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Some future scenarios of Russian natural gas in Europe

Tatiana Mitrova [a], Tim Boersma [b, *], Anna Galkina [c]

[a] Energy Research Institute, RAS, Moscow, Russia
[b] Energy Security and Climate Initiative, The Brookings Institution, Washington, DC, USA
[c] Energy Research Institute, RAS, Moscow, Russia

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ABSTRACT

This study contains a number of scenario studies to assess the share of Russian natural gas in the European natural gas mix going forward. Scenarios were calculated using the NEXANT world gas model (WGM) integrated in ERIRAS modeling information complex SCANER. The calculations in the WGM are based on demand and potential production forecast in each gas producing and/or gas consuming country of the world up to 2040. The paper continues with a discussion of the (limitations of the) most often debated alternatives to Russian gas. We conclude that remarkable little changes in the European natural gas mix in the scenarios under study, and that absent very drastic policy interventions Russian natural gas will continue to play a prominent role in the EU.

1. Introduction[1]

Ongoing turmoil in Ukraine has once again sparked a debate about European energy dependence on Russia. That debate is not new and has been revitalized repeatedly since the first major supply disruption in 2006, which took place after several decades of fairly stable supplies. That decade-long cooperation between the then Soviet Union and European Economic Community has resulted in a European gas market that has a vast network of pipeline infrastructure, connecting roughly 75% of European markets and facilitating the transportation of significant supplies of natural gas to come into the market (for a detailed account of the origins of Europe's dependence on Russian natural gas, see Ref. [9].

Since the 1990s, European institutions have been engaged both in liberalizing European gas markets, which had historically been developed at the member state level, and in further integrating them. This process is not complete, despite the explicit ambition of the European Commission (EC) to achieve an integrated internal market by 2014. These efforts are crucial for the European Union (EU) as a whole, as domestic production of natural gas continues to dwindle, and import dependence increases despite the fact that demand is predicted to be largely flat, and possibly even decreasing. Other studies provide detailed overviews of the progress that has been made over the last two decades in terms of European cooperation [1,3]. Their central argument is, that by integrating national gas markets, and investing in sufficient infrastructure, natural gas can flow freely through the EU, and give member states access to various sources of supply. This in turn increases competition, and decreases chances of market power abuse. For the vast majority of the EU, this approach has demonstrably worked. For this paper, suffice to say that completion of the internal market is not expected before the end of the decade, and several member states in the EU as a result will be single-source dependent for the nearby future.

Despite a new push for European market integration under the flag of the so-called Energy Union, absent drastic interventions in the institutionalized division of labor between public and private actors in European gas markets, on the European level we do not foresee a radical shift away from dependency on Russian natural gas supplies that has been plead for by so many politicians and commentators, on both sides of the Atlantic. Instead, absent such interventions, we assume that the fundamental incentive for private entities to act (i.e. price) has not changed, and that political preference will not enter the commercial lexicon. This, combined with the reality that most alternative supplies are only second best options (because their costs are higher and the quantities are not expected to be sufficient to replace 150 bcm of Russian gas, or

* Corresponding author.
E-mail address: tboersma@brookings.edu (T. Boersma).

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because supplies will not reach the market in the foreseeable future) and a substantial amount of natural gas supplies is tied up in long-term contracts, leads us to believe that despite the often expressed political desire for change no significant change will in fact happen.

Based on these observations and premises, we have conducted a number of scenario studies to assess the share of Russian natural gas in the European natural gas mix going forward. Their method, data, and main conclusions are discussed subsequently. Then we discuss the limitations of the most often debated alternatives, e.g. importing more liquefied natural gas (LNG), or bringing in alternative supplies through the so-called Southern Corridor (we include reference to the Mediterranean in this context). We then discuss our main findings and highlight what they mean for the EU gas market development and energy security.

2. Method

Apparent and implicit changes in the European energy diversification policy are examined using analytical and statistical methods. For an assessment of the role of the different gas suppliers and their competitiveness, optimization modeling, which covers all the potential gas supply options and their costs, was necessary. As the European gas market is becoming more integrated in the global gas trade, gas is expected to come from different sources from all over the world, so the assessment of the supply options and their potential role in covering European gas demand requires the use of the global gas model. There are just few global gas models optimizing total gas supply costs: Global Gas Model (GGM) developed by Wood MacKenzie[2], WGM (World Gas Model) developed by the University of Maryland[3] and DIW[4], world gas model (WGM) developed by NEXANT[5] and World Gas Trade Model developed by Rice University[6].

In this study the NEXANT world gas model (WGM) integrated in ERIRAS modeling information complex SCANER [12] was used. The calculations in the WGM are based on demand and potential production forecast in each gas producing and/or gas consuming country of the world up to 2040. The model contains a few thousands of routes of LNG and pipeline gas supply connecting these countries (and corresponding transportation costs). The aim of the WGM is to deliver optimized volumes of gas supply by each route. The optimized solution is set to be the cheapest one. In other words, the WGM searches for the minimum cost of meeting world gas demand. Unlike many energy markets models, which use prices as assumptions, the WGM calculates gas prices as long-run marginal costs of supply in each country. To account for the features of gas markets pricing mechanisms the data on volumes, prices and take-or-pays of long-term contracts is also included in the model.[7]

One of the basic assumptions of the WGM – gas demand forecast by country – is obtained from SCANER and calculated based on countries' energy balances forecast, that involves projections for economic development, demography indicators, and energy policy analyses. The SCANER complex contains data on almost 200 nodes all over the world, including detailed data on Russian fuel and energy complex. Primary gas demand from SCANER can be adjusted by the WGM if resulting gas prices indicate low competitiveness of gas compared with coal, nuclear or renewable energy.

A set of scenarios were prepared, covering what we believe are the major potential developments regarding Russian gas supplies to European gas market. In these scenarios, the ways in which Russian gas could be replaced were regarded. This resulted in four scenarios: a baseline scenario (assuming no major changes in Russian gas supplies), a scenario without the Extension of the Russian Contracts (reflecting a political desire to stop purchasing Russian gas), a scenario without the construction of Turkish Stream (suggested by Gazprom as an alternative to the cancelled South Stream project), and finally a scenario without Ukrainian Transit (an ambition often voiced by Russian authorities, and often said to take effect in 2019, though comments vary).

2.1. General assumptions for all scenarios

In all scenarios we have made a number of general assumptions.

- In the period from 2015 to 2040, we assume that global gas consumption will increase by 48% to 5.3 trillion cubic meters (tcm). This corresponds to an average annual growth rate of 1.6%.
- We assume that demand for natural gas in Europe[8] will begin to recover as early as 2015 and will increase by 20% to 2040, which is an average annual growth rate of 0.6% in the forecast period, thus reaching the pre-crises level.
- Natural gas production in Europe (with account for a new production profile in the Netherlands) will drop to 212 billion cubic meters (bcm) as early as 2020. However, after 2020 we expect domestic production to continue to decline very modestly, to 199 bcm by 2040. This includes assuming a total of 20 bcm of shale gas production in 2040. In our calculations we assume that over 80% of the European shale gas production takes place in the UK and Poland.
- We assume an average CO_2 emission price of 40 euros per ton in the period from 2015 – 2040.[9]
- Due to the political instability in Iraq, high domestic gas demand in Iran, and limited resource availability in Azerbaijan, the Southern Corridor will be significantly expanded only after 2030

[2] http://www.woodmac.com/content/portal/energy/highlights/wk5_Nov_14/Global%20Gas%20Model%20Overview.pdf.

[3] Optimization Models in the Natural Gas Industry [текст]/Qipeng P. Zheng, Steffen Rebennack, Niko A. Iliadis, Panos M. Pardalos//Handbook of Power Systems I (Energy Systems)/ed. Panos M. Pardalos, Steffen Rebennack, Mario V. F. Pereira, Niko A. Iliadis. – Ganeswill, Florida, U.S.: University of Florida, 2010.

[4] The World Gas Model: a Multi-Period Mixed Complementarity Model for the Global Natural Gas Market/Ruud Egging, Franziska Holz, Steven A. Gabriel. – Berlin: DIW, 2009.

[5] http://thinking.nexant.com/program/world-gas-model.

[6] P. Hartley, K.B. Medlock. The Baker Institute World Gas Trade Model. The James A. Baker III Institute for Public Policy. March 2005. http://bakerinstitute.org/media/files/Research/81966512/the-baker-institute-world-gas-trade-model-biwgtm.pdf.

[7] Data on gas production capacities, long-term contracts and massive datasets on world gas transport infrastructure is provided by Nexant - http://www.nexant.com/solutions/oil-and-gas/natural-gas.

[8] Europe includes 34 countries: Albania, Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Republic of Macedonia, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom.

[9] It is important to note that in light of the 2015 Paris agreement on climate change governments may proceed to implement more stringent carbon regulations. Writing in early 2016 though, carbon prices in the European Emissions Trading Scheme (ETS) hoover around 6 €/ton, and reforms to the ETS will not be implemented before 2018. The carbon price after 2018 is uncertain at this point. Even though this is beyond the scope of this study, we would speculate that a higher carbon price would actually have an upward effect on natural gas consumption, as it would make it a more competitive fuel source for electricity generation in comparison to more carbon intensive coal. In the United Kingdom, policy makers installed a price floor of £18.08 for every ton of carbon emitted, incentivizing fuel switching from coal to natural gas. We cannot rule out more ambitious carbon pricing policies in the EU, but appreciating the complicated politics around this topic believe we should not assume this at this point.