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Business As Usual

European Gas Market Functioning in Times of Turmoil and Increasing Import Dependence

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Introduction

Ongoing turmoil in Ukraine has once again sparked 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 collaboration 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 percent of European markets and facilitating the transportation of significant supplies of natural gas to come into the market.[1]

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 far from 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. This paper will discuss the progress that has been made over the last two decades in terms of European collaboration, and the arguably long road that is still ahead towards full market integration.

In the coming months, we expect to see a new push for further European integration, like the ones launched in 2006 and 2009 after the aforementioned supply disruptions, even though to date we have not witnessed a sizable supply disruption comparable to aforementioned cases. Similar to 2006 and 2009, the relevant question is how quickly the measures can be introduced, and take effect. It is also worth noting that the situation in Ukraine continues to be fluid, and so an escalation of events may trigger unexpected policy interventions. Nonetheless, 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

[1] For a detailed account of the origins of Europe's dependence on Russian natural gas, we refer to Per Högselius, *Red Gas: Russia and the Origins of European Energy Dependence*, (New York, NY: Palgrave Macmillan, January 2013), http://www.palgrave.com/page/detail/red-gas-per-högselius/?k=9781137293718.

enter the commercial lexicon. This, combined with the reality that most alternative supplies are only second best options (because their costs are significantly higher, or the quantities are not expected to be significant any time soon, or 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. Of course the context in which natural gas trade in Europe takes place has changed dramatically, and we now observe a situation in which the EU and Russia are conducting what increasingly looks like a trade war with sanctions flying back and forth. Yet despite that change of context, and assuming that the sanctions in due time will be lifted again, our analysis suggests that absent drastic policy interventions no significant changes in natural gas supplies are to be expected: hence, business as usual.

Based on these observations and premises, we have conducted a number of scenario studies, whose method, data, and main conclusions will be discussed in detail later in the paper. However, we start this report with a brief overview of European market liberalization and reforms to date, and the road that still lies ahead to effect this transformation. Then, after we present our methodology and data, 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 then discuss our main findings and highlight what they mean for the EU gas market development and energy security.

European Gas Markets Under Construction

Notwithstanding efforts in the early 1990s to facilitate non-discriminatory transit of natural gas through the EU and to increase price transparency, the EC in 1998 started developing the European internal gas market with the publication of the first Gas Directive.[2] This Directive contained common rules for the transmission, distribution, supply, and storage of natural gas. It was ambitious legislation, which among other things aimed to implement non-discriminatory market access for undertakings willing to invest, safeguard third-party-access (TPA) to gas infrastructure, and gradually to open up what had traditionally been nationally organized markets, by breaking up incumbent gas companies.[3]

Five years later, the EC established "significant shortcomings" in the desired integration of national gas markets, and to effect these reforms launched the second Gas Directive.[4] This Directive was more explicit in its desire to unbundle what had traditionally been integrated gas companies, because of the alleged risk of cross-subsidization and lack of transparency. In addition, the Directive contained measures to entice consumers to switch between suppliers and protect them in case of disputes. Under the Directive, member states were required to appoint system operators for gas infrastructure, and to create independent regulatory authorities to monitor competition and deal with market abuse, ensure transparency and set tariffs. Unfortunately, it took the EC another number of years before it concluded that these measures "did not provide the necessary framework to achieve the objective of a well-functioning internal market."

The EU then proceeded with the publication of what became widely known as the Third Package, a series of three regulations and two directives (the difference between these two legislative documents is discussed shortly).[5] The two directives focused mainly on consumer rights (e.g. facilitating switching to other suppliers without barriers) and, again, unbundling of integrated companies. As an alternative to full ownership unbundling however, countries were offered alternatives, namely to create an independent system operator (ISO) or an independent transmission operator (ITO). Essentially this choice provides member states with

[2] Directive 98 / 30 / EC.
[3] For a detailed account of this legislative history, see Tim Boersma, *Energy Security and Natural Gas Markets in Europe: Lessons from the EU and United States*, Forthcoming, (Routledge, June 2015), http://www.routledge.com/books/details/9781138795129/.
[4] Directive 2003 / 55 / EC.
[5] "Single Market for Gas & Electricity: Third Package," European Commission, accessed on 7 October 2014, http://ec.europa.eu/energy/gas_electricity/legislation/legislation_en.htm.

the opportunity either to leave the transmission networks within the integrated company with the operation of the networks coming into the hands of an independent operator (ISO), or alternatively to create an independent transmission company in the integrated company with the important difference being that the assets remained on the company's balance sheet (ITO). While further details of these changes are beyond the scope of this paper, it is important to note that in essence these alternatives were designed to facilitate integrated energy companies from the most influential member states, in particular Germany and France, because they had been reluctant to implement previous legislation, based on fears that their companies (national champions) would lose their competitive edge following full scale unbundling. The three regulations predominantly focused on infrastructure and regulation were also important components of the reform program and are discussed in more detail when we address the gas target model. In addition, an alliance of gas transmission operators, called ENTSO-G, was created, as was the Agency for the Cooperation of Energy Regulators (ACER). The third regulation focused on third party access to pipelines and transparency requirements.

In retrospect, this series of events and policies has had the overall positive effect of liberalizing natural gas markets, yet there are also a number of negative outcomes, complicating EU policy making and effective energy market functioning. First, whereas policies to liberalize European gas markets initially focused predominantly on the market side of the energy system, other, and equally important, elements of the gas system, particularly infrastructure and regulation were left unaddressed because the member states could not reach an agreement on how to address these challenges. This asynchrony has resulted in a market in which energy companies by and large started operating on a European scale, while cross-border infrastructure and fine-tuning of regulatory regimes between different member states essentially only happened where it commercially made sense.[6] Second, most of the issued legislation has come in the form of directives, and only a few in the form of regulations. The important difference is that the latter are automatically transposed in member states' national legislation, whereas directives lay down the end results that are expected but leave the member states the opportunity to decide how they want to adapt their national legislation to meet these goals.[7] The problem is that member states can decide not to implement a directive, whatever their motive may be. In the case of natural gas directives, this happened structurally, as confirmed by the laundry list of 14 different member states that had not implemented either the second natural gas directive and/or the third gas directive by late 2012 (the latter should have been transposed into national legislation by spring 2011).[8] This assessment is based on the list of pending infringement procedures of the EC against these member states. In essence, member states carry the responsibility to implement adopted European directives, and if they omit the EC can start an infringement procedure, and eventually take the case to the European Court of Justice.[9] This is a multi-year process that rarely makes it all the way to court, yet member states can delay significantly the implementation of legislation nonetheless.

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[6] See Boersma, *Energy Security and Natural Gas Markets in Europe*.

[7] "Application of EU Law: What Are EU Directives?" European Commission, accessed on 7 October 2014, http://ec.europa.eu/eu_law/introduction/what_directive_en.htm.

[8] "Energy Markets in the European Union in 2011," European Commission Staff Working Document, 15 November 2012, 368 final, part III, http://ec.europa.eu/energy/gas_electricity/doc/20121121_iem_swd_0368_part3_en.pdf.

[9] "Application of EU Law: Infringements of EU law," European Commission, accessed on 7 October 2014, http://ec.europa.eu/eu_law/infringements/infringements_en.htm.

The aforementioned two major negative connotations have contributed to a trend in which parts of the EU gas market have developed at different speeds. The Northwestern part of the market, where the bulk of gas demand occurs, is reasonably well developed and integrated, with sufficient infrastructure and interconnectors. The market has increasing hub-trading, liquidity and price conversion, all confirmations of a well-functioning market. In Central and Eastern Europe and Southern Europe, the situation is totally different.[10] Because these markets are small and fragmented private investors are not interested in putting capital in infrastructure projects (interconnectors, storage facilities, or reverse flow options), and trading floors, if they exist at all, are only marginally established. As a result, single source dependence (on Russian Gazprom) prevails, and the lack of competition leaves buyers of natural gas in this part of the continent vulnerable to arbitrary pricing or other forms of abusive market power. Moreover, whereas markets in Northwestern Europe are increasingly shifting to hub-based pricing mechanisms, in Central and Eastern Europe oil-indexed contracts are expected to continue.[11] We would like to note that while hub-based pricing is generally believed to result in lower gas prices as compared to oil-indexation, this is a theoretical misconception. While lower prices surely are one possible outcome of hub-based pricing, it is possible that spot-based pricing also leads to more volatile prices and that in times of scarcity oil-indexed natural gas may well be cheaper than what is available on the spot-market.[12] Granted, hub prices have been substantially below oil-indexed long-term contract prices since 2009, with some exceptions when hub prices spiked. Recent empirical evidence suggests that the general trend has been towards lower gas price volatility, though day-ahead volatility rebounded at the French and British hubs in 2012 and 2013.[13]

Arguably since the second major supply disruption in 2009, European institutions have made serious efforts to address this lack of market development. One of the structural problems has been the division of labor between European institutions and the member states. Whereas there have been voices calling for a coordinated European energy policy since the Declaration of Messina in 1955, essentially member states still have a strong say when it comes to this topic, though much has changed in recent years. Over the years, as the European community grew from the initial 6 to 28 member states, developing a European energy policy has become more complicated than it was at the onset. While the details are beyond the scope of this study, the three key objectives that have been linked to EU energy policy (security, competitiveness, and sustainability) are inherently contradictory, to a certain degree. In essence, the east of the EU is concerned with security, whereas the northwest is concerned with sustainability, and then there is some concern about competitiveness. These different positions complicate effective policy-making on an EU level. As described, when it comes to market liberalization and market functioning policies, the EC sets the agenda and designs policies, though implementation has not always gone smoothly. In addition, in terms of renewable energy and climate policy the EC is clearly in the driving seat, as confirmed by the ambitious

[10] There is a vast amount of literature on the lack of market development in parts of Europe; for an overview, see Boersma, *Energy Security and Natural Gas Markets in Europe*.

[11] Frank Asche, Bård Misund and Marius Sikveland, "The relationship between spot and contract gas prices in Europe," Energy Economics, vol. 38, 2013, 212 – 217.

[12] To give an example, in January / February 2014 spot-market LNG prices were 30% higher than oil-indexed natural gas.

[13] See Beatrice Petrovich, "European gas hubs price correlation – barriers to convergence?" Oxford Institute for Energy Studies, September 2014, 70, http://www.oxfordenergy.org/2014/09/european-gas-hubs-price-correlation-barriers-to-convergence/.

policies for carbon reduction and renewable energy that have been targeted for 2020.[14] Through Regulation 994/2010 on security of supply, European institutions have had a larger mandate to collect (commercial) data to help better understand how the market functions as well as its shortcomings.[15] The potential value of these data became evident in the European energy security strategy, which was published in May 2014 in light of ongoing turmoil in Ukraine, although it remains to be seen what tangible policy proposals will result from this comprehensive document.[16]

The further integration of natural gas markets in Central and Eastern Europe provides an excellent showcase that progress is being made only at a modest pace. In January 2009, the second (and most recent) major supply disruption occurred following a pricing dispute between Ukraine and Russia that left thousands of Europeans in countries like Bulgaria in the cold.[17] What followed was a new push for market integration. Yet in the years that followed the actions taken did not reflect the urgency as generally portrayed in policy documents and political statements. In several member states such as Poland meaningful progress was made, by opening interconnectors with Germany and the Czech Republic and by constructing reverse flow options in its existing infrastructure, facilitating the possibility to have natural gas flow from west to east if needed. By carrying out comparable measures, the Czech Republic essentially became part of the German natural gas market, and as a result the Czech virtual trading point ceased to exist in July 2014. Yet a significant amount of work remains to be done to increase market resilience and to facilitate meaningful competition in other member states in Central and Eastern Europe. Table 1 provides some specific data on gas infrastructure projects that have been labelled 'key security of supply infrastructure projects' by the EC. This broad overview confirms that—though substantial progress has been made—full market integration, increased resilience and meaningful competition in all EU member states is still many years away despite all the outcries and political upheaval that we have witnessed since 2006.[18]

Existing policies however have given comparatively modest room to European institutions to address the observed shortcomings in infrastructure investments and regulatory streamlining. To start with the latter, the Agency for the Cooperation of Energy Regulators has been active for a number of years, though its mandate and budget are modest.[19] The agency has made important contributions in designing network codes on for instance capacity allocation, but the majority of codes are still pending, creating regulatory uncertainty for the foreseeable future for all market players, both in Europe and beyond.[20] More importantly, even though the most crucial

[14] A follow-up framework for the period until 2030 was proposed in January 2014, and is expected to become formalized in the fall of 2014; see "2030 Framework for Climate and Energy Policies," European Commission, 22 September 2014, http://ec.europa.eu/clima/policies/2030/index_en.htm.

[15] "Regulation 994/2010 of the European Parliament and of the Council of 20 October 2010 concerning measures to safeguard security of gas supply and repealing Council Directive 2004/67/EC (1)," European Union, L 295, vol. 53, 12 November 2010, http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=OJ:L:2010:295:TOC.

[16] "Security of Energy Supply," European Commission, accessed on 7 October 2014, http://ec.europa.eu/energy/security_of_supply_en.htm; see, in particular, "In-depth study of European Energy Security," SWD(2014)330, updated 7 July 2014.

[17] Dan Bilefsky, "Bulgaria, a Russian ally, is left cold and angry," *New York Times*, 12 January 2009, http://www.nytimes.com/2009/01/12/world/europe/12iht-bulgaria.3.19283860.html?pagewanted=all&_r=0.

[18] Data derived from "Communication from the Commission to the European Parliament and the Council," European Energy Security Strategy, European Commission, 28 May 2014, COM(2014) 330 final, Annex 2, p. 22 and further.

[19] Mark Thatcher, "The creation of European regulatory agencies and its limits: a comparative analysis of European delegation," *Journal of European Public Policy*, vol. 18, no. 6, 790 – 809.

[20] See e.g. Jonathan Stern, "The Impact of European Regulation and Policy on Russian Gas Exports and Pipelines," in James Henderson and Simon Pirani, eds., *The Russian Gas Matrix: How Markets Are Driving Change*, Oxford Institute for Energy Studies, (Oxford, UK: Oxford University Press, 2014), 86.

Table 1. Selection of planned gas infrastructure projects in Central and Eastern Europe and their estimated time of completion

Name project	Details	Finished by
Klaipeda – Kiemena pipeline upgrade	Capacity enhancement of the interconnector between Lithuania and Latvia	2017
EL-BG interconnector	New interconnector between Greece and Bulgaria to support diversification and deliver Shah Deniz gas in Bulgaria	2016
EL-BG reverse flow	Permanent reverse flow on the existing interconnector between Greece and Bulgaria	2014
BG storage upgrade	Increase storage capacity in Chiren, Bulgaria	2017
HU-HR reverse flow	Reverse flow enabling gas flow from Croatia to Hungary	2015
HU-RO reverse flow	Reverse flow enabling gas flow from Romania to Hungary	2016
BG-RS interconnector	New interconnector between Bulgaria and Serbia	2016
SK-HU interconnector	New bi-directional pipeline between Slovakia and Hungary, currently under construction	2015
PL-LT interconnector	New bidirectional pipeline, ending isolation of Baltic states	2019
FI-EE interconnector	New bidirectional pipeline between Finland and Estonia	2019
LV-LT interconnector	Upgrade of existing interconnector between Lithuania and Latvia	2020
PL-CZ interconnector	New bidirectional pipeline between Poland and Czech Republic	2019
PL-SK interconnector	New bidirectional pipeline between Poland and Slovakia	2019
PL: 3 internal pipelines and compressor station	Internal reinforcements required to link Baltics with region south of Poland	2016 – 2018
BG: internal system	Rehabilitation and expansion of transport system needed for regional integration	2017 (tbc)
RO: internal system and reverse flow to UA	Integration of Romanian transit and transmission system + reverse flow to Ukraine	Tbd

network codes will be completed by late 2015, and are already being implemented in the major European gas markets in advance of becoming mandatory, in the smaller markets in the east and south of the EU little if anything has been done on this front. Investments in energy infrastructure remain the primary responsibility of the member states. As a result of sheer volumes (and market "relevance") necessary investments in Northwestern Europe are generally made, whereas this is not the case in Central and Eastern Europe. Here public actor intervention, for instance to construct interconnectors, underground storage facilities and reverse flow options to increase resilience against possible supply disruptions, would be helpful. The results of the EU stress tests, which are expected in late 2014, will provide more helpful data on what infrastructural bottlenecks remain. European institutions however have a limited mandate when it comes to co-investing in energy infrastructure. Indeed, it was not until 2013 that the EC received its first structural mandate to co-invest though the amount (€5.85 billion for energy infrastructure, both electricity and natural gas) allocated up to 2020 was woefully meager against an anticipated EC investment requirement of €200 billion.[21] Furthermore the EC has advocated the use of unused cohesion funds, but so far attempts to utilize them have not generated meaningful results, as these funds are often earmarked for other purposes with different interests competing for them when they are unused.

In light of these aforementioned developments, a critical question is when is it realistic to believe that the EC will complete its internal market. While the initial goal was to have this complete by the end of 2014, owing to the events described, and arguably depending on one's definition of a "completed market," it appears that it will take Europe at least another couple of years before member states in Central and Eastern Europe will be resilient to potential supply shocks, and able to attract alternative supplies.[22] While this may sound dramatic, several commentators have noted that in the US restructuring of the market to its current form commenced in 1978 and is still evolving. Consequently, it is fairer to consider Europe's painful market evolution from this perspective.[23] Keeping the US experience in mind, one should note that regulatory uncertainty should be of great concern to European institutions since it may deter potential suppliers of natural gas. For a continent like Europe, which is expected to be increasingly dependent on external suppliers (a crucial contrast with the US!), the main political and regulatory focus has to be on creating an attractive market for suppliers of natural gas, regardless where they are from.

An excellent example of continued regulatory uncertainty is the so-called gas target model (GTM). The GTM has been published (endorsed by European regulatory authorities during the 2011 Madrid Forum) as an endpoint for European gas market liberalization.[24] Essentially, GTM foresees

[21] This first structural mandate of the EC is financed through the Connecting Europe Facility. Available funds, and the estimated investment requirements, are for both natural gas and electricity; see "Future Funding for Energy Policy: Connecting Europe Facility," European Commission, accessed 7 October 2014, http://ec.europa.eu/energy/mff/facility/connecting_europe_en.htm.

[22] As part of the European energy security strategy (see COM(2014) 330 final), member states are currently carrying out 'stress-tests,' which will highlight to what extent member states are vulnerable to supply disruptions. We believe that more than a required data analysis (the data are already widely available, see for instance the in-depth study of that same strategy document), this is an elegant way for the EC to make place for the next one, which is expected to start in the fall of 2014.

[23] For a detailed analysis of US market development, we refer to Jeff D. Makholm, *The Political Economy of Pipelines – A Century of Comparative Institutional Development*, (Chicago, IL: University of Chicago Press, 2012).

[24] For documents related to GTM, please visit "CEER Vision for a European Gas Target Model," Council of European Energy Regulators (CEER), 11 July – 20 September 2011, http://www.ceer.eu/portal/page/portal/EER_HOME/EER_CONSULT/CLOSED%20PUBLIC%20CONSULTATIONS/GAS/Gas_Target_Model/CD.

the division of the European gas market into so-called entry-exit zones. Gas transportation will no longer be done based on a point-to-point system with delivery points by and large at the borders of member states. Shippers that transport natural gas through the EU will have to contract capacity based on these entry-exit zones, and there is concern that this will be a rather laborious trajectory in case several member states are traversed. Moreover, changing this system is expected to create a situation in which existing long-term supply contracts no longer match the duration of the transportation contracts, raising the possibility that suppliers cannot meet their contractual obligations.[25] It is expected that in every zone a gas company will need a trade organization to sell natural gas, a costly endeavor that only large suppliers will undertake when the market size and room for competition is significant. Currently European regulatory authorities (and its coordinating European agency ACER) are developing 12 binding European network codes on cross-border issues, e.g. among which are capacity allocation, balancing rules, rules for third-party-access, and transparency.[26] So far however, the majority of these network codes has not been developed—and their advance implementation is progressing only in parts of Europe—and so regulatory uncertainty prevails. Whereas the end goal for Europe is to create an attractive market where a variety of suppliers can sell natural gas and compete for consumer services, the reality is that Europe continues to be a gas market under construction, with a number of years of regulatory uncertainty ahead. Moreover, in parts of the EU, more particularly the smaller gas markets in Central and Eastern Europe, the lack of infrastructure development and market integration continues to prohibit meaningful competition, and so arbitrary pricing and other possible abuses of market power are rife.

A pressing political question, in light of the ongoing turmoil in Ukraine, is what the effects of these uncertainties are on the political desire to diversify European natural gas supplies. In order to give our assessment of these political issues, we now turn to our analytical data explaining our model and its caveats and our basic assumptions. We then list the major findings of our research.

[25] See Stern, "The Impact of European Regulation and Policy on Russian Gas Exports and Pipelines," 85.

[26] For a detailed analysis of what the Third Package and the Gas Target Model mean for European gas markets, we refer to Katja Yafimava, "The EU Third Package for Gas and the Gas Target Model: major contentious issues inside and outside the EU," Oxford Institute for Energy Studies, April 2013, http://www.oxfordenergy.org/2013/04/the-eu-third-package-for-gas-and-the-gas-target-model-major-contentious-issues-inside-and-outside-the-eu-2/.

Scenarios for Gas Demand and Supply in Europe until 2040

Scenarios were calculated using the NEXANT world gas model (WGM)[27] integrated in ERIRAS modeling information complex SCANER.[28] 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 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.[29]

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.

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 percent to 5.3 trillion cubic meters (tcm). This corresponds to an average annual growth rate of 1.6 percent.
- We assume that demand for natural gas in Europe[30] will begin to recover as early as

[27] "World Gas Model (WGM)," Nexant; more information at http://thinking.nexant.com/program/world-gas-model.

[28] Alexei Makarov, Fedor Veselov, Olga Eliseeva, V. A. Kulagin, Vladimir Malakhov, Tatyana Mitrova, Sergei Filippov, and Lyudmila Plakitkina, "Super Complex For Active Navigation in Energy Research (SCANER) - Modelling Information Complex," Energy Research Institute, Russian Academy of Sciences (ERI RAS), 2011.

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

[30] 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.

2015 and will increase by 20 percent to 2040, which is an average annual growth rate of 0.6 percent in the forecast period.

- Natural gas production in Europe (with account for a new production profile in the Netherlands) will drop to 208 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 percent 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.
- Due to the political instability in Iran and Iraq, the Southern Corridor will be significantly expanded only after 2030 (existing 10 bcm deliveries from Iran to Turkey and 3-4 bcm from Azerbaijan to Turkey will be expanded by 10 bcm from Azerbaijan by 2019 and another 10 bcm from Iran plus 10 bcm from Iraq after 2030).
- We assume that only planned LNG terminals are being built, including long-debated terminals such as the one in Croatia, not the proposed ones.

In the following sections we describe the different scenarios that we have studied, and their main outcomes. We start with our baseline scenario, and then with scenarios, in which we respectively assume that Russian long-term contracts are not renewed, the average Brent oil price is $120/bbl[31] (instead of $100/bbl in the baseline scenario), the controversial transit pipeline South Stream is not constructed, and finally there is no transit of natural gas to the EU through Ukraine. After the analysis we discuss the often debated alternative supplies, before we end this paper with our conclusions.

BASELINE SCENARIO

In our baseline scenario, it is assumed that:

- The Brent oil price is $100/bbl;
- All Russian contracts are extended by ten years after their expiration, with a share of spot-pricing of 35 percent;
- Ukrainian transit is accessible;
- South Stream is constructed.

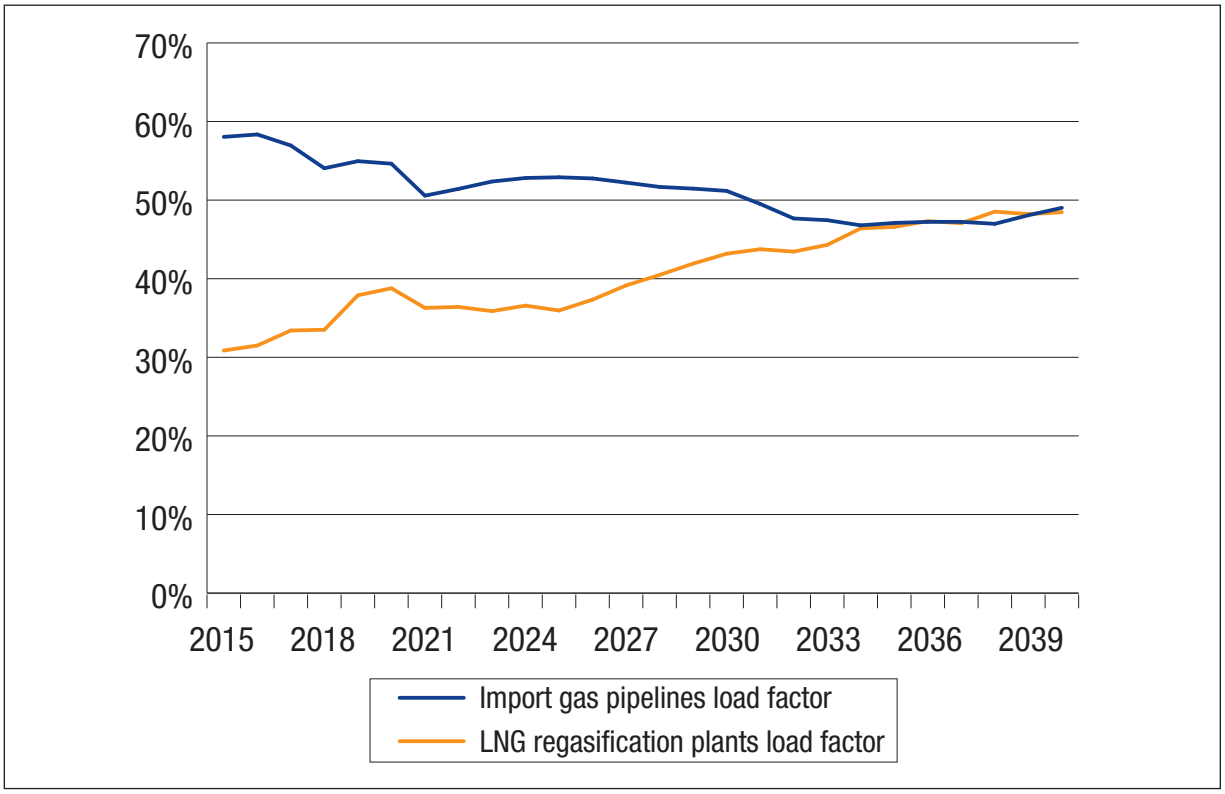
Below, we discuss the main findings of our baseline scenario.

European LNG imports grow quite steadily until the end of forecast period, from an estimated 66 bcm in 2015 to 146 bcm in 2040, while natural gas imports by pipeline increase moderately only until 2025 and then level out (from 219 bcm in 2015 to 238 bcm in 2040). Hence, the utilization of LNG terminals, i.e. the share of existing capacity that is used, in the EU increases from 31 percent in 2015 to 48 percent in 2040, while the utilization of import gas pipelines decreases from 58 percent to 49 percent (Figure 1).

In 2015, with anticipated (rather modest) natural gas demand of 500 bcm, hub prices throughout Europe attain $8–10/mmBtu. If, for example, due to cold winter natural gas demand in Europe in 2015 would increase by 50 bcm up to 550 bcm, the hub prices would grow up to $13–17/mmBtu. In other words, the current amount of excess supply in the market that Europe can attract at competi-

[31] All prices in constant 2012 dollars.

Figure 1. European import gas pipelines and LNG terminals load factors forecast, Baseline scenario



tive prices (meaning prices below those that Asian buyers are willing to pay for LNG) is very limited.

The dramatic increase in LNG import by 2020, which is driven by huge liquefaction capacity additions expected globally (in Australia, North America, East Africa, etc.), will lead to a marked decline in the spot price down to $6–8/mmBtu (at British hub NBP and Baumgarten in Austria, CEGH, respectively). As early as 2025 however, the LNG glut will be absorbed by the Asian consumers and the European hub prices will rise up to $7–10$/mmBtu and continue to grow up to $9–11$/mmBtu by 2040 (Figure 2).

The utilization rate of LNG terminals in Turkey, Greece, Croatia, the Netherlands, Poland, and Sweden is close to maximum for almost the whole forecast period—their expansion could contribute to some reduction in import prices.

In fact, the structure of the European gas balance (Figure 3) will not change dramatically during the forecasted period: pipeline supply share remains nearly flat (about 40 percent of the European gas consumption), while growing LNG imports to Europe will become the major source to compensate for the declining indigenous gas production and will increase their share in demand from 13 percent in 2015 up to one quarter in 2040, getting more diversified (Figure 4).

The share of African pipeline supplies in European gas imports will remain stable (7-8 percent of total European gas demand—Figure 5), while the share of Caspian and Middle Eastern countries (Azerbaijan, Iran, and Iraq) will nearly triple (from 3 percent in 2015 to 10 percent by 2040) upon the corresponding decline in the share of pipeline gas supplies from Russia (from 31 percent in 2015 to 23 percent by 2040 with the major decline occurring

Figure 2. European gas hub prices forecast, Baseline scenario

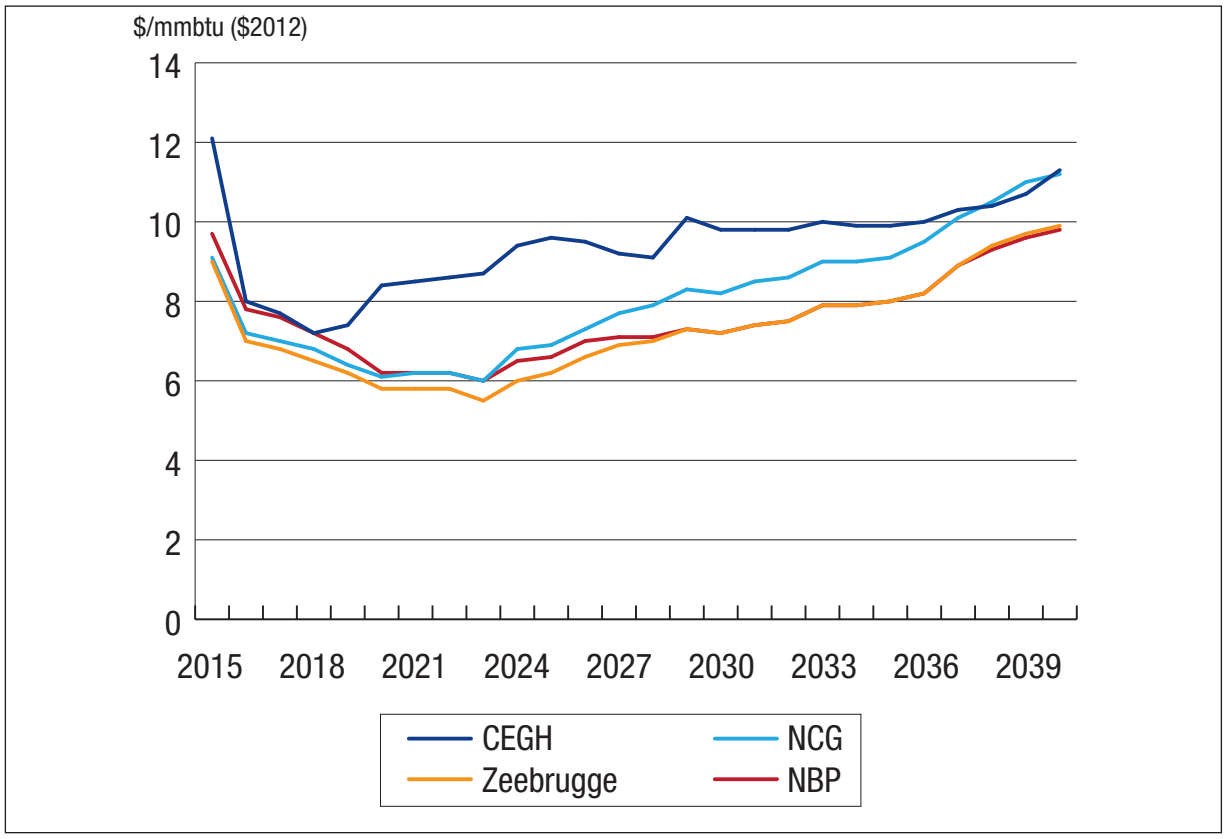


Figure 3. European gas balance forecast, Baseline scenario

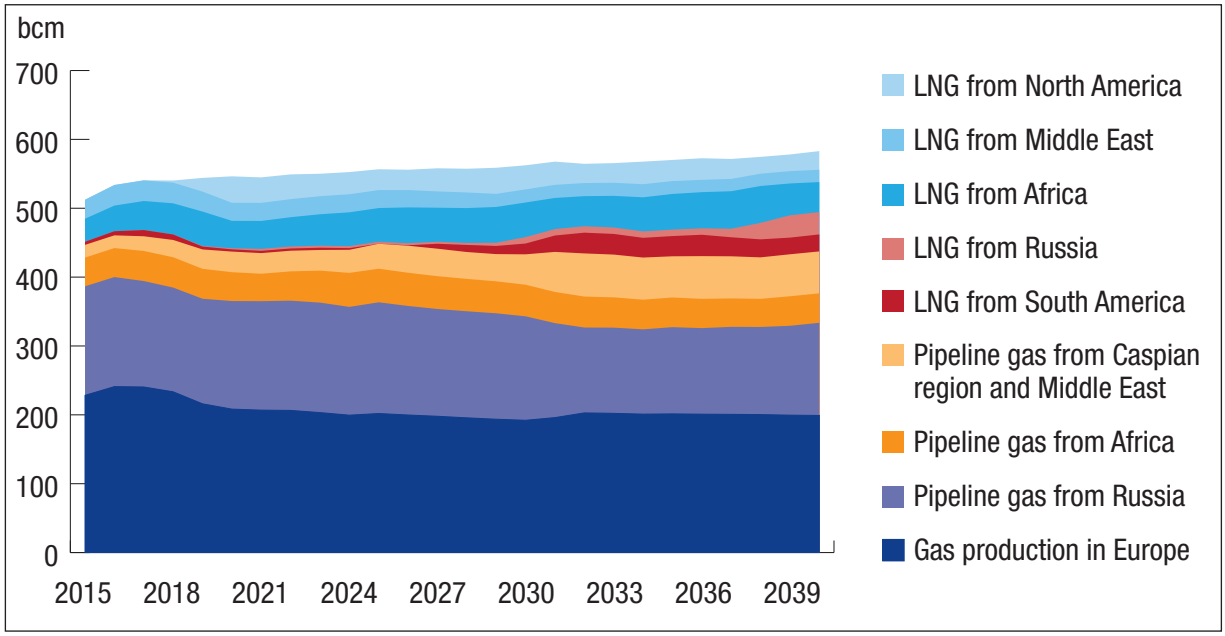


Figure 4. LNG import structure by source in 2015 and 2040

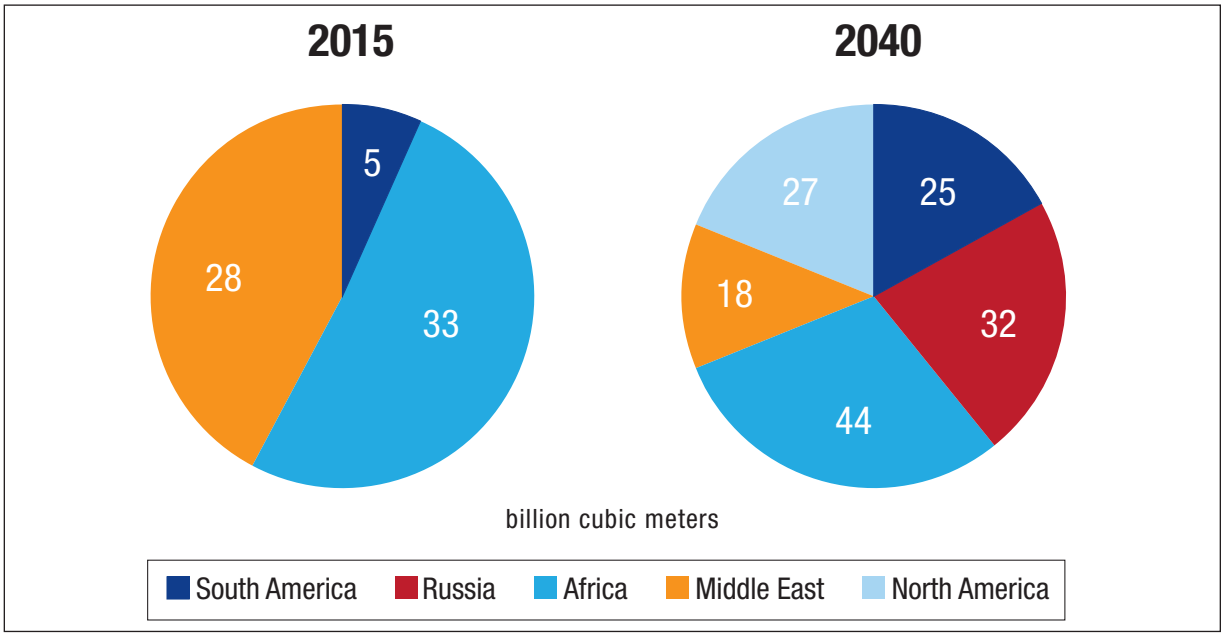
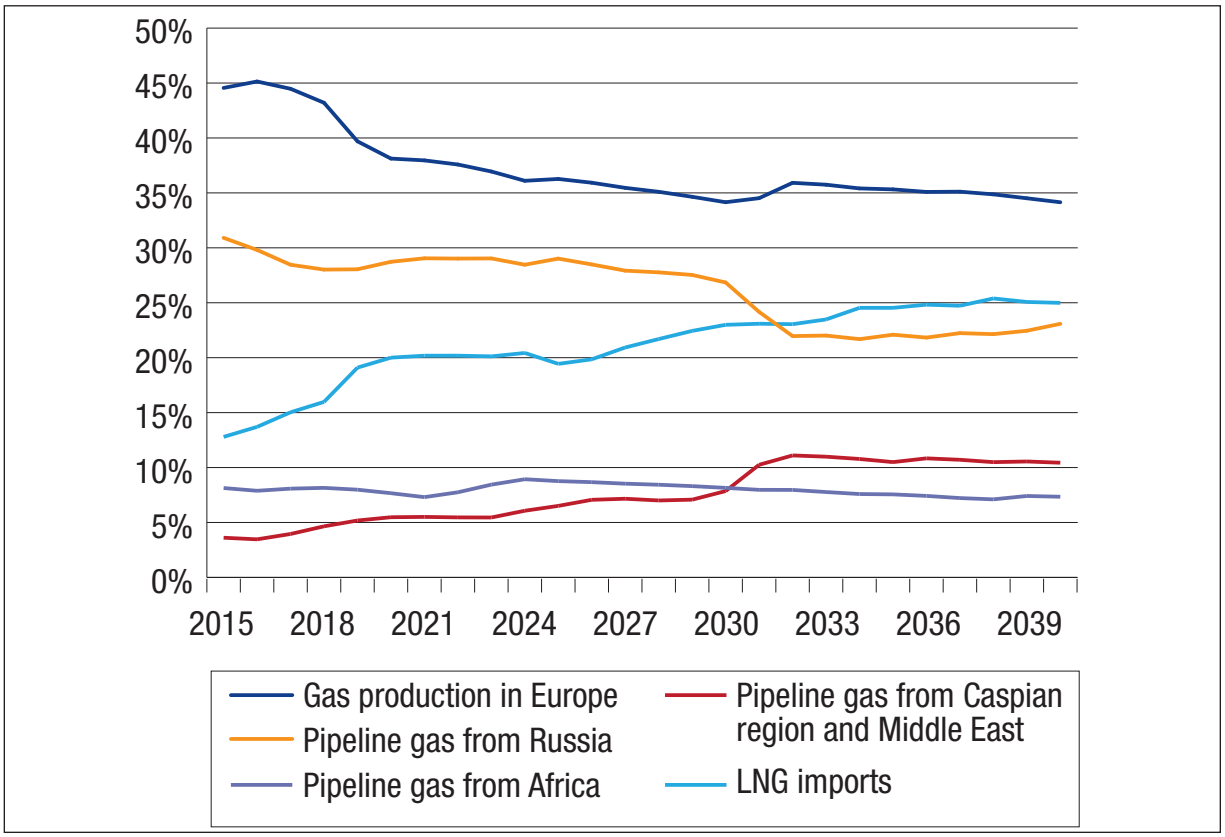


Figure 5. European gas market shares by major supply sources, Baseline scenario



in 2030-2035). This decline in Russian pipeline exports will be partially compensated by the growing export of Russian LNG (up to 32 bcm by 2040). In absolute terms, calculations show that pipeline gas import from Russia will remain at the level of 150-160 bcm until 2025 (including re-export from Central Asia) and then, as the existing contracts expire, it drops down to 125-135 in 2035-2040.

SCENARIO WITHOUT THE EXTENSION OF THE RUSSIAN CONTRACTS

It is assumed that:

- The Brent oil price is $100/bbl;
- Existing gas supply contracts with Russia are not extended;
- Ukrainian transit is accessible;
- The South Stream pipeline is constructed.

As compared to the baseline scenario, LNG imports into the EU grow faster, with a factor of 2.8, to 177 bcm by 2040. Similar to our baseline scenario, pipeline gas imports increase until 2025, and then decrease, but the total volume of pipeline gas imports eventually becomes more modest, namely 205 bcm in 2040 (as compared to 238 bcm in the baseline scenario).

The average utilization of LNG terminals in Europe is twice as high (60 percent) in 2040 than in 2015. In other words, European consumers compensate for the fall in pipeline imports by importing significantly more LNG. In addition to the countries specified in the baseline scenario, Belgium is added to the European countries, where LNG terminals work at maximum capacity.

No significant changes in spot prices are observed as compared to the baseline scenario. In 2019, 2021, and 2031 the spot prices are about 1 percent lower than in the baseline scenario, but the average spot prices for the entire forecast period at the major eight European hubs by 2040 are 3 percent higher than in the baseline scenario, which clearly demonstrates, that LNG options in fact are not cheaper than Russian gas.

In this scenario pipeline gas exports from Russia to Europe fall from 157 bcm in 2015 to 101 bcm in 2040. The dynamics of LNG exports from Russian are almost identical to the baseline scenario, in other words, a steady growth up to 32 bcm to 2040 is expected. Hence, the total Russian share in European natural gas consumption will fall from 32 percent in 2015 to 23 percent in 2040.

SCENARIO WITH BRENT OIL PRICE – 120 DOLLARS

It is assumed that:

- The Brent oil price is $120/bbl;
- All Russian contracts are extended by ten years after their expiration, with a share of spot-pricing of 35 percent;
- Ukrainian transit is accessible;
- South Stream is constructed.

The imports volume and structure are virtually unchanged as compared to the baseline scenario. Shipments under contracts also have not changed since in the model the contracts are inevitably taken and are not revised, but taken at minimum take-or-pay volumes.

Spot market prices at the major European hubs remain almost unchanged (higher by 3 percent on average for the period under study at eight European hubs). Prices of pipeline gas supply contracts in 2015–2040 are 14 percent higher than in the baseline scenario due to the higher oil prices, $11.8/mmBtu on average. Prices of long-term LNG contracts in 2015–2040 are also 10 percent

Figure 6. European gas balance forecast, Scenario without the extension of Russian gas contracts

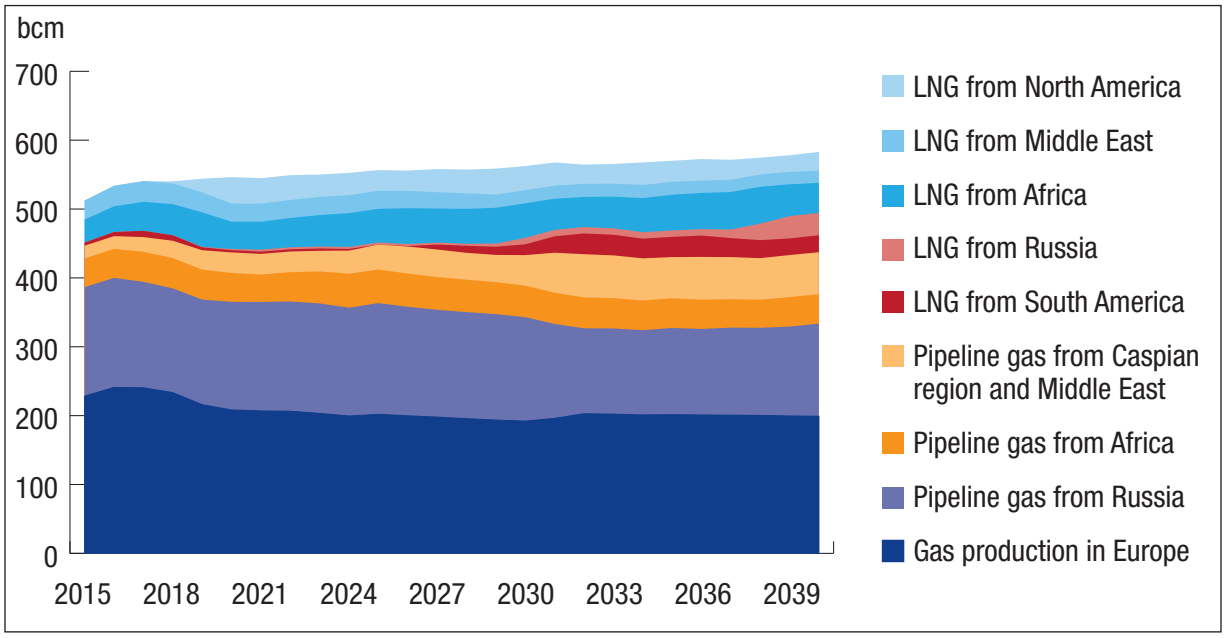
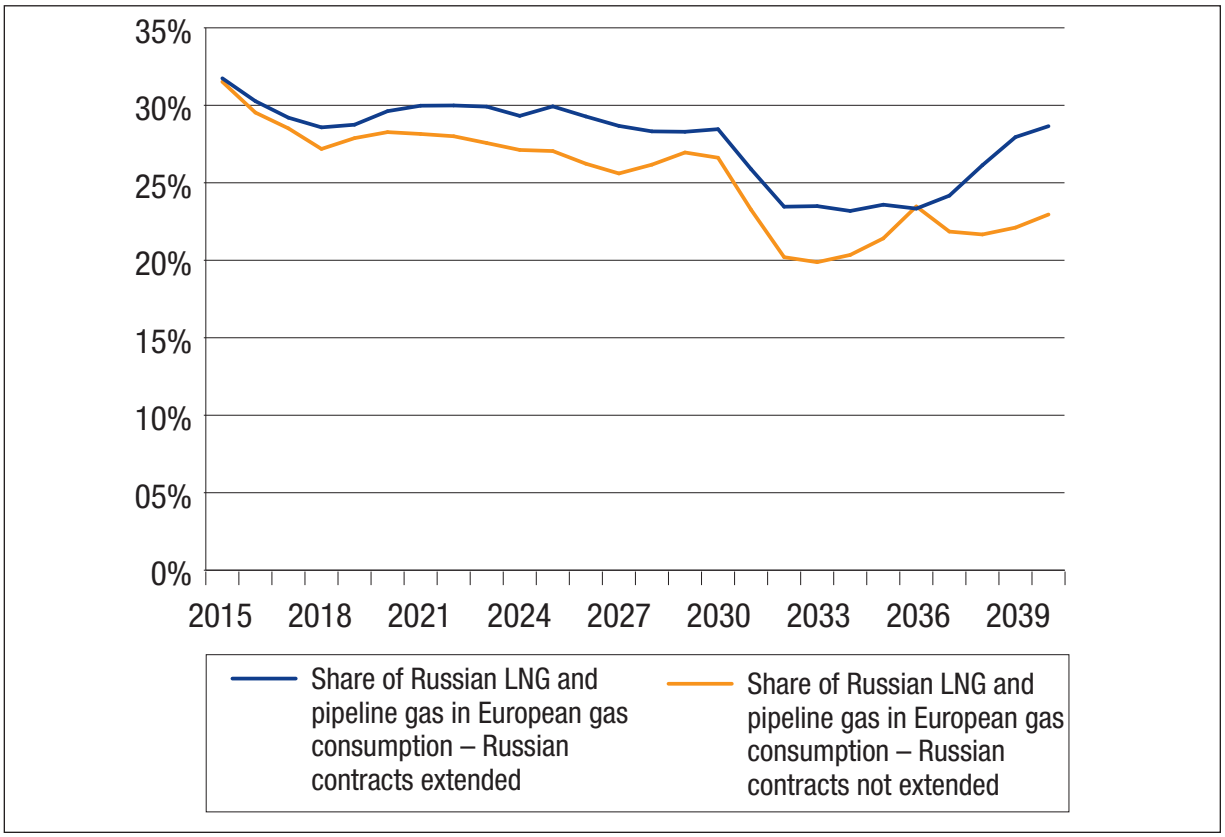


Figure 7. Share of Russian gas in the European gas market by scenario



higher than in the baseline scenario, $10.3/mmBtu on average. As a result, the weighted average gas price in Europe is higher by 6 percent in 2015–2040.

SCENARIO WITHOUT THE SOUTH STREAM

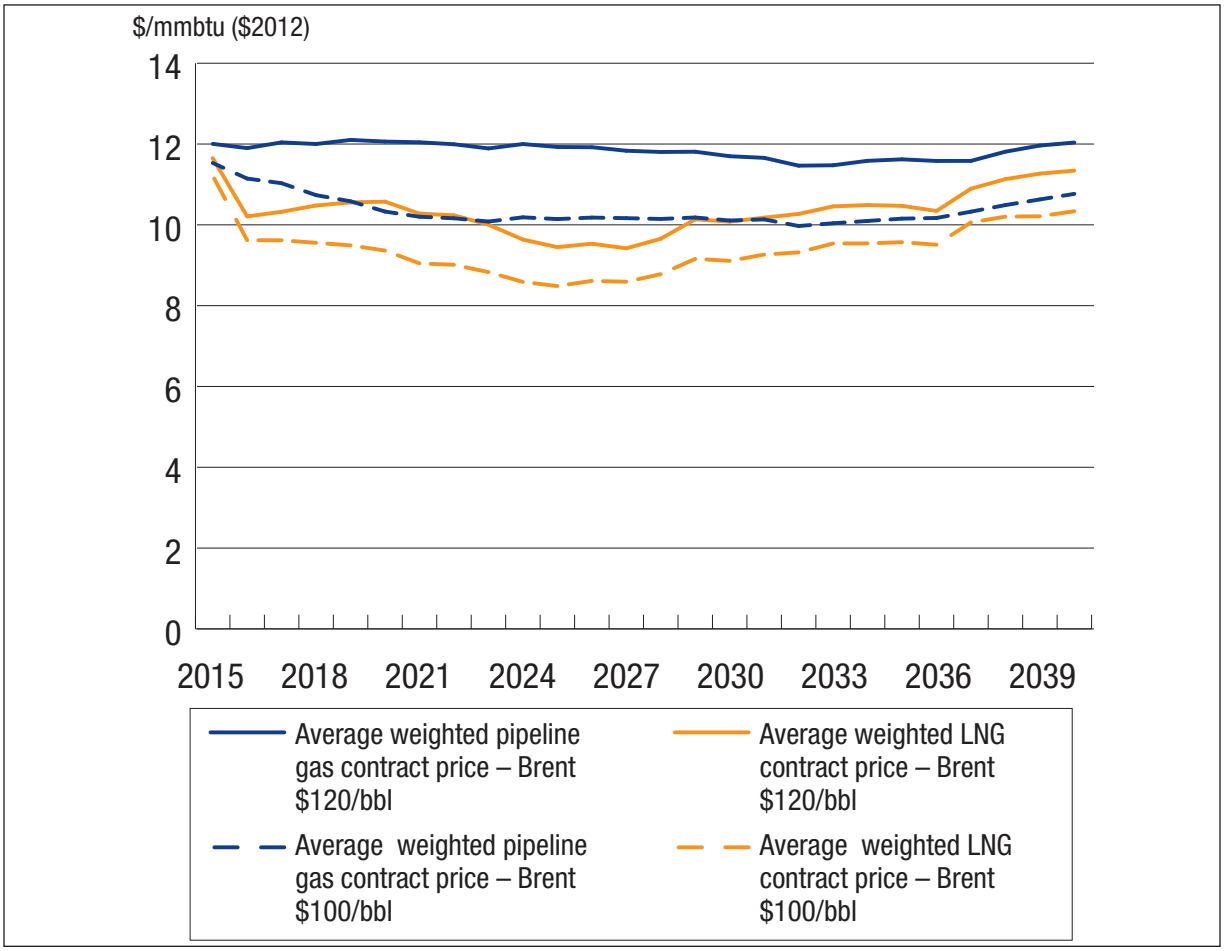
It is assumed that:

- The Brent oil price is $100/bbl;
- All Russian contracts are extended by ten years after their expiration, with a share of spot-pricing of 35 percent;
- Ukrainian transit is accessible;
- South Stream is not constructed.

There are no significant differences from the baseline scenario in terms of imports, including the imports from Russia (the difference in the volume of non-Russian gas imports to Europe from the baseline scenario does not exceed 3 bcm). There are also no significant differences from the baseline scenario in terms of spot prices at eight European hubs (difference is about 0.1 percent).

In the scenario without the South Stream, these volumes are delivered to Europe via Ukraine (up to 6 bcm), through Moldova (up to 10 bcm), and through the Blue Stream (up to 10 bcm).

Figure 8. Average weighted European gas contract prices forecast by scenario



SCENARIO WITHOUT THE UKRAINIAN TRANSIT

It is assumed that:

- The Brent oil price is $100/bbl;
- All Russian contracts are extended by ten years after their expiration, with a share of spot-pricing of 35 percent;
- Ukrainian transit is not accessible;
- South Stream is constructed.

Shutting off the gas transit through Ukraine will reduce the gas consumption in Europe by 6 percent in 2015 and by 1 percent in 2040, if no compensatory measures are undertaken. The expansion of LNG terminals in Germany, Poland, Greece, and Turkey (or construction in Bulgaria) could normalize the prices and consumption volumes to the level specified in the baseline scenario.

Countries affected by the shutting off of gas transit through Ukraine are as follows: Austria, Bulgaria, Bosnia and Herzegovina, Hungary, Serbia, Slovakia (these countries see a consumption reduction in 2015–2020 of 50 – 100 percent), the Czech Republic, Romania, Slovenia (20 – 50 percent), Turkey, Croatia, and Poland (1 – 10 percent).

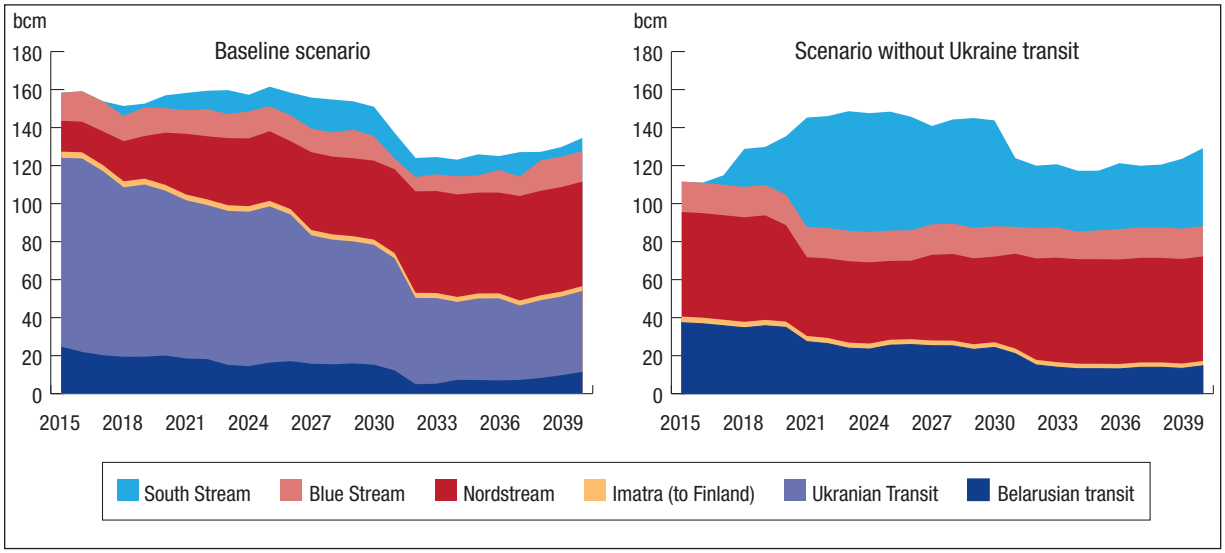
The LNG import volume also remains unchanged relative to the baseline scenario, as "regas bottlenecks" (such as LNG terminals in Greece, Turkey, and Poland), which supply gas to the Balkans and Eastern Europe, are already fully loaded, while due to the lack of interconnectors and pipeline infrastructure gas from the unloaded LNG terminals in North-Western Europe cannot reach these countries. It is worth noting that in due time interconnection levels will improve, enabling more alternative supplies to flow to this part of the continent.

The import of non-Russian pipeline gas is almost similar to the baseline scenario (in some years it increases by max 4 bcm). The import of Russian pipeline gas in 2015 is less by 47 bcm (30 percent) than in the baseline scenario, and it does not recover to the level of the baseline scenario until the end of forecast period (in 2040 it is 5 bcm lower than in the baseline scenario).

Spot prices at seven of eight European hubs remain unchanged compared to the baseline scenario (Belgium, France, Germany, Italy, Netherlands, Spain, and the United Kingdom). However, the prices at the Austrian hub CEGH more than double in 2015, but after 2020, as Austria will start receiving gas through South Stream, these prices will be only 7 percent higher on average compares to the baseline scenario.

Absence of gas transit through Ukraine is compensated by two fully loaded lines of Nord Stream, Blue Stream, increasing transit through Belarus (9 bcm on average), and an increase in South Stream utilization rate.

Figure 9. Russian pipeline gas exports to Europe forecast by scenario



The Limitations of the Alternatives

In light of the ongoing turmoil in Ukraine, policy makers' call for diversification away from Russian natural gas has increased significantly since February 2014. These calls have echoed across the Atlantic Ocean as well, giving Washington policy makers and interest groups a new argument to fuel the U.S. domestic debate about facilitating exports of liquefied natural gas (LNG) to countries without a free trade agreement.[32] Earlier analyses of these efforts and debates have suggested that the rhetorical value of these debates has to be kept in mind since even if more U.S. LNG could come to the market, it could not do so quickly and would unlikely have any meaningful effects in still poorly developed and commercially unattractive Central and Eastern European gas markets.[33] This section briefly discusses the most often debated alternatives to Russian natural gas, and the limitations of each supply source. By no means is this section intended to downplay the value of alternative market outlets. To the contrary, we believe that in combination the efforts made by the EC and private sector entities are invaluable as a cornerstone of European energy security. Rather, this section aims to put these alternatives in perspective.

INCREASING LNG IMPORTS

Importing more LNG is an often noted supply alternative. What policy makers and commentators, however, often overlook is that Europe is in fact well equipped to start importing large amounts of LNG today. Currently, 22 LNG regasification terminals are in operation along European shores, clustered mostly in Spain, Italy, the UK, and France, but also in Belgium, the Netherlands, Portugal, Greece and Sweden. These terminals collectively have an import capacity of 197 bcm/year, which comprises around 35 percent of European annual gas consumption, an amount substantially in excess to total Russian imports, which in 2013, reached a record of 161 bcm.[34] However, the amount of existing LNG regasification capacity says little if anything about the amount of LNG that actually reaches European markets. One must keep in mind that contrary to pipeline natural gas, which serves regional markets, LNG is a global commodity. Though prices vary somewhat with the distance covered, in essence LNG can travel all over the world. Thus, as contracts have become more flexible in recent

[32] For one of the earlier and more elaborate publications on U.S. LNG exports, we refer to Charles K. Ebinger, Kevin Massy and Govinda Avasarala, "Liquid Markets: Assessing the Case for U.S. Exports of Liquefied Natural Gas," Energy Security Initiative Policy Brief, Brookings Institution, May 2012, http://www.brookings.edu/research/reports/2012/05/02-lng-exports-ebinger.

[33] Andreas Goldthau and Tim Boersma, "The 2014 Ukraine – Russia crisis: Implications for energy markets and scholarship," *Energy Research & Social Science*, vol. 3, 13-15, http://www.sciencedirect.com/science/article/pii/S2214629614000607.

[34] SSee Gas Infrastructure Europe (GLE), "GLE Presentation at LNG Construction Summit, Amsterdam: Overview of LNG Projects in Europe – Challenges and Opportunities," 30 April 2014, available at http://www.gie.eu/index.php/publications/cat_view/3-gle-publications.

years and contracted volumes can be reshipped to other destinations, LNG is sold where the highest price for the cargo is paid.[35] In recent years, with Asian economies accounting for the vast majority of growth in natural gas demand, it should not be surprising to note that Europe's share in global LNG trade has continued to decline, with most of that demand shifting to Asia, where in 2013 over 75 percent of global LNG trade took place.[36] As a result of this market shift, utilization rates of existing LNG terminals in Europe have declined substantially with most terminals running at only a fraction of their capacities. As an illustration, Europe in 2013 imported just over 40 bcm of LNG (including Turkey), and the average utilization rates of Europe's existing terminals was around 20 percent (based on net import volumes).[37] The fact that LNG imports into Europe are not an attractive commercial proposition at this point is further underlined by the fact that as of August 2014 six planned LNG regasification plants in Italy, Spain, Cyprus, the UK, France, and Germany have been suspended or cancelled.[38]

In sum, Europe can import more LNG if it chooses, but it depends on the price it is willing to pay. It should come as no surprise that in the European liberalized market private actors generally opt for the most attractively priced natural gas available in the market. In the case of Europe, that effectively means that natural gas that is domestically produced, or imported by pipeline, albeit from Norway, Algeria, Libya or Russia, is more competitive and hence preferred over LNG. In addition, we would speculate that were there to be a glut of LNG targeting markets around the world, including Europe, then traditional suppliers would opt for a price war, and drop prices to prevent LNG from taking over significant market share. It is important to note that this could only happen in the more liquid parts of European gas markets, and so in particular in Central and Eastern Europe the room for competition is still limited, though recent history has shown that in these situations too existing contracts are renegotiated if the difference between spot-prices and long-term contract prices grows substantially. So far a price war scenario has not happened, but suppliers like Gazprom are believed to have significant room for price maneuvering. On the other hand, it is likely that in the future the share of LNG in the European fuel mix will recover somewhat, as more supplies come on stream in the global market space, and we expect that LNG will claim a significant share of European gas demand that comes available as domestic production continues to dwindle. However, it is unrealistic to expect that LNG will be more competitive than natural gas that is produced domestically or supplied by pipeline from neighboring countries like Russia. This seems surely to be the case in the parts of the European gas market that are less integrated and commercially attractive, such as Central and Eastern Europe.

INCREASING IMPORTS THROUGH THE SOUTHERN CORRIDOR

Importing more natural gas through the so-called Southern Corridor has been on European policy agendas for quite some time. For many years, the Nabucco pipeline, explicitly backed by the EC and the U.S. government, featured prominently in these debates, the idea being that 30 bcm of natural gas could be imported from countries

[35] For an insightful paper on the future of LNG contracting formulas, we refer to Peter Hartley, "The Future of Long-Term LNG Contracts," Harvard Unviersity's Belfer Center and Rice University's Baker Institute for Energy Studies, October 2013, available at http://belfercenter.ksg.harvard.edu/publication/23581/future_of_longterm_lng_contracts.html.

[36] "75% of Global LNG Demand in Asia in 2013," International Group of Liquefied Natural Gas Importers, 23 March 2014, http://www.giignl.org/news/75-global-lng-demand-asia-2013.

[37] Thierry Deschuyteneer, "LNG Import Potential to Europe," Gas Infrastructure Europe (GIE), Presentation at Ifri Energy Breakfast Roundtable, Brussels, Belgium, 29 April 2014.

[38] "Global LNG Developments," *Global LNG Info*, accessed 7 October 2014, http://www.globallnginfo.com/index.aspx.

like Azerbaijan, Turkmenistan, and at some point possibly Iran. The Nabucco pipeline was envisaged to transit countries like Romania, Bulgaria, with a final destination in Austria, allowing it to bring new supplies and additional liquidity to Central and Eastern European gas markets.

Unsurprisingly, commercially it made more sense to have the large Italian market as a final destination, and so in June 2013 the operators of the Shah Deniz gas field offshore Azerbaijan (e.g. BP and Statoil) decided to construct the Trans-Adriatic Pipeline to Italy after transiting Greece and Albania.[39] This pipeline will have an initial capacity of 10 bcm, and is expected to start delivering supplies to Europe by 2019.[40] As a consequence, it seems that the government backed Nabucco project has lost its viability.

It is not inconceivable that in the long term additional natural gas supplies will come to Europe through the Southern Corridor but we believe that given the modest size of expected volumes in the nearby future the importance of the Southern Corridor is overblown. In fact, and arguably absent a proper definition, we would posit that for 10 bcm of additional supplies the term 'corridor' seems overstated. Granted, there are potentially significant other resources in the area that may at some point come to fruition and turn into possible commercial alternatives, such as natural gas from Kurdistan, Azerbaijan, Israel, Iraq, Iran, and possibly Turkmenistan. Today, however, the reality is that none of these alternatives is likely to come to fruition in the near future because of significant security and / or commercial challenges, making us believe that we should not expect significant impacts on European gas markets before 2025.

RAMPING UP DOMESTIC PRODUCTION OF UNCONVENTIONAL GAS

For a number of years, policy makers in several European member states, most notably Poland and the UK, have been eager to develop some of their alleged unconventional gas potential. Others, such as the Netherlands and Germany, have been more hesitant following environmental concerns that have been linked to hydraulic fracturing, while France and Bulgaria have banned fracking outright. These developments and the different motives behind them have been well documented.[41]

The reality is that to date in the entire EU not even 100 unconventional exploration wells have been drilled. It is therefore difficult to say what amount of unconventional gas may eventually be recovered. Yet even in countries where the government has actively backed the industry in an effort to get production started, this has not generated any meaningful results. It may be argued that in Poland a number of infrastructural and regulatory hurdles have contributed to this situation.[42] Moreover, by now it appears that the geological conditions may not be as favorable as initially hoped. Thus, the departure of Exxon Mobil, Talisman Energy, Marathon Oil, and ENI from the Polish market suggests that shale gas development will remain moribund for some time. In the UK too, to date the government's efforts to spur

[39] For more information, we refer to Tim Boersma, "What the Trans-Adriatic Pipeline Means for Europe's Energy Diversity," German Marshall Fund of the United States, 26 July 2013, http://blog.gmfus.org/2013/07/26/what-the-trans-adriatic-pipeline-means-for-europes-energy-diversity/.

[40] COM(2014) 330 final, 23.

[41] See e.g. Corey Johnson and Tim Boersma, "Energy (in)security in Poland ? – The case of shale gas," Energy Policy, vol. 53, February 2013, 389-399, http://www.sciencedirect.com/science/article/pii/S0301421512009536 or Tim Boersma and Corey Johnson, "Twenty Years of US Experience: Lessons Learned for Europe," in Cecile Musialski, Matthias Altmann, Stefan Lechtenbohmer and Werner Zittel, eds., *Shale Gas in Europe – A Multidisciplinary Analysis with a Focus on European Specificities*, (Netherlands: Claeys & Casteels Publishers, 15 April 2013).

[42] Johnson and Boersma, "Energy (in)security in Poland."

shale gas developments have not been successful. Even after announcing fees over £100 million per exploration well drilled for local communities, no new exploration activities have been reported and local opposition continues to be fierce.[43]

We believe that in several European member states shale gas extraction will take place eventually. However, in line with EC estimates, we also believe it is unlikely that unconventional gas is going to be transformative in Europe as it continues to be in North America. According to the Joint Research Center, even if shale gas extraction takes off in Europe, in the best case scenario it is expected to halt European import dependence at around 60 percent.[44] In sum, shale gas in Europe can play an important role and can become part of the natural gas market mix, but it will not be transformative and its potential should not be overstated.

[43] Kitty Donaldson, "U.K. to Pay Up to $3M a Well to Councils Allowing Shale Gas," *Bloomberg News*, 13 January 2014, http://www.bloomberg.com/news/2014-01-13/u-k-to-give-millions-of-pounds-to-councils-allowing-shale-gas.html.

[44] For an elaborate analysis we refer to Ivan Pearson, Peter Zeniewski, Francesco Gracceva, Pavel Zastera, Christophe McGlade, Steve Sorrell, Jamie Speirs and Gerhard Thonhauser, "Unconventional Gas: Potential Energy Market Impacts in the European Union," Energy Security Unit Scientific and Policy Report, Joint Research Centre, European Commission, 230, http://shalegas-europe.eu/unconventional-gas-potential-energy-market-impacts-european-union/.

Discussion

In this section we discuss the main findings of the different scenarios that we have studied. Our main conclusion, and this links to the title of our study, is that remarkably little changes in the European natural gas mix in the coming decades in the different scenarios we have looked at. Even with fairly drastic contextual variations, such as the prohibition of the often debated South Stream pipeline from Russia to Italy or the absence of gas transit through Ukraine, in the long term this would hardly have meaningful effects on the origins of natural gas in Europe. In our view, this puts all the noise and upheaval of recent months in perspective. By no means do we want to downplay or reject the political sentiment that we have observed since the skirmishes in Ukraine started in February 2014. However, our analysis does confirm that absent very drastic policy interventions (arguably interventions that go beyond prohibiting South Stream, for example) not much change should be expected in the European gas mix, which will include a significant share of natural gas from Russia in all scenarios under study. Thus we conclude: business as usual.

Of course there a number of important observations that deserve extra attention by policy makers, in particular in Europe. First and foremost, in the short to medium term the lack of market integration in Central and Eastern Europe continues to be a risk in terms of European energy security, as vividly demonstrated in our scenario where Ukraine no longer functions as a transit country for Russian natural gas. While at seven of the eight major European hubs in our study this would have no meaningful impact, at the Austrian hub Baumgarten spot prices would spike and more than double in 2015. This provides us with two important lessons. First, market integration and European collaboration on energy security generates tangible results and for the larger part of Europe a dramatic change in supply routes (almost 50 percent of Russian supplies are transited through Ukraine) therefore does not have a meaningful impact. Second, and unfortunately, the lack of market integration in Central and Eastern Europe is not new, and at this point there are no indications that the issues at hand will be addressed shortly. The new European Commission however has put the issue high on its agenda, and the responsible commissioners have for instance been requested to think of new ways to attract public and private capital for investments in energy infrastructure in this part of the continent, which is direly needed.[45] We should hope that also in this part of the continent a more regional approach to

[45] Tim Boersma, "The European Commission Agenda for Energy and Climate: Not for the Faint-Hearted," *Planet Policy Blog*, Brookings Institution, 12 September 2014, http://www.brookings.edu/blogs/planetpolicy/posts/2014/09/11-european-commission-energy-climate-boersma.

energy security is embraced, and countries can harness themselves to market abuse by facilitating competition in their respective markets.

Second, our analysis confirms that Russian pipeline natural gas will be very competitive until 2030, and after that Russian companies lose a part of their market share, which then stabilizes at around 130 bcm (which is still a significant share of the expected 240 bcm of pipeline imports). Interestingly a part of the loss of market share in terms of pipeline gas is compensated by LNG that comes from the Russian Federation, which we expect to increase up to 32 bcm by 2040. From a political standpoint this marks an important difference, as LNG, contrary to pipeline gas, loses its nationality as it is traded as a global commodity.

Third, in our analysis LNG utilization rates, which as described are currently dramatically low, recover from 2015 onwards, and the share of LNG increases significantly in the European natural gas mix. However, it is important to emphasize that LNG should not be seen as a substitute for Russian natural gas, as is regularly argued, but rather as a substitute for declining European domestic production. Our analysis suggests that in the medium term fiercely debated LNG supplies from the United States will be competitive in the UK, Netherlands, and Belgium, but not in the larger part of Europe.

Finally, in our analysis we account for all major alternative natural gas supplies that feature in (mostly public) debates. We expect that commercial shale gas production will take place within the European Union, but based on experiences so far and most realistic forecasts we do not believe that unconventional gas will be transformative in Europe the way it has been in North America. We also account for alternative supply routes such as the Southern Corridor, but these too do not have a large impact on the overall supply picture in the period under study. Thus, we expect that from 2019 onward 10 bcm of natural gas from Azerbaijan will reach European markets with potential for further increase, and in the longer term an additional 20 bcm from Iraq and Iran will contribute to the establishment of the long-desired Southern Corridor.

In sum, our analysis suggests that the transformation of European gas supply as called for by politicians in light of the Ukraine Crisis will in fact not take place. In all scenarios in the period under study, remarkably modest changes in the European gas supply mix are observed, suggesting that indeed, as posed in the introduction of this paper, political preference will not enter the commercial lexicon. On the other hand, we do observe that in the halls of European institutions there is a deep-rooted desire to alter the existing balance of power between Russia and the European Union. In order to achieve that, one of the ideas that is floating around is active engagement with Turkmenistan, a country whose leaders do not wish to engage with private sector entities but instead wish to make deals with political establishments. This in turn raises all sorts of questions, as politically inspired projects in the past have not been successful (the most prominent example being the Nabucco pipeline), and, more importantly, a substantial share of natural gas in Turkmenistan seems to have been locked in by China. Nevertheless, we observe this urge amongst the political establishment in Europe, and foresee an interesting new avenue for further research.

We would like to end this analysis however with two brief observations. First, European energy security has to be addressed by European actors themselves, and the lack of market integration in Central and Eastern Europe and the problems this continues to cause can effectively be addressed in the cities of Brussels, Budapest, Sofia, and others. While Russia regularly features as a welcome lightning conductor, the answers to EU energy security lie in European collaboration and market

integration, not scaremongering and blaming major outside suppliers. Second, this analysis confirms that the wide contours of the European gas mix, absent drastic policy interventions, are by and large set. Logically, Russia features prominently in all these scenarios. If markets are further integrated, this should not be problematic, as it has not been historically for the larger part of Europe. In addition, a number of promising alternative supplies are being developed, and will become commercially available in due time. All of these alternatives are important in their own right, but it is wise to keep them all in perspective, and not mistakenly assume that they can replace Russia as a prominent supplier of natural gas to Europe.