

NATURAL GAS TRANSPORTATION

Stanisław Brzeziński

Czestochowa University of Technology

Abstract: In the paper, Author presents chosen aspects of natural gas transportation within global market. Natural gas transportation is a technically complicated and economically expensive process; in infrastructure construction and activities costs. The paper also considers last and proposed initiatives in natural gas transportation.

Keywords: natural gas, transportation, globalisation

1. Introduction

Natural gas is rapidly gaining importance in global energy markets. Prized for its relatively clean and efficient combustion, gas is becoming the fuel of choice for a wide array of uses, notably the generation of electric power. Natural gas has increased from roughly 19% of world primary energy demand in 1980 to about 23% in 2002.¹ Natural gas is now produced and consumed in 43 countries around the world, and the International Energy Agency (IEA) [1] predicts that world natural gas demand will be about 90% higher by 2030. They also project the share of gas in world primary energy demand to increase from 23% in 2002 to 25% in 2030, with gas potentially overtaking coal as the world's second largest energy source. The IEA predicts that the power sector will account for 60% of the increase in gas demand. There is plenty of gas to satisfy these visions of global gasification. The broadest measure of gas available totals about 350 trillion cubic meters (Tcm), or roughly 130 years at today's rate of consumption. Even "proved reserves," a narrower measure of just the gas that has been detected and is commercial to develop using today's technology, suggest that scarcity is unlikely to impede a global shift to gas. The widely referenced BP Statistical Review of World Energy reports 176 Tcm of proved gas worldwide, or nearly 70 years at current production levels [2].

2. Natural gas transport

The geographical, financial and political barriers to gas development, however, will be harder to clear. The major gas resources are generally far removed from the projected demand centers. Western Europe, North America, South Asia and China—the areas where gas demand is projected to grow most rapidly—have limited supplies; while over two-thirds of proven gas reserves are located in Russia and the Middle East. Admittedly, the technological hurdles to moving large volumes of gas over long distances are falling rapidly. Already today, one-quarter of world gas consumption is the result of international trade. Delivering gas from concentrated supply sources to distant demand centers will require a

major expansion of natural gas transportation infrastructure—either pipelines, LNG trains, or both. However, the experience with international gas trade is still relatively young. The U.S. has been importing natural gas from Canada since the 1960's. The first major pipeline transporting Russian gas to Western Europe, Transgas, was completed in 1974. Algerian supplies to European markets began in 1983. Efficiency and transport costs are the function of the gas pipeline diameter, the input and output pressure, field conditions of pipeline run (costs are increasing when the area is not flat when the pipeline pass rivers, swamps, numerous roads etc.). (...) Costs are also proportional to thickness of pipeline sides. Increasing of input pressure causes the increase in efficiency of the gas pipeline, but also causes the increase in transfer costs [3].

Much of the experience in international LNG trade relates to the experience of one country, Japan, and its gas suppliers—Indonesia, Malaysia, Australia, Brunei, Qatar, the United Arab Emirates, and the United States.

Pipelines account for 78 percent of that trade; ocean-going tankers carrying liquefied natural gas (LNG) convey the rest [2]. However, pipeline and LNG infrastructures are extremely costly to build and require long time horizons and a predictable economic and political context for investors to sink their capital and knowledge. The International Energy Agency's (IEA) comprehensive assessment of future investment in energy found that about 3 trillion dollars in investment will be needed to meet the growing demand for natural gas between now and 2030 [1]. Most of the investment will be needed upstream – in exploration, production, and processing facilities – in increasingly remote areas where it has already proved difficult to do business. Two countries alone – Russia and Iran – account for nearly half the world's proven gas reserves [2].

The growing role for cross-border gas trade will force new political attention on the security of gas supplies. In the past, “energy security” has been debated almost exclusively in terms of oil markets; the shift to gas will force governments and consumers to ask similar questions of an increasingly vital gas supply. Emerging relationships between major gas suppliers and key end-use consuming countries will create new geopolitical considerations rising to the highest levels of economic and security policy.[4]

In tandem with the shift to gas came international trade. In large measure, trade by pipeline was an extension of the same basic pipeline technologies pioneered early in the twentieth century. Improved steel and, especially, compressors made larger and lengthier pipelines both

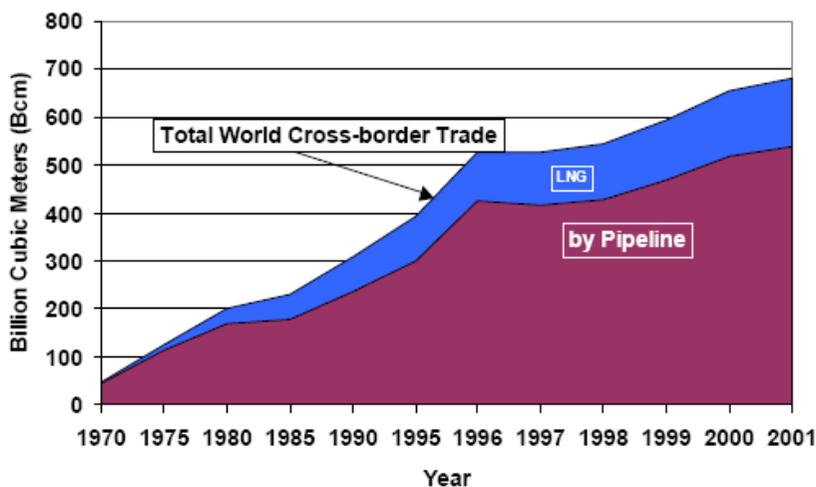


Figure 1 Natural gas demand in relation to transportation means

Figure 1 shows the growth in the demand for gas over the last 30 years in relation to means of transportation. This growth has been propelled by environmental concerns as well as by new technologies that have increased the viability of gas as a substitute for oil and coal, such as the combined cycle gas generator that has significantly increased efficiency of producing electricity from gas, and new technologies in transportation, liquefaction and regasification of natural gas that has significantly lowered the cost of LNG. The risks inherent in large upfront investment costs in either pipelines or in tankers and onshore liquefaction and gasification terminals for LNG was ameliorated by long term contracts that tied gas from a specific field to consumption in a particular market. Because transportation costs, especially for LNG, were relatively high, the level of international trade in gas was limited. In recent years, as a result of technological improvements that have lowered the cost of LNG, the volume of gas traded in international markets is rapidly increasing. This increased liquidity in the market has promoted the emergence of a spot (non-contract) LNG market. This development is similar to that which has emerged in the market for oil over the last three decades.

As gas becomes a more important input to industrialized economies and the volume of gas traded in international markets increase, large consuming countries will begin to focus increasingly on the security and availability of their gas supplies. In addition, given the apparent similarities between the development of oil and gas markets, the question arises as to whether the structure of the gas market will evolve towards that prevailing in the market for crude oil. Concern for maintaining a secure supply of reasonably priced natural gas, which up to now has taken a back seat to its sister fuel, will increasingly be viewed as a vital national interest. This change is bound to influence the “geopolitics of natural gas”[5].

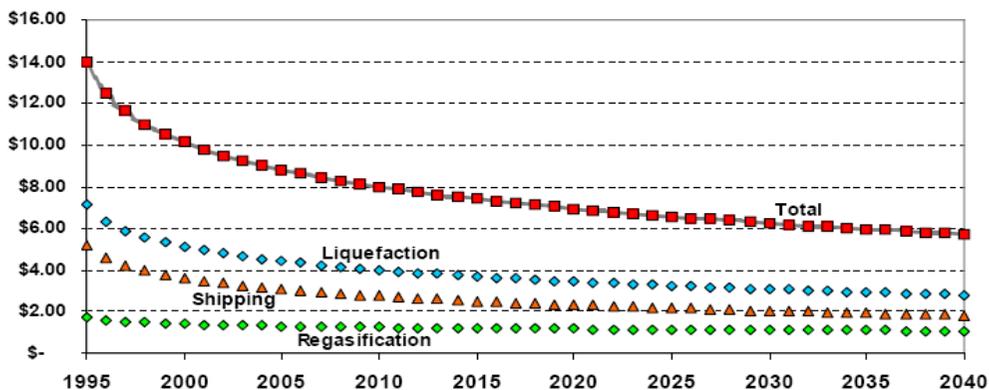


Figure 2 LNG capita costs [6]

3. Recent initiatives

Gazprom, the Russian gas monopoly, will sign an agreement in principle with Germany's Eon and with Wintershall, a subsidiary of BASF, to build the 1,200km pipeline at the cost of \$5bn gas pipeline linking Russia and Germany under the Baltic Sea., according to people familiar with the deal. Gazprom will own 51 per cent of the North European Gas Pipeline, while the German partners will each hold just under 25 per cent.[7]

It has also been proposed that Russia build natural gas pipelines to China and South Korea from producing areas in East Siberia and to Japan and South Korea from the Sakhalin Islands. Gazprom estimates that gas reserves in the Russian Republic of Sakha/Yakutia and in East Siberia total about 230 tcf and that these regions have a production potential of at least 2 icf per

year. Other estimates put probable reserves for the Russian Far East at 50 to 65 tcf for the Sakhalin Islands, 35 tcf for Yakutia and 50 to 105 tcf for East Siberia [8]

A consortium led by Royal Dutch Shell has announced that it will be building a major LNG liquefaction facility on the Sakhalin Islands. The expected primary consuming markets for Sakhalin LNG are in Japan and South Korea, with potential deliver,' to China and the U.S. West Coast. Royal Dutch Shell's \$10 billion Sakhalin energy project is expected to export 234 bcf per year of LNG by 2007. increasing to 468 bcf in the next decade. The Shell consortium Sakhalin-2 block is said to contain up to 16 tcf of natural gas. Another consortium, led by ExxonMobil and including Gazpromneft, is developing the Sakhalin-1 project. This project could supply Japan. via pipeline, with up to 300 bcf of natural gas per year. The Sakhalin-1 area is said to contain as much as 14 tcf of natural gas [9]. Several other consortiums have plans to develop oilier Sakhalin projects in the future. For example, in return for bringing Gazprom into Sakhalin-2. Shell may receive acreage in Sakhalin-3 when it is re-tendered next year [10] Gazpromneft also has a 51% stake in a joint venture with BP to develop Sakhalin-5 acreage.

Strategically, Russian natural gas supplies could become an important source of diversification for Japan. China and South Korea from dependence on energy supplies from the Persian Gulf. More generally, increased volumes of Russian gas exports to Asia could have considerable ramifications for liquefied natural gas (LNG) pricing to Asia.

Much of current world production of natural gas is coming from mature basins in the United States and the North Sea. Russia, the second largest current producer after the United States, currently accounts for almost one quarter of world production of natural gas but has substantial reserves that remain untapped. Furthermore, Russia and the countries of the former Soviet Union"" rank first globally in undiscovered natural gas potential. [11] These countries already export considerable quantities of natural gas to Europe, and they are expected to become important suppliers to the growing needs in Asia.

The countries of the Middle East also have substantial natural gas resources, both proved and potential, which are relatively untapped. With the reemerging interest in LNG. the Middle East is well positioned to become a major supplier given its proximity to growing markets for gas imports in South Asia and Europe. Particular interest in developing export projects in Qatar and Iran reflect those countries' massive reserves and strategic location to serve growing markets in both the East and the West.

European demand for natural gas currently totals more than 18 trillion cubic feet (tcf) per year. The Russian state-monopoly Gazprom supplied European countries with 4.8 tcf of gas in 2003, and it has contracted to increase this to 6.6 tcf by 2010. However, to meet rising European demand for gas. Russia will need to further develop natural gas fields on the Yamal peninsula and Shtokmanovskoye region, as well as build new infrastructure for delivery. Similarly. Italy recently completed a new pipeline to import natural gas from Libya. European buyers are also considering additional purchases of LNG from various sources in Africa and the Middle East, with new LNG importing terminals under consideration in various locations in Western Europe.

4. Conclusion

Gas became the raw material of international trade that rises of 9% annually, on average. Unfortunately, gas transport costs from its extraction localization to regions of consumption has significantly increased in the comparison to transport of crude oil. It should be noticed that development of the world gas market and diversification of supplies has the strategic importance, in the context of terrorist acts (e.g. attacks on the infrastructure of gas mains in Iraq, murders of oil companies personnel in Saudi Arabia), however it is considered that gas

transport infrastructure, especially pipeline and LNG tankers can become the possible aims of the attack, so the security costs have been still increasing.

References

- [1] World Energy Outlook, IEA 2000.
- [2] BP Statistical Review of World Energy 2004
- [3] **Commercializing Natural Gas: Lessons from the Seminar in Nairobi for Sub-Saharan Africa and Beyond**, Energy Sector Management Assistance Programme, World Bank, Washington DC, January 2000, p. 29-30.
- [4] VICTOR D.G., JAFFE A. M., HAYES M.H., (ed.): **Natural Gas and Geopolitics from 1970 to 2040**, Cambridge University Press 2006
- [5] SOLIGO R., JAFFE A. M.: **Market structure in the new gas economy: Is cartelization possible?**, James A Baker III Institute for Public Policy, Rice University, 2004
- [6] HARTLEY P., MEDLOCK K., NESBITT J.: **A Global Model of Natural Gas Markets: Some Case Results**. James A Baker III Institute for Public Policy, Rice University, 2004
- [7] WAGSTYL S., OSTROVSKY A.: **Russia and Germany to seal \$5bn gas pipeline deal**, *Financial Times*,: September 06, 2005
- [8] TRONER. A.: **Japan and The Russian Far East: The Economics and Competitive Impact of Least Cost Gas Imports**, Baker Institute working paper, available at www.bakerinstitute.org.
- [9] HARTLEY P., BRITO.: **Using Sakhalin Natural Gas in Japan** Baker Institute working paper available at www.bakerinstitute.org
- [10] **Sakhalin-2 to Expand -With Gazprom Aboard** *World Gas Intelligence*, October 13. 2004
- [11] **United States Geologic Survey. World Resource Assessment, 2000**