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## Transformation of the European natural gas pricing model

**Abstract.** This article discusses the prospects for Russian natural gas in the European market given the increased competition and changes in the geopolitical situation. Russia's problems in the

European gas market began in 2012. Competition increased due to number of factors, including stagnation in demand for gas, competition from other energy sources, subsidies for the renewable energy, increased surplus of the liquefied natural gas (LNG), and changes in the geopolitical situation. While the EU gas import dependence is 70%, share of Russian gas exported to the EU in 2015 was 42% (132 billion m<sup>3</sup>). Nevertheless, the debate is going about potential refusal of Russian gas in Europe continues. Most claims against Russian gas are linked to pricing and unequal treatment of different markets. Which pricing policies should Russia adopt to address growing competition? To answer this, the article considers pricing models in the European gas market. Particular attention is paid to the assessment of current dynamics of the LNG market: prospects for the United States in this area, and analysis of the market position for the LNG plants currently being built. The purpose of this study is to assess the extent of potential changes in the European gas market, and to identify the key factors that must be taken into account in the first instance by Russia and its gas companies to build their strategy in Europe. The analysis in export gas price trends suggests that Russia has a competitive advantage in the European market, even considering the departure from using long-term contracts for gas pricing and switching to prices linked to market prices at traded European hubs. Protection of its main market - the European one - will be crucial for Gazprom as midterm strategic goal.

**Keywords:** European Natural Gas Market; Liquefied Natural Gas (LNG); Natural Gas Pricing Policy; Long-Term Gas Contract; Gas Hubs

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#### Трансформація європейської моделі ціноутворення на природний газ

**Анотація.** У статті розглянуто перспективи присутності російського природного газу на європейському ринку в умовах загострення конкуренції та зміни геополітичної ситуації. Проблеми, з якими зіткнулася Росія на європейському ринку газу, розпочалися в 2012 році. Причини загострення конкуренції: застій споживання на ринку газу, конкуренція між різними енергоносіями, субсидування відновлюваних джерел енергії, зростання надлишків скрапленого природного газу (СПГ), зміна геополітичної ситуації. Залежність ЄС від імпорту природного газу становить 70%, частка російського газу в імпорті ЄС у 2015 році склала 42% (132 млрд м<sup>3</sup>). Проте дискусія з приводу доцільності відмови Європи від російського газу триває. Найбільш суттєві претензії до Росії пов'язані з диференціацією ринків та цінами на газ. Для визначення оптимальної політики Росії в умовах конкуренції, що зростає, в статті розглянуто питання ціноутворення на європейському ринку газу. Особливу увагу приділено різним аспектам оцінки поточної динаміки розвитку ринку СПГ: перспективам США в цій сфері, аналізу ринкових позицій заводів СПГ, що будуються. Аналіз тенденцій у сфері ціноутворення свідчить, що Росія має конкурентні переваги на ринку Європи, навіть за відходу від ціноутворення на основі довготермінових контрактів і переходу на прив'язування цін до цін європейських хабів. Захист Газпромом позицій на європейському ринку, провідному для компанії, матиме принципове значення як для власної господарчої діяльності компанії, так і для забезпечення геополітичних інтересів Росії у середньостроковій перспективі.

**Ключові слова:** європейський ринок газу; скраплений природний газ (СПГ); механізм; формування цін на газ; довгострокові газові контракти; газові хаби.

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#### Трансформация европейской модели ценообразования на газ

**Аннотация.** В статье рассматриваются перспективы присутствия российского газа на европейском рынке в условиях обострения конкуренции и изменения геополитической ситуации. Проблемы, с которыми столкнулась Россия на европейском рынке газа, начались в 2012 году. Причины обострения конкуренции: застой спроса на газ, конкуренция между различными энергоносителями, субсидирование ВИЭ, растущее количество излишков сжиженного природного газа (СПГ), изменение геополитической ситуации. Импортозависимость ЕС по газу составляет 70%, доля российского газа в импорте ЕС в 2015 г. составила 42% (132 млрд м<sup>3</sup>). Тем не менее, дискуссии по поводу целесообразности отказа Европы от российского газа продолжаются. Наибольшее количество претензий к России связано с дифференциацией рынков и ценами на газ. Какой политики в ценообразовании газа должна придерживаться Россия в условиях обострения конкуренции? Для решения поставленной проблемы в статье рассмотрены вопросы ценообразования на европейском рынке газа. Особое внимание уделяется различным аспектам оценки текущей динамики развития рынка СПГ: перспективам США в этой области; анализу рыночных позиций строящихся СПГ заводов. Анализ тенденций в области ценообразования экспортных цен газа свидетельствуют о том, что у России есть конкурентные преимущества на рынке Европы, даже при отходе от ценообразования на основе долгосрочных контрактов и переходе на привязку цены газа к ценам европейских хабов. Отстаивание Газпромом его основного европейского рынка будет иметь принципиальное значение как для собственной хозяйственной деятельности, так и в качестве геополитического инструмента России в среднесрочной перспективе.

**Ключевые слова:** европейский рынок газа; сжиженный природный газ (СПГ); механизм; формирования цен на газ; долгосрочные газовые контракти; газовые хабы.

## 1. Introduction

The importance of gas industry for Russia's economy cannot be overemphasized: it brings around 10% of the country's exports. Gas exports amounted to 34.8% of production in 2015. The main market for Russian gas is Europe. The main importers of Russian gas in 2015, according to Gazprom, are Germany (about 28%), Turkey (17%), and Italy (15%). Oil and gas industries have a significant impact on Russia's balance of payments and the state budget. However, the share of oil and gas revenues in the budget of the Russian Federation decreased from 51.3% in 2014 to 37.4% in March 2016. During the first 9 months of 2016 the gas related cash inflow was \$ 21.4 billion. This constitutes one third of the revenues in 2015 and less than a half - of 2014. «For the first 9 months monetary income of the Russian economy felt by 3.4 times, and had become a record low since 1999 (USD 15.6 billion), according to the Russian Central Bank data.» [1] The share of oil and gas revenues in GDP is also gradually reduced. The negative factors affecting this trend are the collapse in oil prices (since 2014), the stagnation in demand for gas in Europe, and LNG surpluses.

The transformation of the conditions in the European gas market makes it particularly urgent to analyse the causes of these changes and to assess further prospects of Russia in the market, especially considering possible LNG inflow, and impact of the price factor.

## 2. Literature review

Theoretical issues of gas pricing are addressed in works by D. Stern (2012) [2-3], D. Gordeev, G. Idrisov, E. Karpel (2015) [4], A. Konoplyanik (2008) [5]. In the European market, publication of the Energy Charter Secretariat (2007) is the main methodological document [6]. Analysis of gas prices in the European market is presented by J. Henderson (2016) [7], T. Mitrova (2015) [8]. S. Melnikova and N. Troshina (2016) analysed LNG prices [9]. However, the development of gas market pricing mechanism requires an overview of the established methodologies.

**3. The aim of this study** is to analyse causes for current changes and to assess Russia's prospects in the European gas market, considering impact of LNG and new pricing structure.

## 4. Results

To keep the share of Russian gas in the European market, Russia may have to enter into a price war against the United States and Australia, the key suppliers of LNG. Protection of its main European market will be crucial for Gazprom as a mid-term strategic goal.

### The pricing mechanism in international gas market

The specific features of the pricing in the international gas market are:

1. None of the energy sources' pricing theories is applicable to pricing for natural gas. The differences in the mechanisms of the pricing for oil and for gas are linked to the corresponding physical properties of oil and gas, in particular the differences in their energy density, and due to their difference in the cost of transportation and storage.
2. Most countries link gas pricing to the price of the other energy sources (crude oil, diesel, fuel oil etc.). The Groningen principle (named after gas field in the Netherlands), or replacement cost principle, has been applied in Europe since early 1960's; in essence, it ensures that the gas price is negotiated at the level of the weighted average cost for other fuels adjusted for transportation to the location of consumption and applicable taxes (end user diesel fuel price only has 60% of actual diesel cost component and oil fuel - 40%). In the long-term LNG contracts for the Asia-Pacific markets, the price of gas is tied to crude oil from 1970, and typical contract stipulates «the slope of the curve A» (factor A), i.e. setting the correlation coefficient to the price of oil (ranges 5-17%, e.g. in Russian contracts is generally 5-11%), and the coefficient B, which shows the cost of transportation. 80% of long-term LNG contracts in the USA are linked to Henry hub prices/ and the other 20% use Hybrid pricing mechanism with reference to the Henry Hub prices.
3. Mechanisms of gas pricing for short-term and long-term contracts are quite different.
4. Gas trading is carried out in real or virtual hubs, at spot prices.

5. Monopolies often discriminate on price.

6. Mainly, two pricing models are used: the pricing of long-term contracts and pricing for hubs/exchanges.

The pricing model for long-term contracts (typically 15 to 30 years) is using a sliding base pricing formula. Typically it is tied to the price of competing fuels. For long-term contracts stipulations on the possible movement of sliding prices as important (this issue often constitute the subject of arbitration disputes): base price, indexation of base price, adjustment frequency (monthly or quarterly), possibility to update base price and/or indexation coefficient (usually once every three years), minimum or maximum price level (the floor and the ceiling), confidentiality clause, contract clause on arbitration, «intended destination» (excluding the possibility of resale).

Pricing in the long-term contracts is also linked to «take or pay» provision, according to which the buyer has to take the contracted volume, or, if it is unable to take it, pay for the minimum amount of gas (usually, 85% of the amount provided for in the current contract year) at the contracted price. Long-term contracts are usually not public, and provide little transparency for pricing mechanisms and other key commercial terms («big secret»). Expediency of the long-term (rather than short term) contracts is defined by need to guarantee a sustainable demand for gas. For exporting countries, this guarantees ROI on investment (the price is sufficient to recover the investment in gas production and transportation to the importing country's borders). For importing countries, the market should be sufficient to absorb the contracted volumes of gas (due to the take or pay principle). This pricing model is being transformed in the European markets since 2008. The transformation precludes expanding the set of competing energy sources and linking prices to European hub prices.

Pricing at hubs/exchanges is determined on the basis of supply and demand for gas at the exchange. The share of spot transactions in the world LNG market is about 30%. Gas prices in North America are formed in the hubs from the late 1980s, while in Europe - since the end of 2008. The share of this pricing model on the European gas market is 30-55% [10]. Clearly, the explanation for this pricing model may be transportation by tankers, making it more flexible geographically for markets and suppliers; tanker can bring gas to every location capable to unload gas, disregarding market price at specific hub spot. This pricing model cannot be applied to pipeline transportation. The pricing model similar to the one used in the US and the UK gas markets (universal price) is not suitable for continental Europe.

### Competition from US LNG

The strategy of diversification of gas supplies to Europe and scenario planning by experts consider various options to push Russian gas from the European market. These include increase in supply from Norway, imports from Turkmenistan, increase in LNG imports from Qatar and Iran, LNG imports from the United States. Some of these are not realistic: for example, Norway can only increase supply by 20 billion m<sup>3</sup>/year. Gas from Qatar, Iran, and Turkmenistan has already been contracted by China. So American LNG is the most viable scenario to consider.

Deliveries of American LNG to Europe began in April 2016. US LNG introduction increases competition in the European market. US LNG gas is expected to reach 31% of European imports by 2040 [11].

LNG refineries in the United States have the lowest capital costs in the world. The specific capital costs in the US are USD 0.81 thousand/ton, while in Russia - USD 1.13 thousand/ton, and in Australia - USD 3.3 thousand/ton [9]. The reason for the world's lowest capital costs in the US for LNG plants is in the fact that LNG plants infrastructure has been created from idle re-gasification terminals (input LNG terminals are rebuilt for export)/ Besides, the price of American LNG projects (unlike for the Russian and Australian) does not include neither the development of its own upstream resource base nor the transport network from the production site to the LNG plant. This allows companies from the United States to promote its manufacturing as a low-cost, which, however, does not guarantee a low cost of their gas for the final consumer.

Specific features of US LNG projects may also include:

- Tolling schemes (the buyer acquires gas on the market and pays for liquefaction). Liquefaction costs are fixed and reflect

capital costs. For example, it costs USD 80-107 per thousand m<sup>3</sup> for Sabine Pass project, and USD 125 per thousand m<sup>3</sup> for the Corpus Christi project. Thus, LNG exporters avoid all market-related risks from changing raw material costs, which are in turn borne by the international companies and end-users. Export destinations are trading international companies, Europe, India, Korea, Japan, and Chile.

- Long-term contracts for 20 years (when the United States was an importer, the contracts were short-term and medium-term).
- There is no principle of «take-or-pay».
- Pricing quotations linked to Henry Hub.

There are also doubts regarding export volumes claimed by US LNG manufacturers. They quote 20 million tons per year in the next years, and up to 112 million tons in the mid-term period. At the beginning of 2016 there were four operational LNG terminals in the US, but only Corpus Christi has a contract for gas supply to Europe (20 million m<sup>3</sup> or 15.4 tons/day). US LNG exports to Europe can only be operated by sea. Sabine Pass in 2016-2017 will be the sole US exporter of LNG to Europe. The infrastructure for acquiring LNG tankers is still rarely available established (while the pipeline system for Russian gas is about 50 years old). Replacing Russian gas with alternative sources is thus very expensive. Moreover, we should not forget that, firstly, American LNG is produced from shale gas. We addressed the issues of «shale revolution» in details in the paper referenced in [12]. Abovementioned issues are not only confined to environmental issues but also include economic one: shale gas has a low (2x) calorific value, and contains a larger amount of harmful impurities; the cost of shale gas production exceeds production of conventional gas by 1.5-7 times, it has very low investment cycles; and the subsidies for shale gas production in the US are on par with the cost of oil fields. In the current environment, there is a decrease of interest in shale gas in the world. Second, in the US shale gas has a comparatively high proportion of ethane. In Russia, however, the content of ethane is low even in by-product oil gas. Ethane is only used in the chemical industry (it is the main raw material for production of ethylene), unlike methane, which can be used in the energy production. Third, as gas exports from the US are caused by the decline in domestic market prices, US authorities limit the volume of licenses issued to exporters in order to avoid domestic price growth. Fourth, US LNG has lost its price advantage after the collapse in oil prices.

While supply of US LNG to Europe has already begun, it has more of «geopolitical appeal» rather than the economic one. Asian markets are more profitable for the exporters. The prices for gas in the Japanese market in January 2016 were: US LNG - USD 8.2 per mmbtu; Russian LNG - USD 7.5 per mmbtu, Australian LNG - USD 8.1 per mmbtu [13]. And this is while the principle of «take or pay» is not the element of long-term LNG contracts in the USA.

Figure 1 shows the dynamics of the price of gas in the European market (NBP-UK, RUS-GER) and US LNG in the US market at the Henry Hub (HH-USA), compared to Brent oil price index (upper line).

Figure 1. Comparison of Russian and European hubs (NBP UK) and American (HH-USA) on gas prices

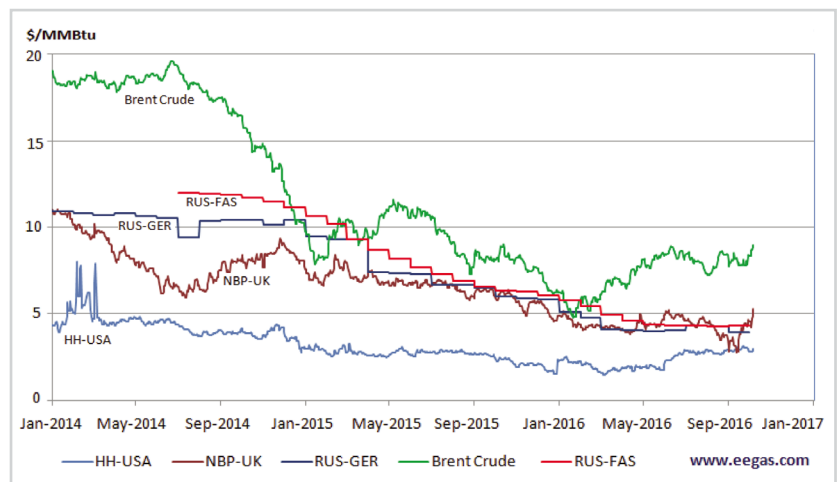
One of the key reasons for US LNG gas exports to Europe is the low price of gas in the US, at Henry Hub (HH-USA). The spread between the price of gas in the US and European markets (NBP-UK) in September 2015 was 2.4 times, yet by September 2016 it was reduced in comparison with the Russian gas (RUS-GER) to 34%, and the exchange spot prices of American and European markets levelled. As of September 2016, the price of LNG in the US

at HH Hub was just USD 2.5 per mmbtu, US LNG price in the European market (USD 4.3/mmbtu) was comparable to European gas (NBP UK Spot, USD 4.5/mmbtu), and only moderately lower than Russian (USD 4.8/mmbtu). The introduction of American LNG in the world market happened mainly due to low gas prices at US exchanges, yet, since summer 2016, there is an upward trend in these prices. According to MarketWatch and EIA, the gas spot price is forecasting to grow to USD 3.07/mmbtu in 2017. This is another argument against potential increase of American LNG exports to Europe.

**European gas market price analysis**

Currently, the European gas market operates with the hybrid system of pricing: the price of long-term contracts at the German border, the monthly price GBP-BAFA (German border price - is an average import price reported by German Federal Office of Economics and Export Control), and the UK price at NBP hub. Let's consider the dynamics of these prices in terms of their spread, and assess the impact by Russian prices. The Gazprom's pricing model for long-term contracts for the European gas market is linked to the price of oil. Until 2012, the average price of Russian gas (Gazprom) to Europe came close to the price of historical contracts linked to the price of oil. But the increase in oil prices led to the claim in August 2012 to the European Commission (EC), and to the antitrust authorities of the EU Member states on violation of European antitrust law by Gazprom [16]. The substance of the claim was about inappropriate market behaviour in the gas market (different market prices for eight Eastern European States) and linking the cost of Russian gas to oil prices (rather than oil products, which is in line with the Groningen principle). To satisfy customers, Gazprom made an adjustments in their prices in 2013 - beginning of 2014. Starting at the end of 2014, there were a drop in oil prices and increase of spread between the spot price of gas (NBP UK) and Gazprom's contract price for gas RUS-GER (see Fig. 1).

In January 2015 spread between price of Russian gas to the border with Germany and the European stock market price at spot NBP UK accounted for 22% (USD 10.49/mmbtu versus US D8.6/mmbtu). By the end of the year the gap starts to decrease again due to the «lag effect» of prices in contracts linked to oil prices (which are usually tied to the price of oil for the previous 6-9 months), and also due to the ongoing adjustment in prices by Gazprom. As of October 2015 all three rates were almost equal (at the level of USD 6/mmbtu). In September 2016 Russian natural gas at the border with Germany cost 36% less than a year ago.



Note: Brent Crude - ICE Brent Index; Brent oil Index on the London Intercontinental Exchange; RUS-FAS - Gas export price index of FAS RF (Federal Antimonopoly Service of the Russian Federation); RUS-GER - Price of Russian gas at the German border (WGI estimation); NBP-UK National Balancing Point (UK) - a virtual hub; HH-USA - Henry Hub price, USA.

Fig. 1: Comparison of Russian and European hubs (NBP UK) and American (HH-USA) on gas prices

Source: [14-15]

Thus, departure from the pricing model of gas under long-term contracts, and transition to the model of individual transactions on the basis of spot prices is impossible in the medium term. As practice shows, gas hub marketplaces have not become flexible. However, the transformation of the Groningen principle to link contractual price not just to competing energy sources, but also to the stock exchange quotations of gas in European markets, is reasonable. This approach was used by Gazprom, which over the past 5 years has shown some flexibility in pricing gas for Europe.

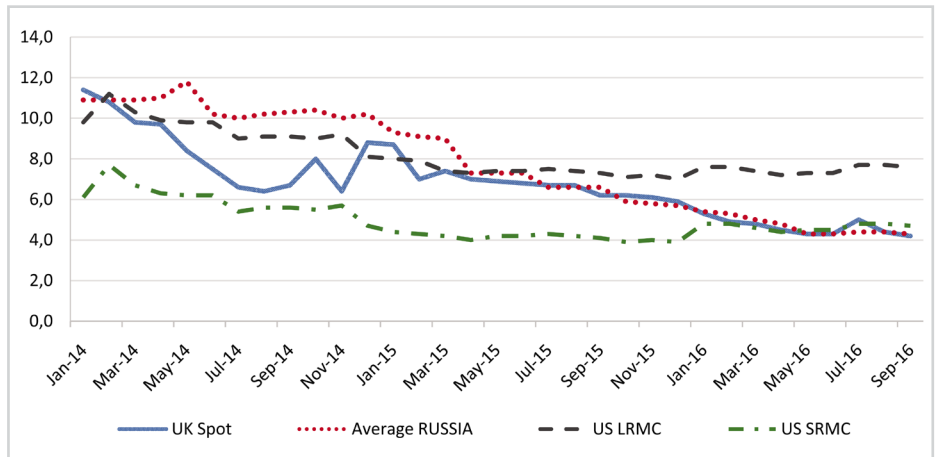
In order to assess Russia's competitive strengths for gas price competition it is important to compare the marginal cost of manufacturing in the short and long term. Russia's competitive advantage lies in the fact that Gazprom has excess capacity in fully developed gas field (about 100 billion m<sup>3</sup> in the Western Siberia). The marginal cost of extraction in the short run (SRMC) is low, and the calculated price of gas at the border with Germany could be USD 3.5/mmbtu [7] (for example, in 2014 the price of Russian gas to the border with Germany was USD 10.58/mmbtu, in January 2016 the price of gas in Europe was USD 4.5/mmbtu). Cost of production by Gazprom in September 2016 was USD 0.89/mmbtu [14]. This data indicate that Russia has enough capabilities to wage price war. Yet the question is - how low should prices drop, and whether they should equal SRMC level? Aggressive pricing is reasonable, if the loss from the price reduction will be offset by an increase in sales. Fig. 2 shows the marginal costs of US LNG in the European market (in the US they are much lower, Henry Hub price is at USD 2.3/mmbtu). Fig. 2 shows that US SRMC in January 2016 amounted to USD 4/mmbtu. Gap between the price of Russian gas and SRMC in January 2016 was only USD1.5. Given the production costs below one US dollar, Gazprom has the ability to lower the price.

Low cost of delivery is not the only prerequisite for winning the price war; Gazprom also needs to change the pricing system. Gas trade is based on long-term contracts, and tied to the oil basket. Yet in 2014-2016 Gazprom has shown flexibility in pricing, and reduced contract prices to the spot level, and dropped them even lower in the summer 2016 (see Fig. 1).

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Note: LRMC - long-run marginal cost (when all costs are variable)  
SRMC short-run marginal cost (when the amount of some resource remains constant)

Fig. 1: European gas prices compared with the limit costs of US LNG  
Source: [7], elaborated by the author

The level of competition in Europe is likely to increase, and Gazprom will need to use incentives and price concessions in its trade. Changing the pricing strategy (price reduction to the SRMC level in the short term, with the possibility of price recovery in the future) for Gazprom makes sense as part of the corporate strategy in the European market, to protect its market share and to maintain long-term position as the main supplier of gas to Europe. The adoption of this pricing strategy can be caused by the fact that unlike many gas producers, Gazprom is state-owned. From political point of view, this strategy could also make sense for the country, as it should support position of Russia as the key energy partner for Europe. Whether national budget can sustain such a strategy or not, remains an open question for separate study.

5. Conclusions

The share of Russian gas in the European market is 42%. To maintain this share despite decline in consumption of European gas, arrival of new LNG importers, and geopolitical challenges, Gazprom needs to change the concept of long-term contracts. This will allow it to influence directly the price level of European hubs through physical control of exports, and will allow containing US LNG imports in the short term. At least over the next five years, Europe will remain the main export market for Russian gas.