The New Natural Gas-Based Technologies in the Context of Northeast Asia†

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All economies, including those in Europe and East Asia, are now facing the linked challenges of energy security, rising energy prices and climate change. These challenges all point in the same direction: the need for an increased emphasis on energy efficiency and on the de-carbonization of energy sources. Achieving these goals, in a way that enhances growth and competitiveness, will require (1) new investment and technological advancement, (2) the development and use of the most cost effective regulatory mechanisms, and (3) coordinated international efforts.

Improving energy efficiency in Russia should be seen as an opportunity to improve the productivity of the economy and of individual businesses. Innovation can create new markets and increase competitiveness through greater resource efficiency and new investment opportunities. The role of the government is to provide an effective policy framework and remove barriers so as to encourage the development and commercialization of new eco-efficient technologies and products.

In this context, the policy and investment decisions taken in Russia with regard not only to the future of its oil and gas industries, but also toward export-oriented natural gas projects, electric power generation and the massive application of technologies that improve energy efficiency, could have significant regional and even global implications. This is the approach shared by the United States and the European Union (EU) in their policy and energy dialogues with Russia. On both these fronts, Russia is engaged in intensive professional exchanges, as both the U.S. and the EU cultivate Russia as their strategic source of energy supply, especially with regard to natural gas, for decades to come.

For example, in the framework of energy dialogue with the EU, more than 100 experts from Russian and European companies and governments participate on a regular basis in the working-level discussions on investment, infrastructure development, trade and energy efficiency, preparing practical recommendations for Moscow and Brussels.

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† This comment was presented at the 14th International Conference of the Honolulu-based Northeast Asia Economic Forum held in China, Shenyang, September 20-21, 2005.

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Moreover, on October 3 2005, the first meeting of the Standing Partnership Council on Energy took place in London. On the part of the U.S., a number of high-level professional meetings were organized to discuss prospects for natural gas and liquefied natural gas (LNG) technology in view of the anticipated demand in North America.

Natural gas and its future in the context of energy supply in the subregion could represent one such area for innovation. While the LNG industry is about 40 years old, regional LNG consumption is still relatively new. At the same time, this is a very dynamic sector, expanding faster than any other sector of the international oil and gas industry. The economies of Northeast Asia, including Japan, the Republic of Korea and Taiwan were behind the development of this industry from its inception, serving as principal importers of LNG. In 2002, according to the Energy Information Administration, 12 nations shipped 113 million metric tons of LNG. Japan received two-thirds of global LNG imports in 1990 and 48 percent in 2002.

LNG projects are massive and expensive; such projects are traditionally financed based on long-term purchase contracts. While LNG is costly to produce, advances in technology are reducing the costs associated with the liquefaction and re-gasification. Over the last two decades, liquefaction costs declined by between 35 to 50 percent, while the cost of building an LNG tanker has fallen by about 45 percent. In addition, re-gasification costs have also dropped. According to projections, the world liquefaction capacity could reach 200 million tons (Mt) by 2007 and 300 Mt by 2012, with the number of suppliers and importers growing.

In addition to traditional LNG exporters such as Indonesia and Algeria, Russia, Norway and Egypt are in the process of constructing liquefaction plants. The number of importers is also increasing. The United Kingdom, India and China are currently building their first re-gasification facilities while the Dominican Republic and Portugal recently opened their terminals. About 40 new LNG projects have also been proposed in North America. LNG currently supplies about 2 percent of U.S. gas consumption, but could take a 25 to 30 percent share of the gas market by 2020. LNG's global energy profile is steadily gaining attention. In June 2003, Federal Reserve Chairman Alan Greenspan told the U.S. Congress that "... if North American natural gas markets are to function with the flexibility exhibited by oil, unlimited access to the vast world reserves of gas is required...Access to world natural gas supplies will require a major expansion of LNG terminal import capacity."

In Japan, the most recent METI publication "FY 2006 Economic and Industrial Policy: Key Points" refers to the set of issues called "Securing

stable energy supply by strengthening fuel strategy."[1] In this document, important measures were identified, including the following:

- Independent development of oil and natural gas in such strategic areas as Russia;
- Diversification of supply sources;
- Protection of Japanese mining rights in the East China Sea and other areas;
- Strengthening Japan's relationship with oil and gas supplier nations;
- Promotion of natural gas-related research and development.[2]

To fulfill these goals, a realistic transportation option must be found to promote natural gas imports from Sakhalin in Far Eastern Russia. Considering the fact that a natural gas pipeline project would be difficult to realize any time soon, as well as high cost and rising cost of LNG, an alternative for Japanese importers is the Compressed Natural Gas (CNG)[3] transportation option. Increasing prices for natural gas could allow CNG transportation technology[4] to become a viable alternative in delivering gas to markets with stable but limited demand such as Niigata. Projects offshore from Sakhalin, in particular offshore stranded and associated gas could serve as the long-term resource base for supplying CNG into the Niigata pipeline grid on to other locations in Japan.

The strength of a CNG system is the ability to start small and to add (or redeploy) capacity as market changes. The advantage of Niigata is the availability of the underground gas storage, as well as the backup gas systems represented by the local natural gas production and the LNG base. These alternative systems would offset the problem of reliability of

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[1] METI, "FY 2006 Economic and Industrial Policy: Key Points,"<http://www.meti.go.jp/english/policy/FY2006keypoints.pdf> (November 1 2005).

[2] For development of the GTL and DME technologies, as well as other fuel sources: JPY 14 billion were allocated. On the other hand, the support measures for increased demand for natural gas accounted for another JPY 14 billion. These amounts are relatively modest, if compared with funding allocated for the effective management of oil reserves and the national petroleum stockpile (JPY 225 billion). In addition, METI intends to promote environment-friendly and efficient use of natural gas.

[3] Compressed natural gas (CNG): Natural gas which is comprised primarily of methane, compressed to a pressure at or above 2,400 pounds per square inch and stored in special high-pressure containers.

[4] Several papers presented at the Offshore Technology Conference in Houston, May 2-5, 2005 reviewed CNG as an economical alternative to LNG.

CNG deliveries that may be caused by the stormy weather. The bulk of the capital and operating costs in a CNG system is the cost of ships or barges and the main challenges relate to the time taken for loading/unloading the CNG and the distance to be covered from the supply source to market. As for the latter, the advantage of Niigata is the geographic closeness from Sakhalin, where CNG can be loaded.

A new concept for CNG transportation and a new type of ship was recently proposed. It would have a containment system weighing 50 percent less compared to conventional pressure ship designs and would provide a larger storage volume.[5] In addition, CNG ships or barges could serve as both transportation and storage facilities and could directly discharge gas into a land-based grid of Niigata. The CNG carriers serve as transport and storage vehicles, discharging their cargo directly into the land based gas grid via offshore and onshore terminals thus avoiding costly liquefaction, re-gasification and storage. Only a few years ago, experts would comment on the prospects of CNG in somewhat skeptical terms: too much metal and too little gas to move. Technologies, however, have been improving rapidly.

The new type of ships (VOTRANS[6] and PNG[7] types) are much lighter in weight, making possible a large storage volume up to 34 million cubic meters of gas. For distances of 2,500 nautical miles or less, this technology should be very competitive vis-à-vis pipeline gas and LNG. This reduces investment in infrastructure and offers greater flexibility. The storage could be located both onshore (underground) and offshore. Moreover, stranded gas could be used for the project. Greater coordinated attention to these opportunities promises significant benefits and could help launch a new industry in a similar way the LNG business started 35-40 years ago.

[5] Introduced by Knutsen OAS Shipping AS, Haugesund, Norway with assistance from Europipe GMBH and Det Norske Veritas, it could be highly competitive compared to pipelines and LNG transport for distances less than 3,000 nautical miles.

[6] Volume Optimized Transport (VOTRANS) technology includes cooling natural gas in the range of conventional temperatures (minus 30 degrees Celsius) and the compression.

[7] Pressurized Natural Gas (PNG) technology does not require cooling, only compression.