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The Fastest Growing Fossil Fuel Source in the European Union

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Abstract

Energy forecasts predict natural gas to be the fastest growing fossil fuel source in the next 2-3 decades in Europe. However, projections of European gas demand are being revised downwards. Due to decrease in indigenous production and increase in natural gas primary consumption certainty about future gas demand in the European Union has changed over the past few years. Thus is expected to become a more dependent to import needed capacity from outside of Europe satisfying the European increasing demand for natural gas and at the same time protecting the climate and environment is one of the greatest challenges of this age. This paper demonstrates the main important planned natural gas pipeline's mechanisms for Europe to see how much of expected future demand of Europe will be covered by planned natural gas pipelines. If there will be no economical and most important political, etc issues it seems planned pipelines will be operated in the time scheduled and cover the most part of European demand raised by decrease in indigenous and increase in primary consumption in coming decades.

Key words: Fossil fuel source; Natural gas import; European Union; Natural gas pipeline

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INTRODUCTION

This paper demonstrates and explains the planned natural gas transport routes and mechanisms, thus the paper is divided into three parts. The first part gives information about origin, history and technical characteristics of natural gas in addition to that World's distribution of proved natural gas reserves and production rates by regions is mentioned and compared between years. In the second part by discussing energy consumption it gives the hint about future growth of natural gas consumption in Europe and simply by comparing the natural gas consumption between years the factors which have important influence on demand curve are founded out beside that it take a outlook for natural gas demand by sectors to highlight the European import dependency from outside of Europe. After describing the possible imports origins, the third part lists and take a deep look to the potential projects which are planned or under construction pipelines to get the natural gas sources to consumption area in Europe .In the final conclusion part results from previous chapter will be evaluated and adequacy of covering the important part of raising demand in Europe with planned pipeline will be figured out.

1. BASICS ABOUT NATURAL GAS

1.1 Origin and History of Natural gas

The discovery of natural gas dates from ancient times in the Middle East. Thousands of years ago, it was noticed that natural gas seeps ignited when lightning and created "burning springs". In Persia, Greece or India, people built temples around these "eternal flames" for their religious practices. However they did not recognize the energy value of natural gas. It was done in China around 900BC. The Chinese drilled the first known natural gas well in 211 BC (Homann, 2008).

In Europe, natural gas was unknown until it was discovered in Great Britain in 1659 although it was not

commercialized until about 1790. In 1821 in Fredonia, United States, residents observed gas bubbles rising to the surface from a creek. William Hart, considered as America's "father of natural gas", dug there the first natural gas well in North America.

Throughout the 19th century, natural gas was used almost exclusively as source of light and its use remained localized because of lack of transport structures, making difficult to transport large quantities of natural gas through long distances. There was an important change in 1890 with the invention of leak proof pipeline coupling. However, existing techniques did not allow for gas going further than 160 km. and it was mostly flared of left in the earth. Transportation of natural gas to long distances became practical in the 1920s as a result of technological advances in pipelines. It was only after World War II that the use of natural gas grew rapidly because of the development of pipeline networks and storage systems.

1.2 Description and Technical Characteristics

Natural gas is colorless, odorless, tasteless, shapeless and lighter than air. It is gaseous at any temperature over -161ºC. When it is at its natural state, it is not possible to see or smell natural gas. For safety reasons, a chemical odorant that smells a little like rotten eggs, Mercaptan, is added to natural gas so that it can be smelled if there is a gas leak.

Natural gas is a mixture of light hydrocarbons including methane, ethane, propane, butanes and pentanes. Other compounds found in natural gas include CO_2, helium, hydrogen sulphide and nitrogen. The composition of natural gas is never constant, however, the primary component of natural gas is methane (typically, at least 90%), which has a simple hydrocarbon structure composed of one carbon atom and four hydrogen atoms (CH_4). Methane is highly flammable, burns easily and almost completely, while it emits very little air pollution. Natural gas is neither corrosive nor toxic, its ignition temperature is high, and it has a narrow flammability range, making it an inherently safe fossil fuel compared to other fuel sources. In addition, because of its specific gravity of 0.60, lower than that of air (1.00), natural gas rises if escaping, thus dissipating from the site of any leak.

1.3 Natural Gas Reserves

World's resources of natural gas, although finite, are enormous, while estimates of its size continue to grow as a result of innovations in exploration and extraction techniques. Natural gas resources are widely and plentifully distributed around the globe. It is estimated that a significant amount of natural gas remains to be discovered.

Figure 1 Distribution of proved natural gas reserves (%) in 2004. The former Soviet Union holds the world's largest natural gas reserves, 38% of the world's total. Together with the Middle East, which holds 35% of total reserves, they account for 73% of world natural gas reserves (Brunner, 2004). In 2000 total world reserves were 150.19 trillion cubic meters. Global reserves more than doubled in the last twenty years. World's ratio of proven natural gas reserves to production at current levels is between 60 and 70 years. This represents the time that remaining reserves would last if the present levels of production were mentioned.

Figure 1
World Proved Gas Reserves (bcm)

2 ENERGY CONSUMPTION

2.1 Europe Primary Energy Consumption by Fuel 2006

As it is shown in the Figure 2, over the period the share of natural gas had reached 24% of the Primary energy Consumption. Because of "its green properties" and highly efficient application technologies, natural gas will remain the fuel of choice and will continue to make a growing contribution to energy supply in the EU27.

2.2 Future Growth of Natural Gas Consumption in Europe

Natural gas can play an important role as a bridging fuel to a sustainable energy future over the coming decades Natural gas consumption in EU member states is expected to increase from 443.58 mote in 2006 to 625 mote in 2030, which is an increase of 43% (FauCheux, 1998). The share of natural gas in the European primary energy demand will rise from 24% in2005 to 30.1% in 2030 (18% in 1990). At 60% of the total demand increase, most of the growth will come from power generation.

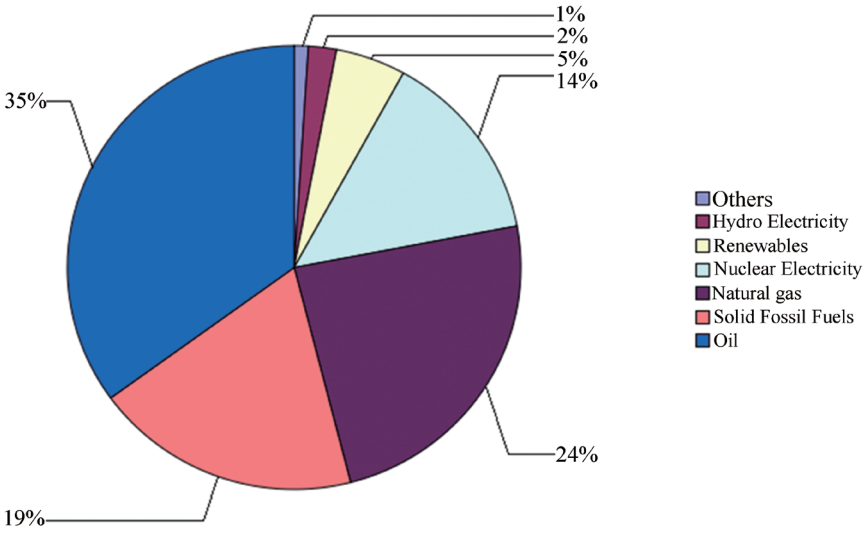

Figure 2
EU Primary Energy Consumption by Fuel 2006

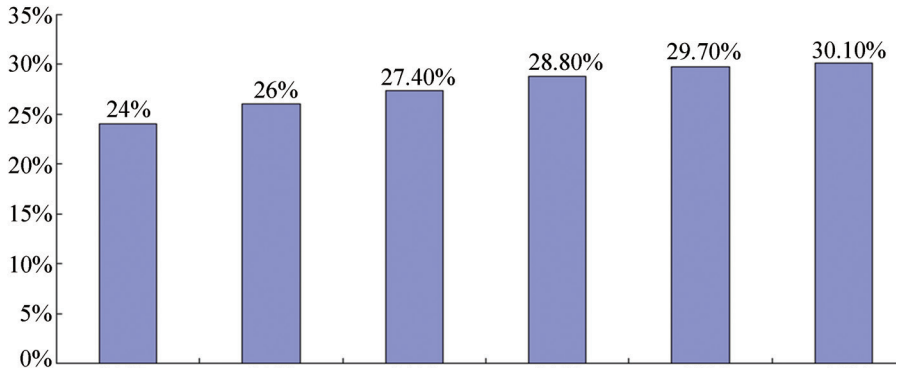

Figure 3
The Growth of Share of Natural Gas in European Primary Energy Consumption

2.3 EU Import Dependency From Outside Europe

On the contrary, production potential of European sources is expected to drop by about 30% as indigenous production all over Europe is decreasing very dramatically. Due to the depletion of gas reserves, even if consumption remained at the same level as in 2005, between 125-173 bcm/yr, external supplies will be necessary to compensate for the loss of production. Therefore it is a must that new sources have to be established for the European gas markets to meet the expected future gas demand (Fiseher-Kowalski, 2004). Liquefied Natural Gas (LNG) is another source for the supply of gas. But the process of liquefying natural gas is still expensive and most of the natural gas exporters and importers have to develop the infrastructure to make LNG shipments cost-effective (Stern, 2004).

Therefore, in the short and middle term, European consumption of piped natural gas is likely to rise. In the Middle East and the Gulf region, Iran and Qatar have around 40% of the world's proven non-associated gas reserves. Iraq is still uncertain concerning its reserves and the future of its gas sector - which is expected to be determined by political developments in the coming years, however, it is still a potential source with an unknown capacity for 2030. By 2030, a production capacity of 890 bcm/yr is expected in the Middle East and Gulf, leaving in excess of 520 bcm/yr ready to be exported (European Commission, 2003).

Supply sources are already available to meet this expected increase in the future European gas demand from neighbor areas such as the Middle East, the Gulf and the Caspian regions. The big challenge, however, is to transport this gas to the consumers and at present the means for transporting these volumes of gas to the European markets is not sufficient.

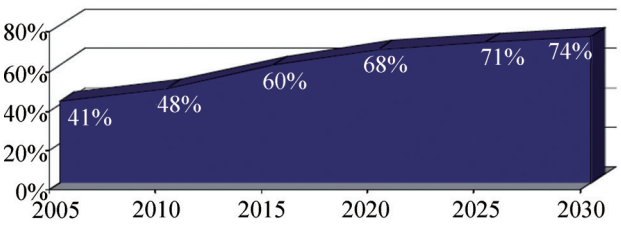

Figure 4
Eu Import Dependency From Outside Europe

2.4 Supply of Natural Gas

Supplies of natural gas give indications about indigenous production and imports in EU25 (Turkeyand Norway are not included). Total net supplies (Indigenous production + imports – exports +/-stocks) of the EU25 increased by 1.9% between 2004 and 2005. Indigenous production in the EU25 has decreased by 6,9% to 8010 PJ (205 Bcm) over the period: Spain (-84%), Slovakia (-38%), Ireland (-34.4%) and France (-25%). In 2005, 41% of EU25 natural gas net supplies were covered by indigenous production. Three quarters of EU25 indigenous production is concentrated in two countries: 43% in UK and 33% in the Netherlands. Between 2004 and 2005, some countries increased their indigenous production with the Czech Republic (54.8%) in the lead, followed by Denmark (23%) and outside the EU, Turkey (26.8%). In 2005, 185.5 Pj (4,7 Bcm) of natural gas were injected in storage across EU25. Total net imports from non-EU countries have increased by 14%, representing 11,706 PJ (300 bcm) in 2005 (Appendix b)

3. FUTURE GAS IMPORT ROUTES INTO EUROPE

There is a need for further capacity for gas import into Europe in future. Many projects have been proposed but only some of them will be realized. There are four main gas-supplying sources from outside Europe, which are Russia, Middle East, North Africa and LNG where gas can be supplied from sources even further away. Each one of the four main gas sources has several potential gas supplying routes. There are many new gas import projects in Europe. From Russia, the transportation capacity in the Yamal-Europe pipeline has also been increased by about 6 bcm yearly since two compressor stations 15 have been added. Green stream also increases the import capacity in Italy by about 9 bcm yearly also.

It is planned to increase the capacity of Trans-Mediterranean Pipeline which is running from Algeria to Italy to 8 bcm/year by 2012 (Energy Information Administration, 2004). In addition to these recently Finalized and ongoing projects, many projects are proposed, as will be shown later.

EU countries can be divided into two groups: the EU border countries able to import gas directly, and the countries which must transit their gas through other EU countries first. The EU border countries are Finland, Estonia, Latvia, Lithuania, Poland, Slovakia, Hungary, Romania and Turkey.

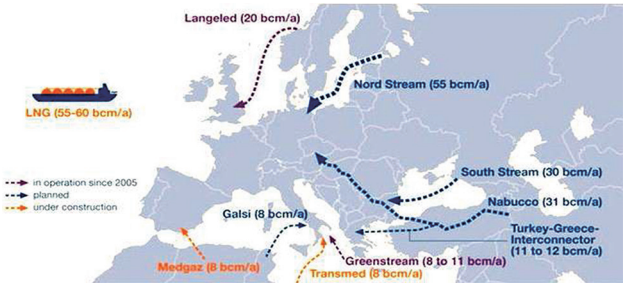

Figure 5
Planned and Under Construction Pipeline Route Into Europe Source

3.1 Potential Projects

So far, some of the proposed gas import projects have not been possible to implement Many gas pipeline projects are promoted to be used for importing gas into Europe. Some of the specific gas pipeline projects planned appears in the list below. These projects are also used to estimate the needs for future investment in the gas import transmission system. So let's demonstrate and take a deep look for these potential projects.

3.1.1 Nord Stream Pipeline

The North European Gas Pipeline (NEGP) or Nord Stream also known as the Russo–German gas pipeline is an offshore pipeline stretching through the Baltic Sea, from Vyborg, Russia to Greifswald, Germany and under construction from 2005 and 2010 (first line) / 2012 (second line) and operated by Nord Stream AG (Ian, 2009). According to latest information from Nord Stream (2007), the project preparation phase entered into a detailed planning phase on 1 January 2007. The start of the main construction is scheduled for the third quarter of 2008 and will be finalized in 2010. The second line is expected to operate in 2012. It is designed to supply western European countries such as Germany, the Netherlands and the United Kingdom with 55 billion cubic meters of natural gas annually, mainly obtained from the Shtokman gas field in the Barents Sea (overall reserves have been estimated for 3.7 trillion tons).

Nord Stream could provide about 25% of rise in natural gas needed which has been mentioned in previous sections.

Figure 6
North Stream Pipeline Route

3.1.2 South Stream Pipeline

South Stream is a new gas pipeline system which will link Russia to the European Union across the Black Sea. The agreement provides for a technical and economic feasibility study of the project which will be prepared by Saipem, a subsidiary of Eni, and it is expected to be completed by 2008. The necessary political and regulatory evaluations and approvals, and establishes the guidelines for the cooperation between both companies for the planning, financing, construction and technical and commercial management of the pipelines. Simply south stream is a proposed gas pipeline to transport Russian natural gas to Italy. The project would partly replace the planned extension of Blue Stream from Turkey through Bulgaria and Serbia to Hungary and Austria. South Stream is also likely to dash hopes of Gazprom joining the Nabucco Pipeline project. The South Stream project is seen as a rival to the planned Nabucco pipeline (Dresen, 2006). There are doubts about the feasibility of South Stream project, since it may cost twice as much as Nabucco. Some experts claim that the South Stream pipeline is a political project to counter Nabucco and to expand Russian presence in the region.

But on 25 February 2008 Russian First Deputy Prime Minister and Hungarian Prime Minister both have confirmed that there is no contradiction between South Stream and the Nabucco pipeline project, designated to bring Caspian (Azerbaijani) gas to South and Central Europe via Turkey. "South Stream will have no negative impact on Nabucco, just as Nabucco will have no negative effect on South Stream.

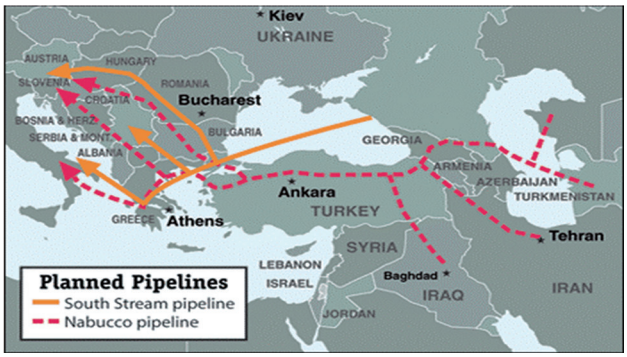

Figure 7
Route of Planned South Stream and Nabucco Pipeline

3.1.3 Nabucco Pipeline

Nabucco pipeline is planned pipeline which may be will supplied with gas from Iran, Iraq, Azerbaijan, Kazakhstan, Turkmenistan, Egypt and Syria. The main source of supply will be the second stage of the Shah Deniz gas field, coming on-stream in 2013. There is an agreement for 8 bcm of natural gas per annum with further expansion. Turkmenistan would provide for Nabucco 10 bcm of gas annually. The Iraqi gas would be imported from the Ekas field via the Arab Gas Pipeline (Honoré, 2006). In the long term, Egypt could provide 3-5 bcm of natural gas. There is also option, that Nabucco could be feeded with Russian natural gas through the Blue Stream pipeline. In 2006, Gazprom proposed an alternative project competing Nabucco Pipeline by constructing a second section of the Blue Stream pipeline beneath the Black Sea to Turkey, and extending this up through Bulgaria, Serbia and Croatia to western Hungary. In 2007, the South Stream project

through Bulgaria, Serbia and Hungary to Austria was proposed (Ian, 2009). It is seen as a rival to the Nabucco pipeline.

The Nabucco project is included in the EU Trans-European Energy Network program and a feasibility study for the Nabucco pipeline has been performed under an EU project grant. The FEED services of the pipeline, including the overall management of the local FEED contractors, the review of the technical feasibility study, route confirmation, preparation of the design basis, hydraulic studies, overall SCADA and telecommunications, GIS and preparation of tender packages for the next phase, is managed by UK-based consultancy.

According to a preliminary time schedule this Development Phase is foreseen to last until end of 2008, when financial close is expected. The construction of the Nabucco Pipeline is planned for 2009 with an envisaged start up of transportation of gas in 2012. (Internet) estimated investment costs including financing costs for a complete new pipeline system amount to approximately 5 billion Euro in 2004 prices (Morita, 2003).

Figure 8
Planned Nabucco Pipeline Route

CONCLUSION

Decreasing share of indigenous production and increase of natural gas primary consumption requires significant increase of base load supplies from remote sources.

Additional imports of 230 BCM/a will be brought to market till 2020. Huge transportation and regas infrastructure projects are planned and under construction. Dependency on Russia is increasing and opportunities for Caspian and Middle East Region are becoming increasingly important despite political risks (Dresen, 2006). If strict economic rational behavior will take place not all projects will be build .However individual strategic decisions e.g. Nord Stream or LNG projects are setting the scene and cause different economics settings for the markets and its security of supply The Ukraine is a key player in securing the security of supply with a transit potential of some 160BCM/a and storage capacity of some 30 BCM This potential and the direct connection to the Caspian region shall be captured in order to secure a wider supply mix.

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