Péter Kotek– Adrienn Selei– Borbála Takácsné Tóth

THE IMPACT OF THE CONSTRUCTION OF THE NORD STREAM 2 GAS PIPELINE ON GAS PRICES AND COMPETITION[1]

The study makes use of gas market modelling to analyse the impact of the Nord Stream 2 gas pipeline on the wholesale prices of European countries and the European gas market competition. It is also inspected how the expected return of infrastructural projects planned in the East-Central European region is impacted by this new development. According to the results, the expansion of Nord Stream – due to the modification of the long term contracted transmission routes – will reduce those capacities that enable the region to access liquid Western gas markets. This will increase the current spread between the Eastern and Western European prices, hindering the integration of gas markets. On balance, the welfare impacts of the expansion will be negative, and most of the drop in welfare will have to be endured by East-Central European consumers and system operators. The analysis also shows that the East-West bottlenecks that are likely to arise due to the modification of the long term contracted routes will warrant the construction of new transmission paths, requiring almost one billion euros of supplemental investments within the East-Central European region.

INTRODUCTION

In 2015, the European Union covered 80% of its gas supply through imports from Russia, Norway, North Africa and countries like Qatar and Nigeria which export Liquefied Natural Gas (LNG). As a result of declining European production, the share of import is expected to further grow. The International Energy Agency (IEA) forecasts that by 2040 it may reach 83 percent of consumption (*IEA* [2015]).

For the last few years the need to build transmission lines crossing several countries (Nabucco, South Stream, Turkish Stream, Trans Adriatic gas pipeline etc.) has been widely discussed. These pipelines would have transported natural gas to European markets from the South-Eastern direction. The proposals for these transmission routes have all failed, except for the Trans Adriatic Pipeline (TAP) which – if built – will, after 2020, annually transmit 10 billion cubic meters (bcm) of Azerbaijani gas through Turkey, mainly to Italy.

The focus of the article paper, the high pressure gas pipeline project called Nord Stream 2, would by 2020 double the capacity of the Nord Stream 1 line, which has been in operation since 2012.[2] The Nord Stream is a 1,200 km long subsea gas pipeline, directly linking Russian production with one of the largest European gas consuming market, Germany.[3] The total enlarged capacity of the

[1]* The study is partly based on the report "Opportunities for LNG within the Danube Region", prepared for the Ministry of Foreign Affairs. The authors would like to thank *Enikő Kácsor* and *Péter Kaderják* for their critique and advice. Translation of the study published in the *Verseny és Szabályozás 2016* (ed. by Pál Valentinyi, Ferenc László Kiss, Csongor István Nagy).

[2] In this article Nord Stream 2 and the *expansion* of Nord Stream refer to the same project, doubling the present annual capacity of 55 bcm to 110 bcm.

[3] One third of the total exported volume of Russia to Europe and Turkey – 45 bcm out of 160 bcm in 2015 - is consumed by Germany. As a point of reference, in 2015 Hungary imported 5.9 bcm of gas (Gazprom Export, Eurostat).

pipeline will reach 110 bcm, comparable to the total volume of Russian gas export to Europe and Turkey, which totalled 160 bcm in 2015. [4]

Gazprom would transmit gas to Europe through the expanded new pipeline, bypassing Ukraine. Gazprom and the other companies[5] within the consortium claim that the main benefit of the project is satisfying the increased demand for gas – arising from dwindling European natural gas production – and improving the security of supply. The project, however, faces substantial political headwind. In March 2016 the prime ministers of nine Eastern European EU member states signed a letter in which they request that the leaders of the European Commission and the European Council take action against the project, citing in particular security of supply considerations.[6] The fierce reactions are understandable especially in a geopolitical context, including the historical suspicion of Central and Eastern European countries toward Russia, fortified by the Ukraine related developments of the last few years.

One of the most important components of the Russian strategy for diversification is reducing the dependence on Ukrainian transit. In 1990 Russia carried out all its European and Turkish export through Ukraine, by today it has reduced this ratio to 50% in several steps: in 1994 with the launch of the Yamal pipeline, in 2003 with the construction of the Blue Stream, and then in 2012 with the commissioning of Nord Stream 1[7] (*Hafner–Tagliapietra* [2015]). The South Stream would have been the last piece of the transmission routes avoiding Ukraine, but in 2014 it was suspended, being replaced by plans to enlarge the capacity of Nord Stream by 2019. The consortium has already stepped from the planning phase toward implementation by having completed the tendering process for the pipes. The construction is scheduled to start in early 2017. According to current plans, on the new infrastructure Gazprom would transmit mainly the gas volumes needed to supply Western and Central European markets, while the gas demand of Ukraine and the Balkan would continue to be supplied through the existing Ukrainian network even after 2019.

The main question posed by the study is how the construction of the new pipeline and the related changes to routes used by Russian long term contracts impact the wholesale gas prices of European countries and the competition in European gas markets. The next chapter of the article describes the market and regulatory environment, then we apply modelling tools to analyse the impact of the construction of the Nord Stream 2 pipeline on gas prices, gas flows and the welfare of market participants under the long term contractual assumptions that we consider as most likely. The second part of the modelling chapter inspects how the expected return of planned infrastructural projects within the Central and Eastern European region would be affected by the capacity expansion of Nord Stream. Finally, we highlight the impacts of the project on the Hungarian market and make policy recommendations.

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[4] Source: http://www.gazpromexport.ru/en/statistics.

[5] The planned ownership structure of the Nord Stream 2 consortium is Gazprom (50 percent), the German Uniper (10 percent) and Wintershall (10 percent), the UK Royal Dutch Shell (10 percent), the Austrian OMV (10 percent) and the French Engie (formerly GDF Suez, 10 percent). Source: http://www.nord-stream2.com/our-company/prospective-shareholders

[6] The signatories are the Czech Republic, Hungary, Poland, Slovakia, Romania, Estonia, Latvia, Lithuania and Croatia (http://uk.reuters.com/article/uk-eu-energy-nordstream-idUKKCN0WI1YV).

[7] The Yamal pipeline transmits gas from North-Western Siberia through Belarus and Poland to Germany, it has an annual capacity of 33 bcm. The Blue Stream transmits gas from Russia to Turkey with a subsea pipeline across the Black Sea. Its current capacity of 16 bcm per year can be doubled in the future. Nord Stream directly links Russia with Germany through a subsea pipeline under the Baltic Sea. As already mentioned, this was completed in 2012 and has an annual capacity of 55 bcm.

THE MARKET AND REGULATORY ENVIRONMENT

One of the principal goals of European energy market regulation is the creation of the uniform internal market, the gas market integration. In addition to the three large energy regulatory packages, with its regulation 347/2013 the EU established the framework to support priority European investment projects from a regulatory perspective (mainly through accelerated permitting) (*EU* [2013*a*]). In particular, those can be viewed as priority projects that bring about the missing West-East and North-South connections, aim to eliminate isolated markets or enable pipelines to handle bi-directional flows. By establishing the Connecting Europe Facility (CEF), Regulation 1316/2013 of the EU (*EU* [2013*b*]) established funding to support the Projects of Common Interest (PCI) fostering the previously mentioned goals.

Since 2010 a lot of infrastructure has been built to improve the security of supply, including the new Hungarian-Romanian, Croatian-Hungarian and Slovakian-Hungarian bidirectional interconnectors, and developing the already existing East-West transmission lines to allow for physical reverse flows. Of these – from the perspective of market integration – the most important are the Czech-Slovakian and the Slovakian-Ukrainian interconnection where the direction of transmission is influenced by market prices – in 2014, dominant flow direction was from West to East. The price of short term (spot) gas sources has also acted as a ceiling, creating competition for Russian gas in the Ukrainian market, materially improving the negotiating position of Ukrainians against the Russians. [8] At the end of 2015 gas from Europe was purchased by Naftogaz for 224 USD/thousand cubic meters. As a result, the 329 USD/thousand cubic meter price of Russian gas was reduced to 227 USD/thousand cubic meter by Gazprom (*Naftogaz* [2016]).

One can observe that the oversupply in European gas markets has subsided and the infrastructure development projects of the last few years have borne fruit, the previous substantial price difference between the Western and Eastern parts of Europe notably shrank, while it virtually disappeared between the best-connected countries. Compared to previous years, there is hardly any bottleneck on the European gas network.

While even today the European Union covers a large part of its gas consumption through imports, this gas import dependency – despite a shrinking demand – may further escalate during the next few years in line with decreasing domestic abstraction. Gazprom has plans to serve this additional import need, especially since it has natural gas fields from which gas can be supplied at competitive prices. To meet this rising import need, however, other sources – mainly LNG – are also likely to compete. Since 2015, as the Asian gas demand declined, the price premium of Asian markets over European prices has disappeared, making European markets relatively more attractive for countries that export LNG. Against this background, we can expect a strategic game to take place, a major action of which will be the selection of appropriate entry points to reach large European markets. By choosing the transmission routes for long term contracts, Gazprom may be able to cut the access of its competitors from the other small markets as well.

[8] On this topic and on the role of developing transmission lines to become bidirectional please see the 2014 report of REKK prepared for the IEA (*REKK* [2014]).

The regulation of pipelines

Similarly, to other network industries, a vital element of European gas market integration is Regulated Third Party Access (rTPA) to the network. This is a prerequisite for creating wholesale competition. In case of investments that need a long time to break even, however, an exemption may be requested under specific conditions, e.g. if the investment would not take place without granting the exemption.

In addition to constructing the subsea section of Nord Stream 1, it was also necessary to develop the gas network on land, in order to be able to transmit the large volume of arriving gas to consumers. The exemption from rTPA was granted to Gazprom by the German authorities for 100% of the capacity of the OPAL pipeline connecting Germany and the Czech Republic and also the North European Gas Pipeline (NEL) [9] – essentially the onshore sections of Nord Stream. This exemption, however, was approved by the European Competition Authority only up to 50% of the capacity. Following long negotiations, it seemed likely that an agreement would be reached, according to which Gazprom could use even the full capacity of the pipeline as long as no other applicant bid for it on public auctions. The agreement, however, has not been concluded due to the deteriorating relationship between Russia and Europe in the wake of the events in Ukraine (*Stern et. al.* [2016]).

Several articles have addressed the extent to which the European Commission makes use of the regulatory framework, and more specifically, the exemption from rTPA to reach its geopolitical goals (*Pirani–Yafimava* [2016], *Goldthau–Sitter* [2015], *Goldthau* [2016]). In case of projects that reinforce gas source diversification, the Commission typically grants exemption from rTPA, while the procedures on Russian investments get delayed, or even come to a halt when the political relations cool. Indisputably, the infrastructural development projects initiated by Gazprom – also often condemned as geopolitically motivated – receive little EU support, but heavy scrutiny and critique.

Based on the above experience, on the sea section the investor does not anticipate problems with respect to rTPA, since besides the investing consortium there is not any major supplier that would be able to inject gas to the system at the Russian entry point. Regarding the on-shore sections several alternatives prevail:

- Gazprom requests 100% exemption from rTPA (unlikely to be granted),
- Gazprom requests 50% exemption from rTPA, and uses the rest of the capacities as long as other suppliers do not wish to reserve those through public auctions (this is likely to be granted, but it entails the risk of not always getting adequate capacity),
- Gazprom does not request any exemption, but it re-negotiates the long-term contracts with its buyers so that it delivers the gas to Germany at Greifswald (at the entry point of Nord Stream to the German network) and any further transmission is the task of the buyer.

[9] North European Gas Pipeline, going from the Nord Stream through the shoreline of Germany to Rehden, connecting areas that have so far been supplied mainly from the North Sea natural gas reserves.

The need to amend the long-term contracts

These days the long-term gas purchase contracts with Russia typically designate the border of the buyer's country as the location for delivery (*Pirani–Yafimova* [2016]). If these contracts expire after the construction of Nord Stream 2 and the corresponding cessation of the Ukrainian transit, then they would have to be amended based on the mutual agreement of the parties to be able to change the route of transmission. This process is rather lengthy, moreover, the renegotiation of the transfer point may presage a number of changes that are disadvantageous for Gazprom. One such risk is that the buyers may take the change of the transfer point as an opportunity to also revise other contractual conditions, especially the price and the price setting methodology.

Based on the above we selected a modelling scenario under which Gazprom delivers long term contracted gas to the border through the changed route – on Nord Stream instead of Ukraine –, and if needed, it will bear all the costs that arise due to a longer transmission path.

MODELLING

Literature background

In this chapter, we briefly introduce the key features of the European Gas Market Model (EGMM) used during the analysis, highlighting the deviations from other models in literature. Afterwards we summarise the conclusions of studies that use modelling tools to examine the impact of the expansion of Nord Stream.

A wide range of gas market models are used to analyse European and global gas markets. [10] One of the most important features of the model used here is that the market barriers generated by long term gas contracts are depicted in more detail than in other models, thereby the contractual changes expected as a result of the expansion of Nord Stream (primarily, changes to the transmission path and the delivery points in the contracts) can be inspected in more depth. While most of the widely used gas models assume some strategic interaction among market participants, the EGMM model used here presumes a price taking behaviour. This simplifying assumption – even though it obviously has some drawbacks – allows a high degree of detail: modelling by countries and months. Considering the input data for the 35 European countries, as well as the barriers posed by the physical infrastructure and contractual conditions, the model computes the equilibrium prices, volumes of production, consumption, injection to and withdrawal from gas storage facilities and the short term (spot) deliveries that together make up the dynamic equilibrium of the perfectly competitive market. Based on these outputs the welfare of specific market participants can also be quantified. Model calculations cover 12 subsequent months, a period for which market participants have perfect foresight. The dynamic relation between the months is assured by the storage activity (any gas to be withdrawn needs to be injected first or set as a starting inventory) and the transmission barriers of long term contracts. [11]

While the gas market impact of the currently operating first phase of Nord Stream was modelled by several previous studies (see for instance *Lochner–Bothe* [2007], *Holz et. al.* [2009], *Chyong et.*

[10] The summary of the various gas market models is contained in for example *Smeers* [2008].
[11] For a more detailed description of the model see *Selei–Takácsné Tóth* [2015].

al. [2010]), the consequences of expansion have been inspected with the use of gas market modelling tools by only a few studies. Abrell et. al. [2016] applied a partial equilibrium model to examine four network expansion scenarios, including the impacts of expanding the Nord Stream. Their results show that expanding the capacity of Nord Stream reduces European wholesale gas prices by about 6 percent on average, as a result of which we can expect an increase of European welfare by about 1%. Moreover, the expanded capacity will be fully utilised, equivalent to a 20% increase of Russian import. *Dieckhöner et. al.* [2013] used the TIGER model to analyse the impact of various infrastructure scenarios, with special attention to the enlargement of the Nord Stream. Their results confirm the expectations that as a result of expansion, the utilisation of other transit pipelines that transmit Russian gas will considerably decrease, and the direction of prevalent gas flows will change, especially in Central Europe. According to their conclusion, despite significant changes of gas flows and the congestion of selected pipelines, in case the planned infrastructure projects are implemented, by 2019 considerable market integration will be possible.

Analysed scenarios and assumptions

As a first step, we analysed the deviations from the reference scenario caused by the capacity expansion of Nord Stream and the simultaneous change of the transmission path used by the Russian long term contracts. We assume that the transmission routes change as follows: with the exception of the gas transmitted on the Trans-Balkan gas pipeline as laid down in the contracts[12] all the gas that had previously been covered by Russian long term contracts and transported through Ukraine will arrive to Europe through the expanded Nord Stream.[13] We assume that the pricing of the contracts is neutral from the perspective of the buyers, in other words, Russian gas will arrive to a given country at the same price as before.

The input data needed for modelling was compiled from publicly accessible sources: the natural gas transmission, storage and regasification infrastructure was assembled based on the capacity map of the ENTSOG *(European Network of Transmission System Operators for Gas)*, demand was determined based on the data published by the Eurostat and other national statistical offices, prices were derived from publicly available exchanges (the Dutch Title Transfer Facility – or TTF – which serves as the decisive price index for European gas markets) and the price signals of statistical offices.

Earlier we showed that in serving the growing import needs of Europe, increasing LNG imports may become the prime competitor of Gazprom. Accordingly, we inspected the impact of the expansion of Nord Stream under two reference scenarios:

- the 2015 reference scenario corresponds to current market conditions with a more modest supply of LNG (50 bcm per year)
- under the 2020 reference scenario the global LNG supply plays a stronger role in Europe, with about 100 bcm arriving to the continent.

[12] The long term contracted volumes of gas to Bulgaria, Greece, Macedonia, Moldova and Romania will continue to be transmitted through Ukraine.

[13] Please see the *Annex* for the detailed changes of the transmission paths of long term contracts.

In order to attain results that are as close to reality as possible, in our reference we slightly altered the actual 2016 European gas infrastructure: in parallel with the expansion of the Nord Stream, we inserted into the model the bidirectional line connecting the Czech Republic and Austria (BACI) with a daily capacity of 195 GWh. All other conditions (especially the marginal price of the Russian contracts, demand, pricing of external sources and the tariff of the infrastructure access) reflect actual data as observed in 2015.

The 2020 reference scenario differs from the 2015 reference scenario along the following points:

- The supply of global LNG rises in Europe: approximately 100 bcm of LNG is imported to the continent versus the 50 bcm in 2015. From the perspective of Europe this does not entail additional investment costs, only the utilisation rate of the currently operating terminals has to increase;
- European demand increases by 7 percent between 2015 and 2020 – based on the „grey" scenario of the Ten-Year Network Development Plan (TYNDP) of the European Network of Transmission System Operators for Gas (ENTSOG);
- Gas production in Europe declines by 15 percent between 2015 and 2020;
- Investments currently in possession of a final investment decision are implemented by 2020;
- With respect to the price of oil, a major driver of the price of long term contracts, we assumed a 2020 price level of 50 USD per barrel[14];
- The Russian long term contracts in effect in 2015 are included in the 2020 reference scenarios with unchanged conditions.

We describe for both inspected years (2015 and 2020) how the intensity of gas market competition changes compared to the reference cases based on the above contractual assumptions. We inspect this partly through the change of prices and partly through the development of the West-East short term (spot) flows, since for the last few years these flows made it possible for gas from Western European countries to reach Eastern European countries at a more favourable price. In addition, we discuss the welfare impacts of the capacity expansion. According to our hypothesis, since on the West-East pipelines the delivered volume under long term Russian contracts is higher than in the reference case, less capacity remains for short term (spot) flows that could enable gas market competition. As a result, the price difference between the Western and Eastern regions of Europe is likely to increase. The larger price difference may make certain infrastructural projects profitable, projects that under the reference case based on social welfare considerations would not be worth implementing. We inspect this hypothesis by comparing the financial returns of the planned projects of common interest (PCI) of the region with and without the capacity expansion of the Nord Stream.

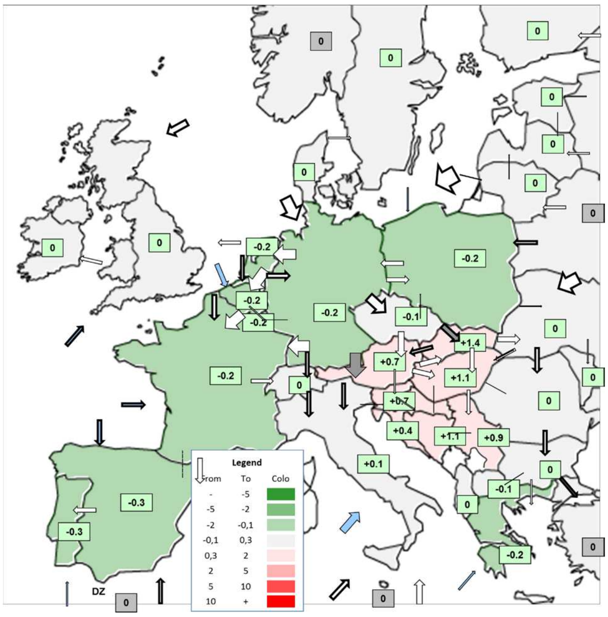
[14] *Source:* REKK estimate based on the World Bank Commodity Outlook, January 2016.

MODELLING RESULTS

The impact of the construction of Nord Stream 2 on wholesale gas prices and the gas market competition

As depicted by Figure 1, the likely change in the path used by the Russian long term contracts due to the expansion of the Nord Stream negatively effects the countries of the East-Central European region (annual average wholesale gas prices increase by 0.4-1.1 EUR/MWh), while the Western European wholesale gas prices moderately decline (by 0.2-0.3 EUR/MWh). As a result, with the expansion of the Nord Stream, the price difference between the Eastern and Western countries of Europe will, *ceteris paribus*, increase. We can also observe that the Balkan countries, the contractual path of which is unchanged, are not impacted by the expansion of the Nord Stream. The only exception is Greece, where prices slightly decline due to increasing LNG imports[15]. Because of the higher volumes of East-West gas flows, every month a bottleneck is formed on the German-Austrian and the Czech-Slovakian pipelines, while in most months also on the Austrian-Hungarian and the Slovakian-Hungarian pipelines. Due to the bottlenecks the volume of cheaper (spot) gas flowing to Eastern countries is insufficient, therefore a price difference takes place between Western and Eastern countries.

Figure 1. The impact of the construction of Nord Stream 2 on European wholesale gas prices, price change compared to the 2015 reference scenario (EUR/MWh)

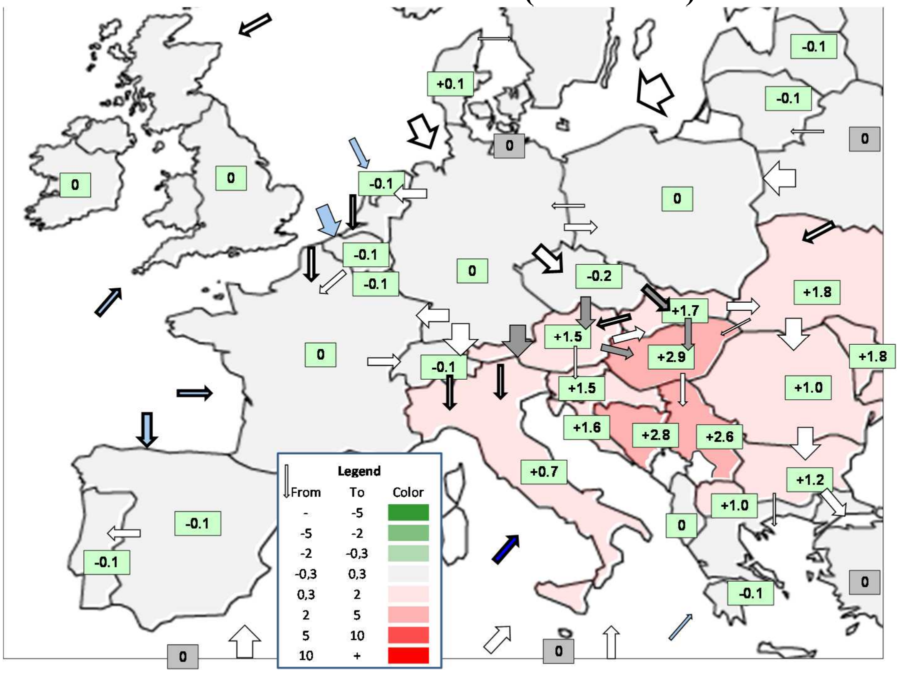


Note: The rectangles represent the price change compared to the reference scenario as a result of expanding the capacity of the Nord Stream.

[15] Part of the LNG displaced by the surplus Russian supply arriving to Western Europe is diverted to Greece as a surplus there.

Under the 2020 reference scenario the currently existing modest price difference between Eastern and Western Europe persists, even increases a little, since the cheap LNG satisfying surplus import needs is available primarily to Western European countries with regasification terminals. Along this reference framework once again we modelled the impact of building Nord Stream 2, with the above described assumptions. As depicted by Figure 2, compared to the 2015 reference scenario the East-Central-European region is more heavily burdened by the construction of the infrastructure, while in the Western European countries we can expect much lower benefits than before, as a result of the increased supply of LNG.

Figure 2. The price impact of the expansion of Nord Stream, price change compared to the 2020 reference scenario (EUR/MWh)



Note: The rectangles represent the price change compared to the reference scenario as a result of expanding the capacity of the Nord Stream.

Our hypothesis, according to which the Nord Stream – by making bottlenecks more severe – will further increase the price difference between the Western and Eastern markets of Europe, is confirmed by the modelling results arising from both the 2015 and the 2020 reference scenarios. This situation is further impaired as a much larger portion of the bottlenecks is reserved for the capacity required by contracted gas, leaving lower capacity for short term (spot) gas competition. As an illustration, we show the transmitted volumes through the most important cross-border pipelines of the region (German-Austrian, Czech-Slovakian, Austrian-Hungarian, Slovakian-Hungarian border). The short term (spot) flows arrive to the region through the German-Austrian and the Czech-Slovakian borders.

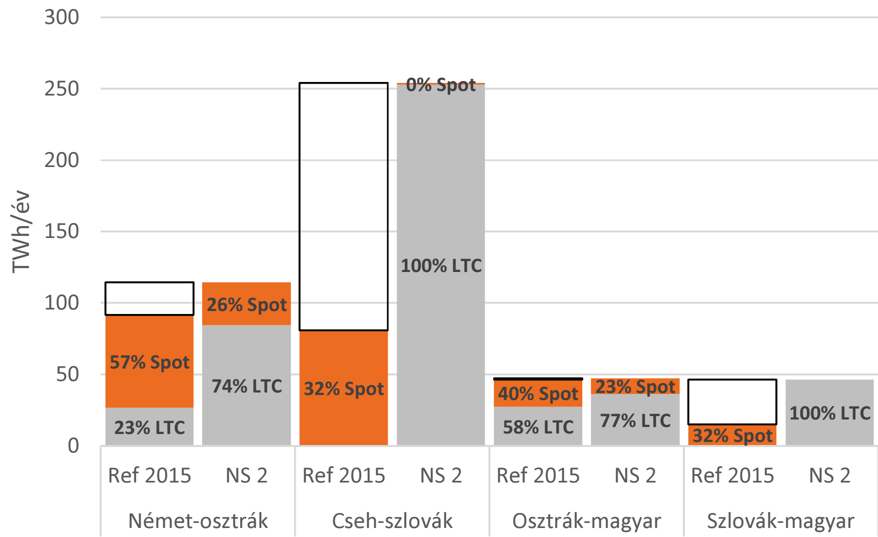
Under the 2015 modelling scenario 57% of the full capacity of the German-Austrian pipeline is reserved for short term (spot) flows, and 23% is dedicated to flows connected to a long-term contract. [16] Following the expansion of the Nord Stream, the Austrian contract, formerly delivered

[16] The contract delivers Norwegian, not Russian gas to Austria. By the 2020 reference this contract expires.

through Ukraine, would be diverted to this border, therefore almost three-quarter of the pipeline would be reserved for long term contracts, reducing short term flows to 26% of the total capacity.

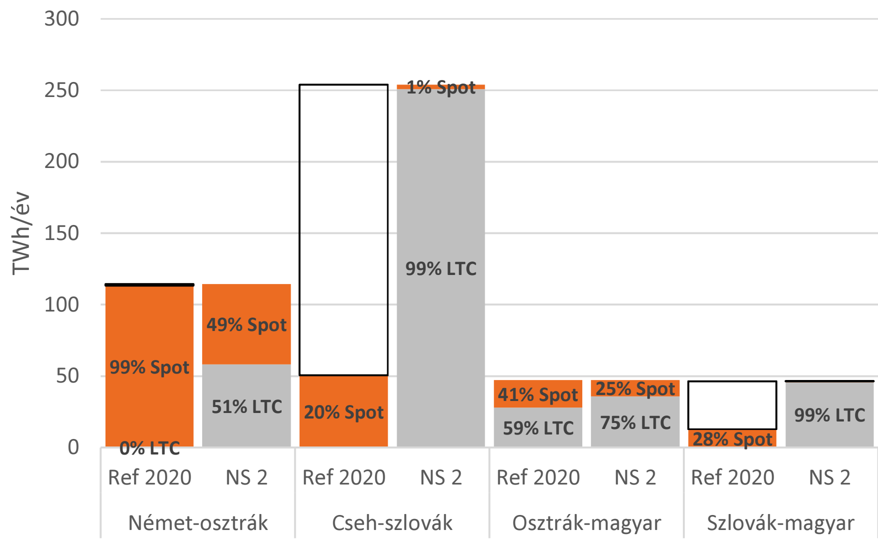
We find a similar, but stronger impact for the Czech-Slovakian and the Slovakian-Hungarian cross-border pipelines: under the reference case capacity utilisation is a mere 32%, made up exclusively by short term (spot) flows, while after Nord Stream 2 is constructed, capacity utilisation jumps to almost 100%, representing exclusively flows under long term contracts (see Figures 3 and 4).

Figure 3. Long term contracted flows and short term (spot) gas flows with and without the expansion of Nord Stream, 2015



Note: LTC: long term contracted gas delivery; Spot: short term gas delivery; Ref 2015: Reference scenario 2015; NS2: along the expansion of Nord Stream

Figure 4. Long term contracted flows and short term (spot) gas flows with and without the expansion of Nord Stream, 2020



Note: LTC: long term contracted gas delivery; Spot: short term gas delivery; Ref 2020: Reference scenario 2020; NS2: along the expansion of Nord Stream

As depicted by the figures, without the expansion of Nord Stream and the related contract amendments, the capacity utilisation of the selected pipelines from West to East is much lower than in case the expansion happens. This is because the Slovakian, Hungarian, Serbian, Bosnian contracts delivered through Ukraine get relocated to these borders. At the Austrian-Hungarian border – vital for Hungary – the 40% share of short term (spot) flows is halved. The year 2015 modelling (Figure 3) indicates that the modified route substantially reduces the access of the region to liquid gas markets, and it hinders integration.

We also carried out our analysis using the 2020 reference scenarios (Figure 4) and derived similar conclusions – channelling long term contracts to the expanded Nord Stream materially reduces the access of the region to Western markets. The reason for the differing capacity utilisation, as per the 2020 reference scenario, is the changed market environment (demand, changing European production, LNG supply).

The modelled increasing gas market prices do not reflect the interrelation according to which the pricing of Russian contracts would depend on the negotiating position of the purchasing country – stemming from the diversification of import and transmission structure. This impact cannot be explored under the current modelling framework, since the model covers a one year cycle. Nevertheless, presumably the pricing strategy of Gazprom may change in the medium term due to declining short term trade, since short term (spot) gas cannot be delivered to the destination country, as the capacities have already been reserved for Russian long term contracted volumes.

The impact of the construction of Nord Stream 2 on social welfare

Next, we inspect the impact of enlarging the capacity of Nord Stream from the perspective of social welfare. The change in welfare includes any shift in consumer surplus, producer surplus as well as the change of the net income of infrastructure operators (system operators, storage facility operators, LNG terminal operators) and traders (storage facility arbitrage and the welfare change of the owner of long term contracts). [17]

With respect to the consumer surplus modelled under the 2015 reference scenario, the new infrastructure generates a positive, but unevenly distributed impact: the consumer surplus declines in Eastern Europe, while it increases in Western Europe. Due to their larger demand, Western markets offset the drop in consumer surplus in Eastern markets. However, a substantial loss is generated for infrastructure operators: the loss of long term contracted flows significantly reduces the revenues of Eastern European TSOs. The revenues of the Ukrainian and Slovakian TSOs are affected most seriously, as they suffer the biggest drop of transit volume. The total European welfare impact of the project is forecasted to be negative, while it will be advantageous for Western European consumers and the Western European infrastructure operators (Table 1).

[17] We do not consider Gazprom as the owner of the long term contract, but its European contracted partner. Today in Hungary this is the Magyar Földgázkereskedő Zrt owned by MVM. Within the modelling exercise we do not inspect the net income of Gazprom.

Table 1. Welfare change for different market participants in selected Western European and Eastern European countries compared to the 2015 baseline (million Euros)

	Change of net consumer surplus	Change of producer surplus	Change of the net income of traders	Change of the net income of infrastructure operators	Total welfare change
All of Europe	155	–112	–479	–1117	–1554
Western Europe	402	–142	–302	415	371
– Germany	133	–16	–78	230	269
Eastern Europe	–247	30	–177	–1532	–1925
– Bulgaria	0	0	–167	0	–167
– Greece	7	0	–130	0	–123
– Hungary	–104	16	41	–16	–63
– Slovakia	–77	0	53	–294	–318
– Ukraine	–2	1	1	–1130	–1130

Modelling based on the 2020 reference scenario provides a more nuanced view of the welfare impacts of the investment (Table 2). From the perspective of consumers, the investment does not achieve a positive balance in Western Europe either, since under the 2020 reference case we assumed a much larger supply of LNG. The arrival of the new LNG source in itself considerably increases welfare in Western European countries and under these boundary conditions the expansion of the Nord Stream affects prices much less and increases consumer surplus to a lower extent. Similarly to year 2015 results, due to diverted flows, the net income of infrastructure operators increases in case of Western European system operators and declines in Eastern Europe. Overall, the project reduces European welfare, and even the welfare change of Western European market participants takes a negative turn.

Table 2. Welfare change for different market participants in selected Western European and Eastern European countries compared to the 2020 baseline (million Euros)

	Change of net consumer surplus	Change of producer surplus	Change of the net income of traders	Change of the net income of infrastructure operators	Total welfare change
All of Europe	–1551	442	–279	–761	–2148
Western Europe	–239	–6	–312	381	–176
– Germany	25	1	–18	217	225
Eastern Europe	–1312	449	33	–1142	–1972
– Bulgaria	–48	–53	–245	–65	–411
– Greece	3	0	–128	0	–125
– Hungary	–240	32	156	–9	–61
– Slovakia	–91	0	68	–125	–148
– Ukraine	–588	339	133	–877	–993

The impact of the expansion of Nord Stream is compellingly conveyed by the change of the investment need for the European natural gas transmission infrastructure. Below we assess the welfare change of completing the current PCI infrastructure relevant for the Central-Eastern European region under two assumptions: in case the expansion of Nord Stream happens and in the absence of it. Modelling is based on the previously introduced 2020 reference scenario, since most investments would take place at around 2020.

We inspected the welfare impacts of the planned projects of common interest under the 2020 scenarios with and without the expansion of Nord Stream. Since Nord Stream substantially raises the prices and lowers the consumer welfare in the East-Central European countries, we analysed the infrastructural elements of the projects of common interest relevant for this region. The technical parameters of the projects (such as the investment cost and the capacity) have been compiled based on the PCI publications of the Commission (*EU* [2016]).

Table 3. The parameters of the inspected projects of common interest (PCI)

Project of common interest	Source country	Target country	Capacity (bcm/year)	Capacity (GWh/day)	Investment cost (million EUR)	Planned length (km)	Diameter (mm)	PCI	Planned year of completion
Polish-Slovakian	PL	SK	5.7	152.4	586*	371	1000	TRA-N-190 TRA-N-275 TRA-N-245	2019
	SK	PL	4.7	126.0					
Greek-Bulgarian pipeline (IGB)	GR	BG	5.0	134	220	185	800	TRA-N-378	2018
	BG	GR	5.0	134					
Trans-Adriatic gas pipeline (TAP)	GR	AL	13.0	348	1500	871	1200	TRA-F-051	2020
Romanian-Hungarian	RO	HU	4.2	113.7	550	n. a	n. a.	TRA-N-126	2023
Bulgarian-Romanian	BG	RO	0.5	562	550*	185	800	TRA-N-431 TRA-N-379	2023 2018
Bulgarian-Serbian (IBS)	BG	RS	3.0	80	220*	185	813	TRA-N-137	2018
Slovenian-Hungarian	SI	HU	1.3	34.8	145	174	500	TRA-N-112 TRA-N-325	2020
Croatian-Hungarian	HR	HU	2.8	76	370	308	1000	TRA-N-075	2019
Croatian LNG		HR	4.0	108	300	-	-	LNG-N-082	2019

* *Estimated value based on the ACER [2015] report.*

AL: Albania, BG: Bulgaria, GR: Greece, HR: Croatia, HU: Hungary, PL: Poland, RO: Romania, RS: Serbia, SI: Slovenia, SK: Slovakia.

Source: European Commission.

We evaluated the projects not only on their own, but we also inspected the impact of packages of projects that include projects that complement each other. We considered the welfare impact of the new infrastructure as the benefit of the investment, while the one-time investment cost (capex) stands on the cost side, and we assumed that the latter takes place during the year preceding the completion of the investment. The operating costs (opex) of the investment are covered by the access tariffs according to current business models. Since the model considers actual transmission fees, their impact is included within the welfare indicators (TSO revenue of the system operator), therefore it does not have to be considered as a separate cost item when the investment is assessed. The welfare change – as already described – includes the change of both the consumers surplus and the producer surplus, as well as the change of the net income of infrastructure operators and traders. Based on the modelling results of the 2020 reference scenario, the welfare change has been assumed to be constant for the whole lifetime of the investment. The lifetime of all infrastructural investments has been assumed to be 25 years, and the net present value was calculated with a 4% real discount rate. [18]

According to the modelling results, from the perspective of the countries of the examined region[19] the projects of common interest (PCI) indicate notably higher welfare impacts when gas from Russia arrives to the region through the Nord Stream. In other words, in this environment even some of those investments break even that in the absence of the Nord Stream would not have covered investment costs from the perspective of social net present value as they would not have carried substantial flows; put differently, the market price among the countries would have levelled off even without their existence (up to the level of the cross-border tariff).

Table 4 reveals the net present value and the benefit/cost ratio of the most important investments and packages of investments. In addition to the net present value, the benefit/cost ratio is an important indicator because in case of investments with slightly positive or negative net present value it shows the extent to which the capital investment of the project generates a profit. In case of a benefit/cost ratio that is close to one, with low positive net present value, the investment cannot be regarded as necessary from a welfare perspective (e.g. the Croatian-Hungarian pipeline with the present high tariff).

Table 4. The net present value and benefit/cost ratio of the infrastructural investments of projects of common interest (PCI) with and without the expansion of the Nord Stream (million EUR)

	Net present value (million EUR)		Benefit/cost ratio	
	Without Nord Stream expansion	With Nord Stream expansion	Without Nord Stream expansion	With Nord Stream expansion
Polish-Slovakian	–521	–456	0.00	0.13
Polish-Slovakian with low Polish LNG tariff[a]	–702	–514	–0.35	0.01
Greek-Bulgarian pipeline (IGB)	261	1145	2.28	6.63
IGB + Bulgarian-Romanian	–262	495	0.58	1.80
IGB + Bulgarian-Romanian + Romanian-Hungarian	–680	77.3	0.35	1.07
IGB+ Bulgarian-Serbian (IBS)	–46	1296	0.89	4.19
IGB (along with the Adriatic gas pipeline)	236	1677	2.16	9.25
Croatian LNG	373	857	2.40	4.21
Croatian LNG + Croatian-Hungarian with high tariff	44.4	528	1.07	1.89
Croatian LNG+ Croatian-Hungarian with low tariff[b]	64.7	1267	1.11	3.13
Croatian LNG with low tariff + Croatian-Hungarian with low tariff[b]	717	1625	2.20	3.73

[a] The regasification tariff of the Polish LNG is 1 EUR/MWh

[b] The Croatian-Hungarian transmission tariff is 1 EUR/MWh at entry and 1 EUR/MWh at the exit

[c] The regasification tariff of the Croatian LNG is 1 EUR/MWh, the Croatian-Hungarian transmission tariff is 1 EUR/MWh at entry and 1 EUR/MWh at the exit.

[18] In harmony with the methodology of ENTSO-G, see *ENTSOG* [2015].

[19] Austria, Bosnia and Hercegovina, Bulgaria, Czech Republic, Germany, Croatia, Hungary, Moldova, Romania, Serbia, Slovenia, Slovakia and Ukraine

If Nord Stream was not completed and the Russian transit would continue to take place through the traditional route across Ukraine, then with the construction of the Greek-Bulgarian pipeline (IGB) (with or without the construction of the Trans-Adriatic gas pipeline)[20] and with the construction of the Croatian LNG terminal (especially if the market protecting tariff applied toward the Hungarian direction is reduced to an average level) the backbone network of market integration could be considered as completed within the region.

If, however, the Russian long term contracted gas captures the capacities originally built for competing spot flows to promote security of supply and market integration, then unblocking the artificially created West-East bottlenecks will require the construction of additional capacities. Due to the higher price level, the additional infrastructural development related to the Greek-Bulgarian pipeline (Bulgarian-Romanian, Romanian-Hungarian, Bulgarian-Serbian) will also turn into profitable investments. The construction of Nord Stream 2 therefore indicates almost 1 billion EUR of additional investment need in the region. It is important to highlight that while these investments boost the integration of European gas markets, and are also profitable for the investors, they essentially restore the situation before the construction of Nord Stream 2, and they are unnecessary in the absence of Nord Stream 2.

CONCLUSIONS AND POLICY RECOMMENDATIONS

We can conclude that due to the resulting bottlenecks, the expansion of the Nord Stream increases the already existing price difference between the Eastern and Western regions of Europe. The modified route of the Russian long term contracts notably deteriorates the access of the East-Central-European region to the cheaper Western European gas markets, thereby impeding the integration. With the cessation of the Eastern gas supply route there is a risk that the prices of the South-East-European region stay permanently higher.

The welfare impacts of the expansion of the Nord Stream are overall negative for Europe. The largest loss is suffered by the East-Central-European consumers and system operators. While under 2015 market conditions the welfare increase of Western European consumers can offset the loss of East-Central-European consumers, under the changed market environment of the 2020 scenario – arising from the rising supply of LNG – the expansion of Nord Stream on balance negatively affects the welfare of European consumers.

Our results indicate that if due to the modified routes the Russian long term contracted gas captures the capacities originally built for security of supply and market integration, then managing the artificially created West-East bottlenecks will require the construction of additional capacities. As a result, in addition to the Greek-Bulgarian pipeline and the line that delivers Croatian LNG to Hungary, building the Bulgarian-Romanian-Hungarian and the Bulgarian-Serbian routes will also become profitable. In total, the construction of Nord Stream 2 will require almost one billion euros of supplemental investments in the region. These investments restore the conditions that existed before the construction of Nord Stream 2, without which they would not be necessary.

The European Commission, the Agency for the Cooperation of Energy Regulators (ACER) and the national regulatory authorities – other than firmly enforcing the execution of the prevailing European regulatory requirements – do not have any tool to prevent this investment. Of the

[20] The Trans-Adriatic gas pipeline is considered only in this scenario.

available regulatory tools particularly the auctioning of the capacities reserved for short term trading can ensure that competition continues at least with the current intensity, despite the expansion of the Nord Stream.

In August 2016, referring to its own market analysis, the Polish office of competition (UOKiK) concluded that the construction of the pipeline would endanger the gas market competition in Poland and would further improve the negotiating position of Gazprom toward consumers in the Polish gas market. This is why the planned consortium – comprising Gazprom and its five European partners to build Nord Stream 2 – could not be established. Following the news, the Western European companies supporting the investment, but also with stakes in the Polish market, withdrew from the consortium. Through other means of project financing or under an alternative consortium structure Gazprom may be able to execute the project. It is also possible, however, that the various authorities hinder the execution of the project for years to come, until finally it is terminated (as it happened in the case of the South Stream).

In the long run, nonetheless, instead of individual resolutions, the key to market competition may rest with ensuring that new sources of supply (mainly LNG) reach the region and harmonised regulation is established.

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ANNEX

Table A1. The estimated volume and transmission route of Russian long term contracts delivered through Ukraine – and the changing route in case Nord Stream 2 is constructed

	Annual contracted volume (TWh/year)	Expiry	Point of delivery	Route	Route in case of Nord Stream 2
RU–AT	68.4	After 2030	Baumgarten	RU–UA–SK–AT	RU–DE–AT RU–DE–CZ–AT
RU–BA	1.3	annually extended	Zvornik	RU–UA–HU–RS–BA	RU–DE–CZ–SK–HU–RS–BA
RU–BG	28	2022–2024	Negru Voda	RU–UA–RO–BG	RU–UA–RO–BG
RU–GR	19.5	n. a.	Sidirokastro	RU–UA–RO–BG–GR	RU–UA–RO–BG–GR
RU–HU	73.6	2019–2021	Beregovo	RU–UA–HU RU–UA–SK–AT–HU	RU–DE–CZ–AT–HU RU–DE–CZ–SK–HU
RU–IT	218	several contracts with various dates of expiry	Baumgarten	RU–UA–SK–AT–IT	RU–DE–CH–IT RU–DE–CZ–SK–AT–IT
RU–MK	1.4	annually extended	Zidilovo	RU–UA–RO–BG–MK	RU–UA–RO–BG–MK
RU–MD	0.7	annually extended	Oleksiivka, Grebenyky	RU–UA–MD	RU–UA–MD
RU–RO	5.3	2030	Isaccea	RU–UA–RO	RU–UA–RO
RU–RS	15	2018	Kiskundorozsma	RU–UA–HU–RS	RU–DE–CZ–SK–HU–RS
RU–SK	63.5	2028	Velke Kapusany	RU–UA–SK	RU–DE–CZ–SK
RU–UA	66.7	2019	Sudzha, Pysarivka, Valuiky	RU–UA	RU–UA

AT: Austria, BA: Bosnia-Hercegovina, BG: Bulgaria, GR: Greece, HU: Hungary, IT: Italy, MD: Moldova, MK: Macedonia, RO: Romania, RU: Russia, SK: Slovakia, UA: Ukraine.
Source: Pirani, S.–Yafimava, K. [2016] and REKK compilation.