Then, this was magnified by speculative investors in the market. Although it seems calming down slightly, several years may be necessary for improving the fundamental conditions. In summary, both Asian Premium and expanding light-heavy spread indicate lack of investments in upstream (lack of alternative supply sources) as well as downstream (lack of appropriate refining facilities).

From the foregoing review, energy trend and challenges of Northeast Asia will be summarized as follows.

a. Northeast Asia is one of the world-class energy markets and is expanding fast, driven by China's rapid growth, to become the world largest energy market in 2020s. This also means that Northeast Asia will become the market discharging the largest quantity of CO_2.
b. Even now, Northeast Asia is facing various challenges in the field of energy and environment; on one hand, increase of Middle East dependence, unstable and unfair oil pricing, security of sea lanes, and, on the other, low energy efficiency, environment pollution, and so on.
c. Hence, on the supply side, securing oil supply and decreasing Middle East dependence are the important policy objective. On the consumption side, energy conservation and rational use should

be promoted to ease market tension and protect regional/global environment.

Figure 8: AXL-AH Spreads (FOB by loading month)



Source: IEEJ compilation from MEEDS

During the past several years, severe energy and power shortages have been observed elsewhere in China threatening civil life and economic activities. Feverish expansion of China's energy and resource import is told to have pushed up world energy prices. Japan and Korea cannot look on these issues as a fire on the opposite shore of the East China Sea, since interdependence of regional economies is progressing fast. Japan and Korea have made substantial investment in China. For example, 2880 Japanese firms were operating over 7600 factories and branch offices in China in 2003; number of Japanese firms in China exceeded 4000 in 2005. Regional cooperation to jointly cope with energy issues is essential to realize sustained development of Northeast Asia.

For the regional cooperation, implementing body such as "Northeast Asia Energy Partnership" should be established. Possible field of collaboration under such organization will be;

a. On the supply side, enhancing security of oil supply through oil stock piling, safer sea-lanes, emergency response program for short-term disturbance, amplifying oil supply base through accelerating upstream E & P, building transportation infrastructure and upgrading downstream refining capabilities for the long run sustainability, and diversification of energy sources such as promoting natural gas, nuclear and renewable energies.
b. On the consumption side, technology transfer and joint technology development, and enforcement of energy conservation and environmental protection.

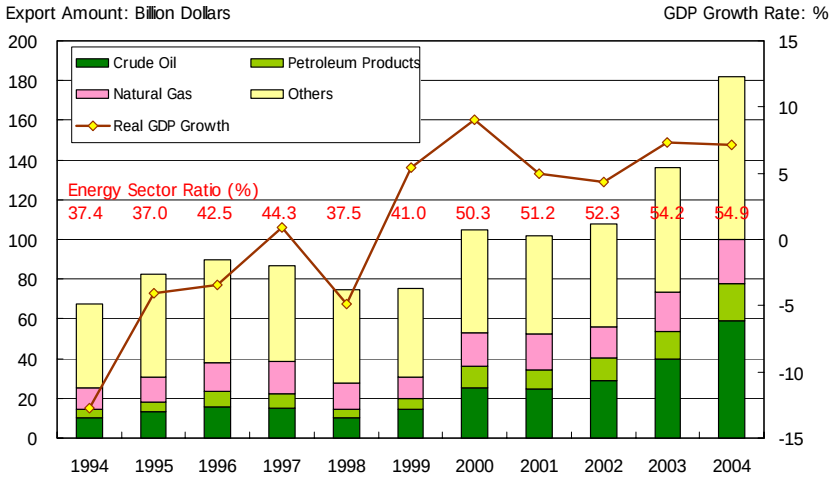
Among these candidate policy options, developing Russian energy resources and bringing them into Northeast Asia will be a very realistic and important option. However, construction of long distance pipeline is necessary to transport energy resources located deep interior provinces of Russia.

2 Russian Economy and Energy Export

Position and role of energy in Russian economy is another key in considering the possibility of bringing

Russian energy resources to Northeast Asia. Russian economy has recorded over 7% growth in the past years. Oil and gas are the important income sources for the Russian economy, contributing more than 50% of Russian export.

Figure 9: Oil and gas in Russian Export Revenue



Source: Interfax Petroleum Report, Central Bank of Russia (http://www.cbr.ru)

The current major outlet of Russian oil and gas is Europe, but the European energy market is maturing and politicians are debating on 30% reduction of fossil fuel consumption by 2020. In the past four years, Russia increased oil export by 2.2 million barrels per day, while European oil import increased only 1.2 million barrels per day. The Baku to Ceyhan (BTC) pipeline is to start bringing one million barrels per day of CIS crude to Europe in 2005. Expansion of CPC pipeline is also under study. Europe is the most competitive oil market having plenty of supply sources such as North Sea, North Africa, Middle East and CIS countries, and Russia is positioned inferior to them in terms of distance and capacity of pipeline for oil transport. Thus, to keep oil export expanding for sustained economic growth, Russia needs security of demand and diversification of market. In this regard, growing Asia is highly attractive golden market for Russia, if pipeline transport is economically viable.

Figure 10: Russia and Northeast Asia

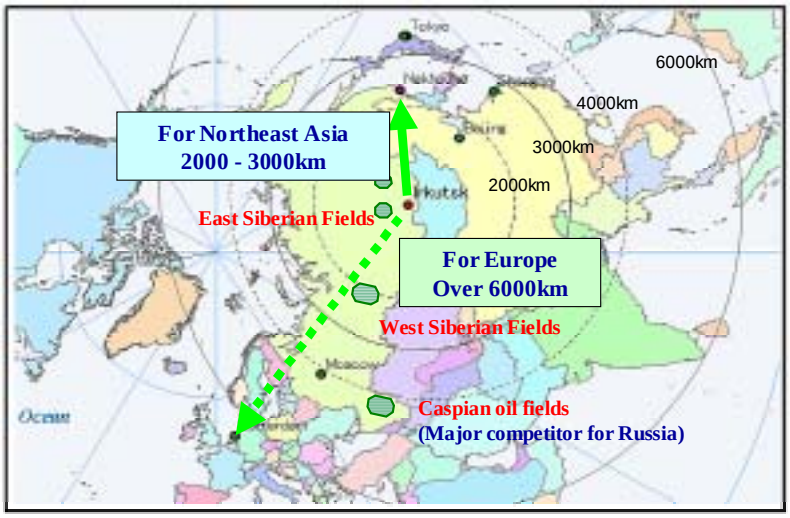
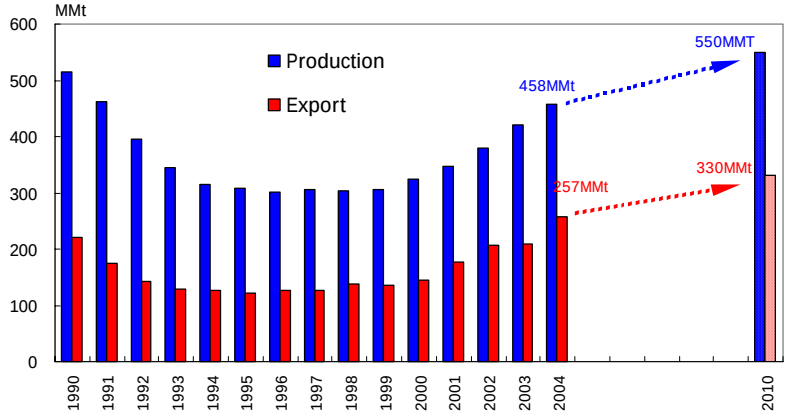


Figure 10 shows proximity of Russia to the Northeast Asia. Even from the west Siberia, the current oil production center of Russia, Europe and Asia are in the same distance. The East Siberia is much closer to Northeast Asia, while it is at present the farthest supply source due to lack of infrastructure directly connecting them.

Regarding supply potential, Russia is the world largest oil producer[4] and its oil production is forecast to grow further. Federal Energy Agency of Russia is proposing that the country should review the former forecast up to 500 million tons for 2008 and 600 million tons for 2015. Since the population of Russia is limited and natural gas is used widely in the nation, domestic oil demand is thought to grow only moderately. Then, most of the incremental production may be exported. However, the current exporting capacity of about 250 million tons is fully utilized. Russia being a continental country, expanding new pipeline for expanding market is the important policy objective.

Figure 11: Russian Oil Production and Export



Source: Russian Oil and Gas Report

The map in Figure 12 shows potential energy flow from eastern Russia to Northeast Asia. Resource potential of east Siberia is huge in terms oil, gas and hydropower, but they need to be transported for a long distance to the market. This requires gigantic investment and settlement of cross-border issues relating to transit.

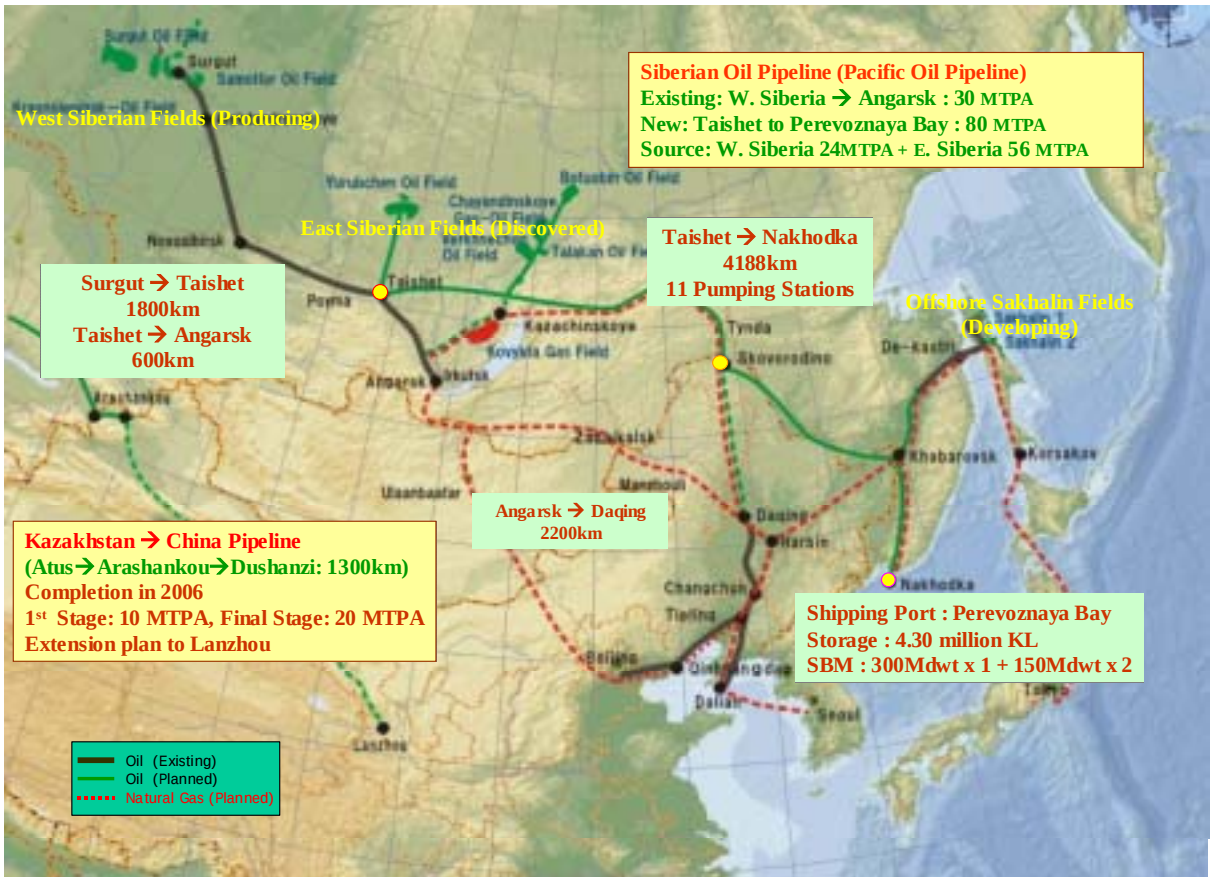
In the eastern Russia, several projects are already going on. They may be classified into three categories, namely, those already ongoing, in final stage of project formation and still not past conceptual stage. In category 1, Sakhalin-1 and Sakhalin -2 are now under construction. In category 2, Siberian oil pipeline is in the final stage of project formation. Natural gas pipeline from Siberia and Sakha Republic may be classified for category 3. Hydropower supply from Amur River basin has also been proposed. These gas and power plans have been discussed for decades, but they have not yet come out of the conceptual stage.

Among category 1, Sakhalin-1 is expected to start oil production of 250 MBD at the end of 2005

[4] According to IEA Monthly Oil Market Report, Russia produced 9.23 MMBD of oil in 2004 followed by Saudi Arabia with 8.75 MMBD, USA 7.68 MMBD and Iran 3.93 MMBD.

followed by natural gas production of 6 million ton per annum (MTPA) in LNG equivalent later. Crude oil will be piped to De Kastri on the continental shore and then shipped using ice-class tankers. Natural gas is planned to be piped to Northeast Asian market. Sakhalin-2 has started early oil production in 1998 from temporary facility operable during ice-free season. The project is constructing oil and gas pipelines to the southern tip of the island, where crude oil (150 MBD) and LNG (9.6 MTPA) will be shipped from ice-free port of Prigorodnoye near Korsakov. The whole facility will be put in operation in 2007. The combined production of Sakhalin projects will be 400 thousand barrels of oil and 15 million ton LNG equivalent natural gas.

Figure 12: Potential Energy Flow from Eastern Russia



3. Siberian Oil Pipeline

On December 31, 2004, the Russian government announced its official decision to construct the Siberian oil pipeline (Russian calls it as the "Pacific oil pipeline"). Ten regional governments of eastern Russia have already shown their agreement to the construction. Ministry of Energy and Industry is going to finalize the business plan by May 1, 2005.

Siberian oil pipeline will be constructed from Taishet, a Siberian city along the existing crude oil pipeline to Angarsk and about 600km northwest of Irkutsk, to the Perevoznaya Bay of Pacific coast, located west of Nakhodka. The total length will be 4188km with 11 pumping stations to carry 1.6 million barrels

per day of oil. At the Pacific coast terminal, 4.3 million ton oil storage and shipping facility will be constructed: one SBM to accommodate 300,000dwt class tanker and two SBMs for 150,000 tonners. According to the current plan, the pipeline will be constructed in two phases. Phase -1 from Taishet to Skovorodino will complete by 2008 and the oil will be tentatively rail transported from there to the shipping terminal. China plans to construct a branch line from Skovorodino to Daqing, which carries oil finally to Dalian. In Phase-2, the section from Skovorodino to Perevoznaya will be completed. The total construction cost is estimated as $10-14 billion.

This pipeline will open up a new era to the energy structure of Northeast Asia. But there are several challenges, such as oil reserves and economics.

Figure 13: Petroleum Resources of Eastern Russia

	Probable	Possible	Total
Oil	Billion Barrels	Billion Barrels	Billion Barrels
East Siberia	6.1	15.3	21.4
Krasnoyarsk & Irkutsk	4.1	14.8	18.9
Sakha Republic	2.0	0.5	2.5
Sakhalin	4.3	5.6	9.9
Eastern Russia	10.4	20.9	31.3
Natural Gas	Tcm	Tcm	Tcm
East Siberia	3.007	2.595	5.602
Krasnoyarsk Krai	.629	.652	1.281
Irkutsk Oblast	1.161	.879	2.041
Sakha Republic	1.216	1.064	2.280
Sakhalin	.599	.239	.837
Eastern Russia	3.606	2.834	6.440

Source: IEEJ World Bank Report "Northeast Asia Natural Gas Trade"

Regarding the oil reserves, potential of east Siberia is huge. Theoretical expectations murmured among academicians but not backed by positive data amounts to 100 billion barrels. Current expectation based on seismic and drilling is 20 billion barrels and the proved reserve 6 billion barrels. With only the existing reserves of east Siberia, the pipeline capacity of 1.6 MMBD would not be fulfilled as 6 billion barrels roughly compare to 0.6 MMBD production for 30 years. At present, these reserves do not have transportation infrastructure linking them to the market. Therefore, further exploration in east Siberia is not very attractive. In east Siberia, exploration coverage is still limited hampered by harsh natural condition, but, once pipeline plan is finalized, exploration will be accelerated to bring more of proven reserves.

At any rate, the current proved reserves in east Siberia is in short and they would not be developed for production in time for pipeline start-up due to lack of supporting infrastructure and harsh natural conditions (swampy in summer and freezing in winter). Therefore, at first, crude oil needs to be put in from the existing oil provinces. Crude oil from the west Siberia can be brought in at starting up of the pipeline, since Russian oil production is expected to increase 2 million barrels per day by around 2010-2015 but in short of market to entertain it.

Current frustration on the project is that, as Russian seems to be weighing Japan against China in negotiation on institutional loans, the phase-1 plan seems to serve only for China. Another issue is that only 24 million tons of west Siberian oil is allocated. Some Russian sources are saying that the phase-2 construction would be started only when development of east Siberian fields are started. Thus, Japan is facing difficulty to justify mobilization of government controlled fund. Japanese government desires simultaneous construction of the whole pipeline to the Pacific coast.[5]

It is apparent that rail transport is costly, double investment and troublesome for world-class oil trade. In the early days of Daqing crude export to Japan, crude oil was rail transported. Cargo availability at Dalian was big head ache for vessel operation until completion of the trunk pipeline. More importantly, it is desirable to open up access to mega market as soon as possible to assure stable business for the pipeline.[6] Northeastern province of China is oil producing province and can provide maximum 0.4 million barrels per day market, while the Northeast Asia is importing 10 millions barrels per day of oil. One of serious issues to be solved in opening the new oil road is crude oil pricing, since the oil will be flowing in a direction totally different from the current one coming from the south. It is more reasonable and acceptable if the price of Siberian crude would be determined according to market mechanism in mega market with multiple players. Then, as discussed later, even if crude oil should be transported for longer distance from west Siberia, the incremental pipeline tariff would be negligible compared to the current market price of oil.

In eastern Russia, substantial quantity of natural gas has also been found. The estimated reserve already exceeds 100 Tcf and another new giant field Levoberezhone (reportedly 57 Tcf) was found in 2004 near Irkutsk. However, market development is a problem except for Sakhalin-2, which will ship the natural gas in the form of LNG. Interior natural gas is stranded since long distance pipeline is expensive. Another anxiety is that disposal of associated gas is necessary in sustaining oil production; this is a time bomb for oil development. Considering high transportation cost of natural gas, GTL may be a recommendable option. Problems are that GTL technology is monopolized by limited number of players in the world and currently GTL is highlighted as a measure to produce high-grade petroleum products, which in turn requires strict technologies. However, if it is more loosely considered just to generate lower grade polymerization for spiking into crude oil and transport via crude oil pipeline, and the technology were widely released, GTL may be applied more easily for utilization of stranded interior gas.

4. Economics of Pipeline

Pipeline economics is the most controversial factor in mobilizing remote interior resources. Let us look into it using a simplified model. Here, the pipeline construction cost is assumed at $12 billion as initial investment (in addition, intermittent maintenance investments are considered) for the whole

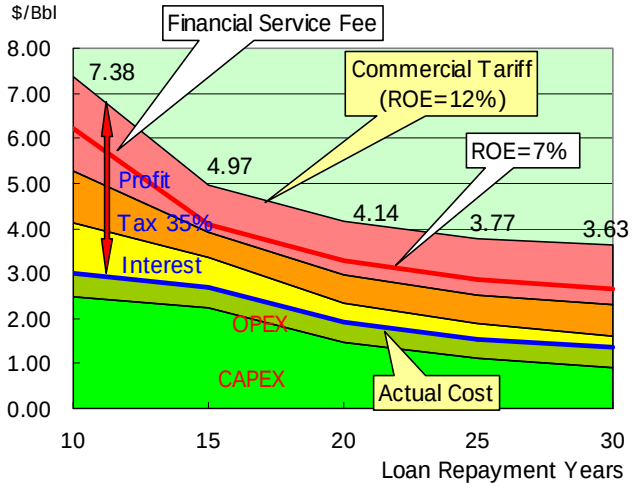
5 In late May 2005, President Putin instructed the Russian government offices to look into the cause why Japan insists on early construction of the phase-2.

6 A pipeline project being highly capital intensive, duration of the build-up period to reach plateau operation substantially affects its economics.

facilities to transport 1.6 million barrels per day.[7] Other assumptions are a) equity/loan ratio at 35/65, b) interest rate at 5%, c) loan repayment starting upon commencement of operation, d) annual Opex at 2% of Capex, e) corporate tax rate at 35 % on profit and f) 10 year depreciation. Considering the lower business risk nature of pipeline, economics are calculated for much longer periods of loan repayment than for ordinary business investment.

Pipeline project is highly capital intensive. As shown in the chart, loan repayment period affects the commercial tariff substantially in the range shorter than 15 years. Assuming a fair return on equity (ROE) at 12%, a commercial project requires high financial service fee, namely, sum of interest, tax and profit; these amount to 1.5 to 3 fold of the actual cost consisting of Capex plus Opex. This means, price risk barrier for a commercial project is 2.5 to 4 times of the actual cost. There is a big room for government initiative, and what we should study on pipeline economics at an early stage is not to upgrade the cost estimation but to consider appropriate financial structure.

Figure 14: Economics of Siberian Oil Pipeline



For example, project threshold can be substantially lowered by provision of long-term credit, lowering criteria of project economics, tax exemption and/or subsidy. It is reported that Transneft, the designated operator of the pipeline, has proposed $6.70/Bbl as the pipeline tariff. This corresponds to 11.5 years of loan repayment period in the above model, which is quite normal for ordinary institutional finance. However, government sector may be able to provide much longer credit for this strategic project to lower the pipeline tariff. As an example, the Japanese government provides over 30-year loan for environmental projects. Secondly, should 7% were applied as the required ROE, which is in the range of the US national bond interest rate, the required tariff will be lowered by almost one dollar per barrel. Thirdly, overall tax revenue for the government will be defined by the FOB price of crude oil but not by the tax on the pipeline tariff only, as government will be obtaining tax revenue from the upstream production simultaneously. Therefore, tax exemption or subsidy on pipeline would not mean

[7] Breakdown of various numbers of required investments ranging $ 10-14 billion is not known yet, but they are supposed to include cost for upgrading of the existing pipeline and construction of storage/shipping facilities at the exporting port. When the Siberian oil pipeline plan was first explained in 2002, Transneft estimation of the construction cost including the upgrading of the existing pipeline to Angarsk was $6.5 billion.

reduction of the overall tax revenue. The lower the tax on pipeline tariff, the higher the tax revenue from the upstream. In any way, government can increase the combined tax revenue only by increasing export. Therefore, there is a good incentive for government to consider tax exemption and/or subsidy on pipeline.

Then, let us compare feasibility of oil pipeline and gas pipeline. Here, the natural gas pipeline cost for the same distance is assumed at the same amount with the oil pipeline, $12 billion, but the through-put at 30 billion cubic meters per year.[8] As shown in the table, the commercial pipeline tariff is below $5/Bbl for oil and around $2/MMBtu for natural gas. These are more than double of the conventional ocean transportation. But the technical cost is only a half of them. Currently imported prices are in the range of $50/Bbl for crude oil and $6/MMBtu for natural gas, and then commercial pipeline tariff is only 10% of the final market price for crude oil, but 30 to 40% for natural gas.

Figure 14: Oil Pipeline and Gas Pipeline

Project Period	Pipeline Tariff ROE=12% (A)	Actual Cost (B)	Market Price (C)	B/A	A/C	B/C
Oil (1.6MMBD)	$/Bbl	$/Bbl	$/Bbl	%	%	%
15 Years	4.97	2.70	CIF 50.0	54	10	5
25 Years	3.77	1.55		41	8	3
Natural Gas (30 Bcm/y)	$/MMBTU	$/MMBTU	$/MMBTU	%	%	%
15 Years	2.37	1.20	At City Gate 6.00	51	40	20
25 Years	1.79	0.69		39	30	12

Key factors on feasibility of them may be summarized as follows:

Oil Pipeline

a. Commercial pipeline tariff is about 10% of the market price of crude oil
b. Calculated pipeline tariff is substantially lower than that for rail transport, which is about $10/Bbl
c. Crude oil contract term is generally shorter and flexible with the big export market of Northeast Asia
d. Project size is too large for the private sector

Gas Pipeline

a. Commercial pipeline tariff is 40 to 50% of the market price of natural gas at city gate
b. Existing gas market in Northeast Asia is tightly guarded by long-term LNG contracts. Market penetration is not easy.
c. Piped natural gas (PNG) is inferior to LNG in market development. PNG can pick up only the demand along the pipeline, while LNG can integrate all the markets within a circle of certain transportation distance.
d. Project size is too large for the private sector

[8] This assumption is made according to IEEJ's study on Siberian natural gas pipeline; The World Bank report "Northeast Asia Natural gas trade (2003)". Currently Russia, China and Korea are studying on mobilization of 30 Bcm natural gas from Kovyktinskoye gas field near Irkutsk to Northeast Asian market via pipeline.

From the above observation, in case of oil, only the project size is the obstacle for implementation. Institutional finance is the already available instrument in the contemporary world to help this. In case of natural gas, on the other hand, all the issues listed above have to be solved before gas pipeline could be justified. Then, it is apparent that full scale of government initiative and support is essential to realize natural gas pipeline.

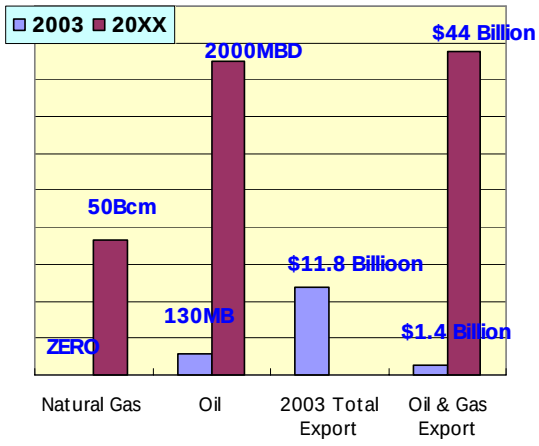
5 Implications of Russian Resources for Northeast Asia

Although there are many difficult hurdles, expected benefits of introducing Russian resources will be huge for Northeast Asia. Listing up direct effects on energy, for example, that will

a) Improve energy security of the region to make it possible to diversify import sources,
b) Create new Asian marker crude ex-Nakhodka that will stabilize Asian oil market and mitigate Asian premium, and
c) By introducing natural gas, energy sources will be diversified and the environment will be improved.

In addition, the gigantic project will considerably improve regional security through economic development and trade. The eastern Russia, being behind development, will receive more than 50 billion dollars of energy related investments in upstream and pipeline. Pipelines will also serve as energy lifeline of the provinces. Russian export to the northeast Asian countries was only 11 billion dollars in 2003. Once energy export projects are completed, oil and gas export from Russia to Northeast Asia will amount to 2 MMBD of crude oil and 50 Bcm per year of natural gas. These will exceed 40 billion dollars per year at the current market prices. These activities will in turn promote mutual investment in the region enhancing economic development and regional security further.

Figure 15: Russian Exports to Northeast Asia



Source: IMF "International Financial Statistics"
IEA "Natural Gas Information 2004"
Blackwell Energy Research "World Oil Trade"

On the other hand, there are many challenges in developing Russian resources as reviewed earlier and they are different between oil and gas. These factors have to be carefully considered in formulating the

resource and infrastructure development program.

In case of oil, pipeline economics is not an issue. Problems are reserves and funds for E&P and pipeline. More exploration is necessary to increase and confirm the reserve base, and considering poor infrastructure and harsh natural conditions, it takes long time to develop them. Huge funds are necessary for upstream and pipeline, but they are in the range of magnitude generally required in upstream sector. Therefore, an initiative to kick off the project is the key. One important consideration is that the already identified reserves are stranded due to lack of infrastructure. Once pipeline construction is confirmed, upstream E&P will be accelerated substantially, but not vice versa.

In case of natural gas, reserves are not an issue, but pipeline economics and market development. As China's natural gas market is just to emerge nationwide, it may take sometime more to grow up to sufficiently justify an international size project. In Northeast Asia, issues on pipeline transit have to be clarified also, engaging Mongolia, China and North Korea. All in all, an initiative by government sector is essential. One important note here is that natural gas price is to globalize by LNG approaching high US gas price and improved LNG costs. Consuming countries should look into their policy options considering that LNG is superior for market development, but PNG is superior for securing regional supply.

Developing energy resources of eastern Russia will substantially contribute to the development and security of Northeast Asia. Expected social benefit will be huge such as enhancing energy security and sustainability by increasing and diversifying oil supply to the region, improving environment by introducing natural gas, mitigating Asian Premium and creating Asian oil market. In addition, pipeline will serve as social infrastructure to enhance and support upstream E&P and downstream market development as well as securing energy lifeline for the eastern provinces of Russia.

Important note here is that these social benefits cannot be reflected in investment economics of the private sector. For example, should the new pipeline ease Asian Premium by $1/Bbl, Northeast Asia could save $10 million per day or $3.6 billion per year. To consider such social benefit, role of government initiative is essential. In addition, sovereign power is also necessary to prepare playground for private sector such as clear, fair and stable laws and regulations, and assurance of fair enforcement of them regarding investment, operation, transit and trade, and administrative institutions to support safe and smooth operation. Private sector cannot provide huge investment fund or super long-term credit. Providing support in a due balance with the expected social benefit, government can substantially lower the project threshold.

6. Conclusion

In concluding the foregoing analysis, the Siberian oil pipeline should be built to the Pacific coast soonest possible with government initiative. It is expected to bring a new market for Russian crude oil and counter the rapidly increasing oil demand in Northeast Asia. With direct access to the global market from the open seaport, it is possible to solve marketing and pricing issues that are always controversial in

bilateral trade. However, interconnecting rail transport is expensive but in no way credible for world-class trade.

Natural gas pipeline may be considered as the phase two after the oil pipeline. As it is necessary to improve economics and develop market, natural gas needs more elaborate study and international collaboration. At the same time, proceeding construction of oil pipeline will provide infrastructure and technology for pipeline construction and operation, substantially improving economics of gas pipeline. Motives for regional energy cooperation will also be promoted through experiences of the oil pipeline.

All in all, it is desirable to form Northeast Asia Energy Partnership to implement these energy related projects toward sustainable development of the region. Principles should be priority approach to examine overall benefits against economics and individual disputes, where evaluation of non-commercial social benefits will be very important. The regional partnership shall serve as the organization identifying benefits and roles, capability and preparedness of participants, drawing up collaborating action plans, and finally implementing them.

These look challenging and lengthy, but the author trusts that human wisdom can find the way forward someday not very remote.

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