



Russian gas transit through Ukraine after 2019: the options

The outlook for transit of Russian gas to Europe, and in particular transit across Ukraine, in 2020 and in the period up to 2025, is considered in this paper. The outlines of the problem are well known: Gazprom is aiming, by constructing transit diversification pipelines (principally, Nord Stream 2 and Turkish Stream), to minimise transit across Ukraine, and eventually to reduce it to zero; Naftogaz Ukrainy aims to retain the transit business as an important source of revenue. In any case, the transit diversification pipelines are very unlikely to be operating at full capacity by 31 December 2019,¹ when the current transit contract between Gazprom and Naftogaz expires. New contractual arrangements must therefore be agreed; they are being negotiated in an atmosphere of unprecedented friction between the two companies. Failure to reach agreement would result in supply disruptions; this could seriously damage the gas industry's efforts to raise its status as part of Europe's energy supply future. I review the progress of transit diversification (Section 1), the state of the negotiations (Section 2) and possible outcomes (Section 3), and consider the implications of no agreement being reached (Section 4). I then review the prospects for transit of Russian gas to Europe up to 2025 and the implications for Ukraine (Section 5), and look at the issue of seasonal flow factors (Section 6). Finally I comment on the investment requirements of the Ukrainian transport system, and the influence on this of gas market reforms (Section 7), and present conclusions.

1. Transit diversification is underway, but will not be complete by 2020

Table 1 presents, in outline, the problem facing Gazprom and its transit diversification strategy. Two Scenarios, reflecting possible pipeline capacity into Europe, excluding routes through Ukraine (but including existing pipelines to Finland, and through Belarus and Blue Stream) are presented (summarising Table 4, below). Scenario A² reflects the likely state of affairs in 2020: it is assumed, first, that EU regulation of the OPAL extension of Nord Stream will be adjusted to allow Gazprom to use all its capacity, and therefore to use the full capacity of Nord Stream 1 (55 bcm);³ second, that one string of Turkish Stream will be operational; and, third, that no other transit diversification pipelines will yet be operating. Scenario C reflects a possible state of affairs in 2021-25: that the Nord Stream 2 project, and both strings of Turkish Stream, are completed, and the total non-Ukrainian transit capacity exceeds 200 bcm. Even in this case, though, shutting the door on Ukrainian transit entirely may be problematic, (a) because volumes at the top of the range of demand projections mentioned could only be delivered using Ukrainian transit, and (b) because of seasonal factors.

¹ Once a major pipeline is laid, several months of testing are required to bring it up to full capacity. This needs to be taken into account when assessing exactly when capacity will be available. For another discussion of this, and other post-2020 transit issues, see: Thierry Bros, *Oxford Quarterly Gas Review 4* (to be published in December 2018), pp. 9-20.

² Table 1 includes two scenarios, A and C. These are excerpted from Table 4, which also includes a third Scenario, B.

³ For details see: Katja Yafimava, *The OPAL exemption decision: past, present and future* (OIES 2017)

The table then presents volumes of gas to be exported from Russia (measured at the Russian standard), at three different levels of demand. The first is a minimum level corresponding to 70% of the take-or-pay levels in Gazprom's long-term contracts. The second and third rows correspond to total European demand (including Turkey) for Russian gas, under scenarios worked out by Howard Rogers at OIES – one assuming high Asian demand for LNG, which will pull LNG away from Europe and increase European demand for Russian gas, and the second assuming low Asian demand for LNG. (These rows summarise projections in Table 3, below).

In order to calculate the volumes of Russian exports required to meet European demand, shown in the table, we have taken two steps. First, to the net demand for Russian gas in Europe we have added volumes supplied to Ukraine by reverse flow (from Germany and other European countries) and to other non-EU destinations, which we project at a material level (above 10 bcm/year), to project gross import volumes. Second, these are further adjusted (multiplied by 1.061818) to arrive at projected gross volumes to be exported from Russia, as measured by the Russian standard. This is due to the lower calorific value and different temperature at which gas is measured in Russia. In simple terms, 1.062 bcm of gas measured at the Russian standard must flow into the pipeline system, to provide 1 bcm of gas measured by the IEA standard at the other end. The gross gas exports from Russia (flows into the pipelines, measured at the Russian standard) could therefore be 185-187 bcm in 2020, and 192-225 bcm in 2022.

The projections of import demand and their relationship to pipeline capacity are discussed in sections 5 and 6. For measurement standards and conversions, see the Appendix. In the paper, volumes are expressed using the IEA standard, unless stated otherwise.

Table 1: Overview: the effect of transit diversification pipelines

	Scenario A. OPAL cap lifted, one string of Turkstream added. Possible for 2020	Scenario C. Two strings Turkstream + two strings of NS2 added. Possible for 2021-25
Pipeline capacities		
To Finland	5	5
Via Belarus	43.4	43.4
Blue Stream	16	16
Nord Stream	55	110
Turkish Stream	15.75	31.5
Total without Ukraine	135.15	205.9
Ranges of demand for Russian gas exports (flow into pipelines, measured at the Russian standard)		
At 70% of TOP levels	138	114-138
"High Asian LNG demand" scenario	187	187-225
"Low Asian LNG demand" scenario	185	181-192
Surplus of transit volumes over non-Ukrainian capacity (flow into pipelines, measured at the Russian standard)		
At 70% of TOP levels	2.85	0
"High Asian LNG demand" scenario	51.85	0-19.1
"Low Asian LNG demand" scenario	49.85	0

Source: Source: Katja Yafimava and Howard Rogers, OIES / Tables 3 and 4 (below)

The final rows of Table 1 show the surplus of transit volumes over non-Ukrainian capacity, i.e. the volumes that can only reach Europe via Ukraine. These show that, in 2020, Gazprom may well require about 50-52 bcm of Ukrainian capacity. In practice, given seasonal flow factors, the requirement may be greater. In 2021-25, assuming that Nord Stream 2 is in operation, the requirements will be substantially lower – but Ukrainian capacity would still be required at the highest levels of demand. Under the “high Asian LNG demand” scenario, this is particularly true in 2022, when European demand for Russian gas may hit a peak, with existing LNG suppliers being drawn to the Asian market by high prices, and new LNG export capacity not yet available. There may also be a requirement for Ukrainian transit capacity to cover seasonal peaks.

The only transit diversification line expected to be fully operational by 1 January 2020 is the first string of Turkish Stream, which will supply 15.75 bcm of Russian gas to western Turkey, and, together with the Blue Stream pipeline (16 bcm capacity), reduce Turkey’s dependence on the route via Ukraine and Romania substantially. Construction of the second string of Turkish Stream, which will bring Russian gas to south-eastern Europe, has not begun, pending a decision on the route, and resolution of regulatory issues. It is likely to be completed by 2025, and effectively to replace 15.75 bcm of Ukrainian transit capacity. Nord Stream 2 has faced political opposition, as well as regulatory and permitting problems; it is likely that these will delay, but not stop, the project; it is likely to be completed by 2021 or 2022.

2. Negotiations on transit after 2020

Negotiations between Gazprom and Naftogaz Ukrainy on post-2020 contractual arrangements began in April this year. However, the norms that usually govern commercial relationships are not in place; in particular, day-to-day inter-company cooperation and communication largely broke down in 2014-15 and remain absent. While transit continues, with scant reference to contract, direct Russian gas exports to Ukraine ceased in 2015. Challenges to the contract terms from both sides resulted in one of the largest ever commercial arbitration disputes.⁴ The tribunal’s decision, made in February this year – and in particular the \$2.56 billion (net) award against Gazprom – continues to be fiercely contested in a series of legal actions. This conflict cannot be understood only on a corporate level: it is part of a breakdown of political, diplomatic and economic relationships between Russia and Ukraine, which is as grave as it could be short of a declaration of war. This stems from the removal of the Yanukovich government in Ukraine in February 2014 and includes: Russian annexation of Crimea in March 2014; the military conflict in eastern Ukraine, which has resulted in 10,000 deaths, the internal displacement of 1.8 million people in Ukraine and the migration of 430,000 refugees to Russia;⁵ Russian economic, political and (in a manner and on a scale that are disputed) military support for the separatist “republics” in eastern Ukraine; and the collapse of Russian-Ukrainian trade.⁶

Given these circumstances, hardly auspicious for commercial negotiations, the European Commission invited the Russian and Ukrainian governments to tripartite political negotiations on gas transit. Immediately after the Gazprom-Naftogaz arbitration case was completed in March, Maros Sefcovic, EC vice president, announced that Brussels “stands ready to steer a trilateral process”; he referred to the Commission’s previous success in brokering the “winter package” agreement on gas transit in the winter of 2014-15.⁷ An intergovernmental meeting was held on 17 July in Berlin; a further meeting was scheduled for October, but at the time of writing had not taken place. The positions of the parties may be summarised as follows:

The EC is pressing for a guarantee from Russia of a minimum volume of transit through Ukraine for an unspecified period of time after 2020 – in Sefcovic’s words, “substantial volumes which would

⁴ See: Simon Pirani, *After the Gazprom-Naftogaz arbitration: commerce still entangled in politics* (OIES, March 2018)

⁵ UNHCR, *Ukraine Situation: Operational Update*, September 2018, p. 1

⁶ In 2007-2010, Russia accounted for between one fifth and one third of Ukraine’s trade all together. Now, it accounts for less than one-fifth of imports and only about one-tenth of exports. Author’s calculations from World Bank data.

⁷ European Commission, “Statement of Vice-President Sefcovic on Russian-Ukrainian natural gas situation”, 2 March 2018



guarantee commercially viable transit". It has been implied, but not stated openly, that, in exchange for such a guarantee, the Commission and leading European governments would ensure the removal of regulatory obstacles to the construction of Nord Stream 2. An example of such an obstacle is the proposal made in November 2017 to extend offshore the operation of the Gas Directive of the Third Energy Package. In June 2018 a proposal was reportedly accepted by the European Commission to postpone any decision on this during the negotiations on Ukraine transit.⁸

The German government has publicly tied its support for Nord Stream 2 to its call on Russia to ensure continued gas transit via Ukraine. Chancellor Angela Merkel stated in April that "the political aspect of this question has to be taken into account"; she repeated this at a meeting with Russian president Vladimir Putin in August, and specified: "Even if Nord Stream 2 is built, Ukraine has a role to play in gas transit."⁹ German foreign minister Peter Altmaier reiterated this stance at a meeting with Sefcovic in Brussels in September.¹⁰

The Ukrainian government, and executives of Naftogaz Ukrainy, have stated that, for Ukrainian transit to be economically sustainable, volumes need to be above 40 bcm/year.¹¹ They have appealed to European governments to support maximisation of transit volumes through Ukraine and to oppose construction of Nord Stream 2. President Poroshenko has stated that he is working with European allies to block the project; deputy foreign minister Lana Zerkal' and Naftogaz CEO Andrei Kobolev have argued that preserving a large-scale Ukrainian transit business can help prevent all-out war between Russia and Ukraine.¹²

The Russian government, and Gazprom executives, have said that, notwithstanding transit diversification, they wish to continue Ukrainian transit, with the proviso that the terms must be commercially acceptable. At the start of the negotiations, Gazprom CEO Aleksei Miller, reiterating a stance taken since 2016, suggested that the company could commit to 10-15 bcm/year of transit across Ukraine. At the talks in Berlin in July, energy minister Aleksandr Novak said that a possible increase in the level of Russian exports to Europe was discussed, and that on that basis the Ukrainian system could be used. Novak repeated a proposal made by other Russian officials, that "outstanding claims" – by implication, including the \$2.56 billion Stockholm arbitration award, to be paid by Gazprom to Naftogaz – should be dropped as part of any settlement. This latter suggestion has been dismissed by Ukrainian officials including foreign minister Pavlo Klimkin.¹³

Proposals to stop Nord Stream 2, and drop arbitration claims, unlikely to succeed

The Ukrainian proposals to prevent completion of Nord Stream 2 have received considerable public support,¹⁴ but seem likely only to delay the project, rather than to halt it completely.

⁸ "Evrokomissii ne stanet razdrzhat' Gazprom", *Vedomosti*, 5 July 2018

⁹ "Gazprom mozhet sokhranit' tranzit gaza cherez Ukrainu", *Vedomosti*, 10 April 2018; "Russia will consider 'economic' Ukrainian transit", *Argus FSU Energy*, 23 August 2018

¹⁰ "Germany to build LNG plant in 'gesture' to US", *Euractiv*, 19 September 2018

¹¹ "Ukrainu ne ustroit tranzit 10 mlrd kub m gaza v god", *Interfaks-Ukraina/UA Energy*, 11 April 2018; "Russia will consider 'economic' Ukrainian transit", *Argus FSU Energy*, 23 August 2018

¹² "Poroshenko nadeetsia ostanovit' Severnyi potok 2", *Ukrainska Pravda*, 12 July 2018; "Poroshenko predostereg Evropu ot lovushki gazovogo shantazha RF", *Ukrainska Pravda*, 22 September 2018; "Gehen Sie nicht in Putins Gas-Falle!", *Rheinische Post*, 22 September 2018; "Gazoprovod Severnyi potok-2 neset voennuiu ugrozu", *Ukrainska Pravda*, 15 September 2018; "Kobolev: Ukrainskaia GTS sderzhivaet Putina ot masshtabnoi voyny", *Ukrainska Pravda*, 16 September 2017

¹³ "Gazprom nachal peregovory s Naftogazom o novom tranzitnom kontrakte", *Vedomosti*, 11 April 2018; "Rossiia i Ukraina proveli peregovory o tranzite gaza", *Vedomosti*, 18 July 2018; "Russia and Ukraine to hold further gas transit talks", *Reuters*, 17 July 2018. For an earlier statement of Gazprom's position, see e.g., "Gazprom perevedet eksport gaza", *Vedomosti*, 16 June 2016.

¹⁴ The *Financial Times* called for Nord Stream 2 to be blocked by Brussels; see "Nord Stream 2 pipeline is against Europe's interests", *Financial Times*, 21 August 2018. See also e.g. Alan Riley, *Nord Stream 2: understanding the potential consequences* (Atlantic Council, June 2018)

Map 1: The Nord Stream pipelines



Source: OIES

Although president Poroshenko appealed to US politicians to impose sanctions on the pipeline, at the time of writing it appears that Washington's focus is on reinforcing financial-sector sanctions on Russia.¹⁵ There are two caveats. First, US policy, in this area and others, is unpredictable due to president Trump's style of decision making. Second, the financial-sector sanctions will impact Nord Stream 2, as they will other Russian projects; in Gazprom's case, there is the additional problem that the legal disputes with Naftogaz forced Gazprom to suspend external borrowing and rely on its own funds and private loans.¹⁶ Construction of the offshore section of Nord Stream 2 began in September, with pipe being laid in the Finnish sector of the Baltic Sea by the pipeline vessel *Solitaire*; in November it was reported that 200km had been laid, that all the pipes for the line had been delivered and most of them coated; the operating company has also drafted plans for re-routing the pipeline around the territorial waters of Denmark, the only Baltic state yet to approve construction.¹⁷ Gazprom CEO Miller in October reiterated that the pipeline will be finished in time to start commercial deliveries by 1 January 2020 (although he did not specify at what volumes).¹⁸ Given all the circumstances, operation at full capacity by 2021 or 2022 seem more likely.

¹⁵ "Russia worried US will sanction NS2", *Natural Gas World*, 13 September 2018; "Tougher Russia sanctions face skepticism from Senate Republicans", *The Hill*, 5 August 2018; "Poroshenko pogovoril s delegatsiei Kongressa SShA", *Ukrainska Pravda*, 1 September 2018

¹⁶ "Russia's Gazprom suspends external borrowing amid spat with Naftogaz", Reuters, 6 August 2018; "Russia's Gazprom to take pause on external debt market", Reuters, 31 August 2018

¹⁷ "Gazprom nachinaetsia stroitel'stvo morskoi chasti Severnogo potoka-2", *Vedomosti*, 3 September 2018; "Russian NS2 starts laying Finnish section", *Natural Gas World*, 5 September 2018; "200km of N Stream pipe laid", *Interfax Russian and CIS Oil and Gas Weekly*, 1-7 November 2018

¹⁸ "Russia can build Nord Stream 2 on its own", *Argus FSU Energy*, 4 October 2018

The Russian proposal that claims, including those arising from the Stockholm arbitration, be dropped, seems unlikely to gain traction. The outcome of the arbitration was denounced as “asymmetrical” by CEO Miller, and Gazprom has appealed against the tribunal’s two decisions (on the transit and supply contracts) in the Swedish courts. Gazprom said that it would not pay the \$2.56 billion award made against it until these procedures were exhausted. Naftogaz then started proceedings in Switzerland, the UK and the Netherlands for the arrest of Gazprom assets to enforce the award.¹⁹ In June, a Swedish court suspended enforcement of the arbitration decision, potentially undoing the legal basis of such arrests, but in September, this decision was reversed.²⁰ In Switzerland, legal arguments over possible arrest of assets at the premises of Gazprom subsidiaries continue;²¹ in the Netherlands, Gazprom’s stake in Blue Stream, and debts owed to Gazprom by Blue Stream, have been seized under a court order;²² in the UK, courts have ordered that some Gazprom assets (shares in Nord Stream AG) should not be disposed of, pending a full hearing in February 2019.²³ In addition to these cases arising from the arbitration, seven Naftogaz subsidiaries have claimed compensation, at the Permanent Court of Arbitration at the Hague, for damages arising from the expropriation of their assets in Crimea after the annexation; a decision is expected in early 2019.²⁴ Given the political background, abandonment of all these actions seems unlikely.

The conclusion, therefore, is that the negotiations will largely concern questions of volumes, capacities and tariffs. It is now extremely unlikely that the Nord Stream 2 project will be cancelled, although its use could be constrained by regulation. It is also unlikely that all the legal actions mentioned will be withdrawn. But if either of these things happen, they could change the direction of the negotiations.

3. What a deal may include

Any agreement between Gazprom and Naftogaz Ukrainy on post-2020 transit from 1 January 2020 will probably – given the poor relationship between them, the relatively unpredictable nature of future demand for Russian gas in Europe and Russia’s transit diversification strategy – be relatively short-term: a one-year agreement with provisions for renewal, or at most a three- or five-year agreement.²⁵ The agreement will probably need to be compliant with the EU third energy package (i.e. the Third Gas Directive and Gas Regulation 715), since Ukraine, through membership of the European Energy Community, accepts these provisions as the foundation for gas market and gas transmission legislation. Certainly EU representatives in the trilateral talks will insist on those provisions, as they have throughout the Ukrainian market reform process. Moreover, the Network Code on Interoperability, which is part of the Energy Community acquis, is legally binding for Ukraine, although not the Network Codes on Capacity Allocation and Tariffs.²⁶ The content of the agreement may include:

¹⁹ “Naftogaz initiates enforcement of Stockholm awards”, Naftogaz press release, 30 May 2018; “Gazprom soobshchil ob otmene sudom resheniia ob areste aktivov v Anglii”, *Vedomosti*, 13 September 2018

²⁰ “U Gazproma poiavilsia shans osporit’ reshenie o vyplate \$2.6 mlrd”, *Vedomosti*, 14 June 2018; “Naftogaz serves Gazprom with order to freeze assets in the UK”, Naftogaz press release, 19 June 2018; “Svedskii sud ostalsia na storone Gazproma”, *Vedomosti*, 28 June; “Svea court approves enforcement”, Naftogaz press release, 13 September 2018; “Ukraine’s Naftogaz to proceed with Gazprom asset seizures”, *Platts/ SP Global*, 14 September 2018; “Gazprom to seek to review Swedish court’s latest ruling”, *TASS News Agency*, 13 September 2018

²¹ “The Zug Superior Court has reinstated”, Naftogaz press release, 4 July 2018; “Gazprom oproverg zaiavleniie Naftogaza o vozobnovlenii aresta aktivov”, *Vedomosti*, 5 July 2018

²² “Gazprom-Naftogaz Spat Persists”, *Bloomberg*, 29 August 2018; “Sud v Amsterdame arestoval doliu Gazproma”, *Vedomosti*, 29 August 2018

²³ “Gazprom soobshchil ob otmene sudom resheniia ob areste aktivov v Anglii”, *Vedomosti*, 13 September 2018; “Gazprom to seek to review Swedish court’s latest ruling”, *TASS News Agency*, 13 September 2018

²⁴ Naftogaz press release, “PCA Tribunal holds Naftogaz-Russia hearings”, 21 May 2018

²⁵ For another discussion of possible terms in a deal, see Bros, *OIES: Quarterly Gas Review* (December 2018), pp. 13-17

²⁶ I am grateful to Katja Yafimava, who has helped to clarify these points. See also: Katja Yafimava, *Building New Gas Transportation Infrastructure in the EU – what are the rules of the game?* (OIES, July 2018), pp. 123-136

Volumes. Research at OIES on European and global gas market trends suggests that demand for Russian gas in Europe in 2020-25 will be in a range of 171-212 bcm/year (see section 5 below). This implies gross exports from Russia (flows into the pipelines, measured at the Russian standard) of 181-225 bcm/year. Gazprom will therefore need, from 2020 – and until its transit diversification pipelines are in operation – to book 46-90 bcm/year transit capacity through Ukraine (see Table 1). In practice, the requirement for transit on a daily or monthly basis through Ukraine will probably be higher, given additional requirements at peak times. An agreement on transit will need to provide for these volumes. Gazprom is likely only to enter into an agreement that allows it to reduce flows through Ukraine as and when transit diversification pipelines become available.

Tariffs. In January 2016, Ukrainian gas transportation tariffs moved to an entry-exit basis, away from the previous volume basis, in line with market reforms designed to align its regulations with the EU. Cross-border entry tariffs were set at \$12.47/mcm, and exit tariffs at \$31.03-\$32.80/mcm for the large-volume exit points to Slovakia and Hungary, and \$23.12-\$28.99 for smaller-volume exit points to Poland and Romania.²⁷ The nominal average total tariff for gas delivered to Europe, stated by Naftogaz, is \$57.70/mcm. However these tariffs are not paid, as Gazprom, the only customer for Ukraine transit services, is invoiced under the 2009 transit contract, at under half this level. The Stockholm arbitration tribunal rejected a claim by Naftogaz that the contract should be amended retrospectively.²⁸ Contractual arrangements post 2019 will have to comply with the entry-exit methodology. Naftogaz Ukraine managers have estimated that expected tariffs in 2020 will be much lower than the current nominal tariff, as follows:

Table 2: Naftogaz estimates of post-2020 transit tariffs

	Annual capacity booked, bcm	Tariff, incl. VAT & fuel gas, \$/mcm
Current tariff paid under 2009 contract*		24.42
Current tariff (set by regulator)		57.70
Estimated post-2020 tariff	30	15.90
	50	11.00
	70	8.30
	90	6.70
	110	5.60

* OIES estimate based on contract and Naftogaz publications

Source (post-2020 estimates): Presentation at Flame conference, Amsterdam, May 2017, "Development of the Ukrainian Gas Market", Yuri Vitrenko, Naftogaz Ukraine

In July 2018, Yuri Vitrenko, Naftogaz's chief commercial officer, stated that, assuming full capacity utilisation of the Ukrainian system, the cancellation of Nord Stream 2 and third-party access to Russian pipelines for central Asian producers, tariffs may be around \$2.17/mcm/100 km, including VAT and fuel gas. He said that the updated estimates had been made on the basis of amendments to European regulations.²⁹ These conditions are unlikely to be met, but Vitrenko's statement suggests a

²⁷ The exit tariffs are: \$32.80/mcm (Uzhgorod, to Slovakia), \$31.03/mcm (Beregove, to Hungary), \$25.73/mcm (Drozdovychy, to Poland), \$23.12/mcm (Orlivka, to Romania), \$28.99 (Tekove, to Romania). See Ukrtransgaz web site <<http://utg.ua/en/utg/business-info/tariffs.html>>. For capacities and volumes see Naftogaz Ukraine, *Annual Report 2017*, pp. 101-103

²⁸ See Naftogaz Ukraine, *Annual Report 2016*, pp. 85-86; Pirani, *After the Gazprom-Naftogaz arbitration*, p. 6

²⁹ Facebook post by Yuri Vitrenko, 16 July 2018. <<https://www.facebook.com/yuriy.vitrenko/posts/10155889216988458>>. In 2016, a Naftogaz presentation gave estimates, for transportation from the Siberian fields to Germany, of \$73/mcm via Nord



tariff of about \$20.60/mcm across Ukraine, significantly higher than the figures in Table 2, but still slightly lower than the tariff charged currently.

Naftogaz Ukrainy managers argue that the higher tariff in 2016-19 provided for accelerated depreciation of the gas transit assets, and will allow a sharp tariff reduction in 2020. Regardless of the merits of that logic, the projected tariff levels reported in public by Naftogaz are probably comparable with tariffs to be charged by Nord Stream 2.³⁰ But the total distance to be covered to European destinations – particularly from the Yamal peninsula – is lower via Nord Stream 2 than via Ukraine, meaning that, once the pipeline is in place, even if similar tariffs are charged, Gazprom will have commercial reasons for using the Ukrainian route only for volumes that cannot be transported via Nord Stream 2.³¹ As the proportion of Russian gas produced in Yamal rises, and the west Siberian fields continue to decline, through the 2020s, this competitive disadvantage for Ukraine will be accentuated.

Capacity or commodity? Naftogaz Ukrainy managers have stated that moving to a capacity charge, away from the commodity charges historically used for gas transit in CIS countries, is an issue of principle. The company's annual report states that European tariff formation principles determine "that tariffs should be capacity-based" and complains of "Gazprom's capacity hoarding in the Ukrainian transmission system".³² Gazprom's transit requirements could be satisfied under a contract with capacity-based tariffs, but its strategy implies that it will seek considerable flexibility, e.g. by booking capacity in one pipeline but having the option to access capacity in others. Since 2010, it has used its transit diversification pipelines as base-load and only transited through Ukraine residual volumes, which are higher at peak times (see Section 6 below). This approach can be expected to continue after 2020.

Storage. Historically, up until 2009, Gazprom booked capacity in the large gas storage facilities close to Ukraine's western border, as a means of balancing flows of transit gas to Europe.³³ In recent years it has used its own storage facilities in central Europe, and gas trading, to manage flows. Given the importance of flexibility, the question is raised as to whether post-2020 arrangements could include an element of storage capacity booking.

4. The possibility of no deal

It is possible, although not probable, that no agreement will be reached on Ukrainian gas transit by the end of 2019. The main reasons for this are (i) the collapse of Russian-Ukrainian political and economic relations mentioned above, and (ii) the deterioration of relations between Russia, the US, and governments of European countries that are major consumers of Russian gas, and the consequent shifts in international diplomacy. The reasons to expect that an agreement will be made are, by contrast, commercial: it is self-evidently in the interests of Gazprom, its European counterparties, and Naftogaz Ukrainy. Failure to reach a deal would indicate that political factors had overridden commercial ones. The consequences would include:

Stream 2 (assuming 90% utilisation) and \$58/mcm via Ukraine. The author can not confirm these estimates: the point is that they are made with a view to offering transit competitively. Presentation by Yuri Vitrenko at Ukrainian Gas Forum, October 2016

³⁰ Tariffs for Nord Stream 2 have been projected by Aleksei Miller, CEO of Gazprom, as \$2.10/mcm/100 km, i.e. around 20% lower than the current tariff under the 2009 contract. See "Gas transit via Ukraine 20% more expensive than supplies through Nord Stream 2 – Gazprom", TASS Russian News Agency, 16 June 2016.

³¹ For a comparison of estimated current costs for Russian gas delivered to Europe via Nord Stream and via Ukraine, see Henderson and Sharples, *Gazprom in Europe – two "Anni Mirabiles", but can it continue?* (Oxford: Oxford Energy Insight, March 2018, p. 15)

³² Naftogaz Ukrainy, *Annual Report 2017*, pp. 98-99

³³ Gazprom ended direct purchase of storage services in 2005, during a dispute about 7.8 bcm of "missing" gas; it used the services via Rosukrenergo, which acted as agent, until 2009. See Simon Pirani, "Ukraine: a gas dependent state", in Pirani (ed.), *Russian and CIS Gas Markets and their Impact on Europe* (Oxford: Oxford University Press, 2009), pp. 93-132, here p. 114

(a) A supply interruption starting on 1 January 2020, affecting south-east Europe in particular. The supply interruption of January 2009, caused by a Russian-Ukrainian gas dispute, resulted in a complete cessation for two weeks of gas imports into Bulgaria, Serbia, Bosnia & Herzegovina, and FYR Macedonia, and a partial cessation of imports into Romania, Greece and Croatia.³⁴ Since that time a great deal of political effort has been made both to open up new sources of supply to the region, and to improve the interconnectivity of gas networks,³⁵ but a supply interruption would still have an immediate and negative impact in the region.

The major new supply option that should be available to south east Europe in January 2020 is gas from the Shah Deniz II project in Azerbaijan, delivered to the Turkish-Greek border via the TANAP pipeline. While the project will not achieve plateau output of 16 bcm/year until 2021-22, it is expected to be delivering 11-13 bcm/year by 2020.³⁶ The continuation of TANAP, the Trans Adriatic Pipeline to Italy, will not be ready until March 2020 at the earliest, but it may be possible for traders who have purchase contracts for Shah Deniz II gas to offtake it in Greece and, where transportation infrastructure allows, supply it to other south east European countries.³⁷

Map 2: The Turkish Stream pipelines



Source: OIES

³⁴ Alexander Kovacevic, *The Impact of the Russia-Ukraine Gas Crisis in South Eastern Europe* (OIES (NG29), March 2009), especially p. 11

³⁵ See e.g. "Secure Gas Supplies" page of CESEC web site <<https://ec.europa.eu/energy/en/topics/imports-and-secure-supplies/secure-gas-supplies>> and ENTSG ten-year network development plan <<https://www.entsog.eu/publications/tyndp>>

³⁶ Simon Pirani, *Let's Not Exaggerate: Southern Gas Corridor prospects to 2030* (OIES, July 2018), pp. 9-11

³⁷ "Rome's silence spells trouble for TAP", *Interfax Natural Gas Daily*, 24 October 2018



The major transit diversification option that may mitigate a supply crisis in January 2020 in south eastern Europe is the first string of the Turkish Stream pipeline. From a capacity of 15.75 bcm/year, it is expected to supply 14 bcm/year to Turkey, leaving 1.75 bcm/year that could potentially be used to deliver Russian gas to south-east Europe. Additional infrastructure would be required to bring such volumes from Turkey to Bulgaria – specifically, an 11-km spur linking the Strandzha compressor station on the Trans Balkan Pipeline in Bulgaria to the Turkish grid. Bulgartransgaz, the Bulgarian TSO, has launched a tender for the design, construction and commissioning of this link, so it could be in place by the end of 2019.³⁸ Volumes delivered via this link could be delivered to Bulgaria or transported further e.g. by the Trans Balkan pipeline operating in reverse (a project that has been in preparation for some time and could be ready by the end of 2019).

There are several other infrastructure projects in south-east Europe that could, if completed, improve interconnectivity and allow gas delivered through Turkey to be transported to importing countries in the region. These include the “South Stream Lite” project, to take gas from Bulgaria via Serbia to Hungary, on which TSOs in those countries are collaborating (with the Serbian section due for completion in 2019 but the other sections taking longer); the BRUA pipeline that is now planned to link Romania, Slovakia and Hungary; and the Eastring project. But none of these will be completed by the end of 2019. Parts of “South Stream Lite” and BRUA may be ready by 2021-22; Eastring will not be completed before 2025.³⁹

The availability of Azerbaijani gas via TANAP in Bulgaria, and of Russian gas via Turkish Stream 1 in Greece, and the improved interconnectivity of networks in the region, may mitigate a supply crisis. However, the countries that receive 100%, or nearly 100%, of their gas imports from Russia via Ukraine (Bulgaria, Serbia, Bosnia & Herzegovina, FYR Macedonia) would still be affected. The problems in central European countries that receive Russian gas imports via Ukraine (Slovakia, Hungary, Austria and Czech Republic) would be mitigated by the availability of interconnections from other markets and storage.

(b) *If the supply interruption continued for more than a few days, shortages of gas would occur in Italy, one of the largest markets for Russian gas.* Such shortages could be mitigated (i) by deliveries of LNG to Italy's three import terminals (that have an aggregate nominal sendout capacity of 14.8 bcm⁴⁰), and (ii) by Algerian gas delivered via pipeline, to the extent that it is available.

(c) Gazprom might be compelled to declare force majeure on deliveries to certain points e.g. on the borders of Italy, France, Austria, Hungary, Slovakia and the Czech republic, in addition to those in south eastern Europe.⁴¹ The level of disruption would probably be less severe in these countries than in south eastern Europe, but there would be significant commercial consequences for Gazprom.

(d) If force majeure is declared, the question would be raised as to whether deliveries could be made to alternative points, including on the eastern Ukrainian border. For some years the Ukrainian government and Naftogaz Ukrainy have made clear their preference for this approach, which could extend the European gas market to Ukraine and enhance the development of a traded market. Following the recent anti-trust case, Gazprom gave a limited commitment to accept clauses in its long term contracts giving purchasers the right to require a change in delivery points.⁴² However, in the past those purchasers have not wished to take exposure to Ukraine transit risk. Moreover, the

³⁸“South Stream Lite likely to terminate in Hungary”, *Interfax Natural Gas Daily*, 31 August 2018

³⁹“Romania prepares for greater cross-border flows”, *Interfax Natural Gas Daily*, 21 June 2018; “BRUA uncertainty tests Exxon and OMV's patience”, *Interfax Natural Gas Daily*, 5 September 2018; Eastring web site <<https://www.eastring.eu/>>

⁴⁰The three regasification terminals (with nominal send-out capacity in brackets) are: Toscano FSRU (3.8 bcm/year), Panigaglia (3.4 bcm/year) and Rovigo (7.6 bcm/year). Rovigo is currently used to enhance security of supply. GIIGNL (International Group of LNG Importers) *Annual Report 2018*, p. 38

⁴¹Long-term contracts cover 22.6 bcm/year of Gazprom gas delivered to the borders of these countries, mostly via Ukraine. For details see Simon Pirani and Katja Yafimava, *Russian Gas Transit Across Ukraine Post-2019* (OIES 2016), pp. 58-59

⁴² See Stern and Yafimava, *The EU Competition investigation of Gazprom's sales in central and eastern Europe* (OIES 2017), p. 9



Russian government and Gazprom have opposed proposals for a general shift of delivery of Russian gas to the eastern border of Ukraine.⁴³

(e) A broader political consequence of a supply interruption would be to undermine further the prospects of gas becoming part of Europe's energy supply future, which is already being questioned as a result of the EU's decarbonisation strategy. This underlines the importance of this issue for the whole industry, as well as for those countries for which it is a supply security problem.

It is impossible meaningfully to comment on the likelihood of the EC, Russia and Ukraine failing to broker an agreement. Both Gazprom and Naftogaz Ukrainy stand to suffer from a supply interruption, in terms of lost revenue and disruption of commercial relationships; for Gazprom, the negative implications for its export strategy of declaring force majeure and opening the issue of delivery points may be an additional incentive to complete a deal. The outcome will depend largely on the dynamics between the political parties to the talks, and the extent to which political dynamics influence commercial dynamics. One significant deadline is the expiry of the European Commission's term of office on 31 October 2019. The appointment and approval of new commissioners, and their approval by the European Council, takes time, and the Ukraine transit negotiations would inevitably be disrupted by the handover process.⁴⁴ Therefore, if no agreement has been made by that point, the risk of no agreement being made at all will increase significantly. Another factor of possible relevance is the Ukrainian presidential elections in March 2019, and the Ukrainian parliamentary elections in October 2019. In the run-up to both of these, the political space for the Ukrainian government to make concessions in the negotiations may be limited.

5. Demand for Russian gas in Europe, and for transit, in 2020-25⁴⁵

Even if European gas demand only rises slowly during the 2020s, demand for Russian gas could be significantly higher in the first part of the decade. For this reason, even if both main transit diversification projects (Nord Stream and Turkish Stream) are completed, Gazprom is likely to retain the option to use some Ukrainian transit capacity. However, barring the complete failure of its transit diversification policy, which is unlikely, demand for transit capacity will be substantially lower. Investment will be required both to upgrade parts of the Ukrainian pipeline system for continued use, but also to decommission some parts.

Estimates of demand for Russian gas in Europe

Figure A shows estimates of demand for gas in Europe (including Turkey), and the main sources from which it will be met, up to 2030, made by Howard Rogers at OIES. The estimates assume that European gas demand will rise gently up until 2025, and then level off, due to Europe's changing energy requirement, the effect of decarbonisation policies and the growing share of electricity generation contributed by renewables. On the supply side, the level of demand for Russian gas will be determined (i) by the continued decline of European gas production (principally the Netherlands and the UK), (ii) by the constraints on non-Russian pipeline imports (from North Africa and via the "southern corridor") and (iii) by the availability of liquefied natural gas (LNG).

The LNG market cycle is likely to work as follows. The availability of LNG will be determined firstly by the level of demand for it in Asia, where prices are higher, and will probably remain so, and which will therefore probably remain a favoured destination. The level of demand will influence the pace at which a new generation of LNG export projects is commissioned. At present, expectations are that Asian demand for LNG will remain strong in the early 2020s. If Asian LNG demand is high in the first half of the 2020s, this may encourage more rapid development of new projects, which will reduce prices, and again stimulate demand, in the second half. The level of Asian demand for LNG is a

⁴³See Pirani and Yafimava, *Russian Gas Transit Across Ukraine Post-2019*, p. 49

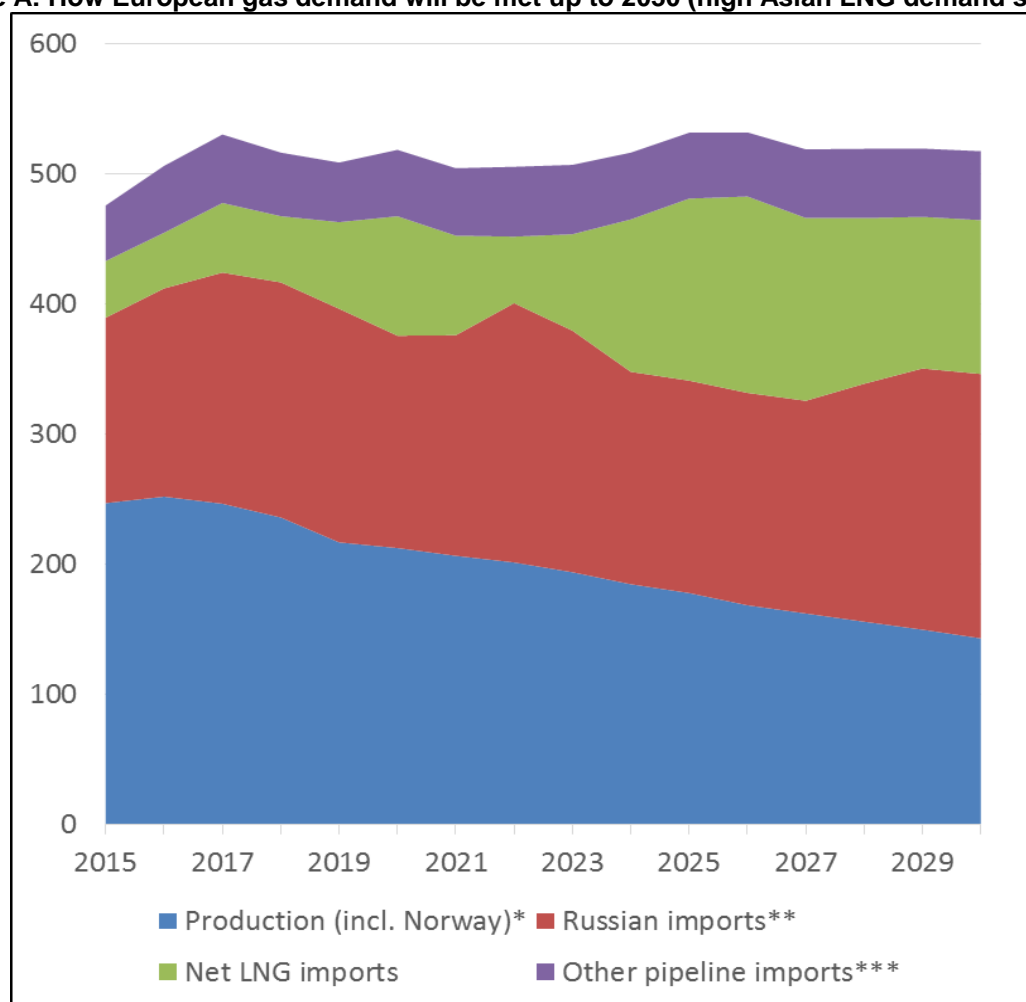
⁴⁴ <https://ec.europa.eu/info/about-european-commission/organisational-structure/political-leadership_en>

⁴⁵ This section is largely based on research by my colleagues Howard Rogers (on demand for Russian gas in Europe) and Katja Yafimava (on transit capacity requirements). I am grateful for their permission to use it. Measurements used are according to IEA standards: see the Appendix.

crucial determinant of demand for Russian gas in Europe: if LNG is pulled away to Asian destinations, Russia is the obvious source of gas to make up the shortfall in supplies to Europe.

Figure A is based on a high Asian demand for LNG scenario (at present, seen as the most likely scenario). European demand for Russian gas could spike in 2022 in particular, with Asia driving global LNG demand and the next wave of LNG export projects not yet complete. In a second scenario, which assumes lower Asian demand for LNG, more LNG is available for the European market, and therefore the demand for Russian gas imports falls – but even in this scenario, it stays above 160 bcm/year throughout the 2020s, slipping below that level in only one year.

Figure A: How European gas demand will be met up to 2030 (high Asian LNG demand scenario), bcm



* The row "production" has some small volumes of net storage withdrawal included.

** Russian imports are net of reverse-flow deliveries to Ukraine and other destinations

*** Algeria, Libya, Iran and Azerbaijan

Source: Howard Rogers, OIES

Table 3 compares projected levels of demand for Russian gas in Europe, in the "high Asian LNG demand" and "low Asian LNG demand" scenarios. Gross Russian pipeline imports include gas on its way to non-EU final destinations (about 10 bcm for Ukraine, plus about 2.5 bcm for the Russian territory of Kaliningrad and less than 1 bcm for other Russian and Belarussian destinations). Net and Gross imports to Europe include Turkey. The gross import figures are relevant, to the extent that we expect the physical reverse-flow trade to continue in the 2020s. The table shows the gross flows into the pipeline system, measured at the Russian standard, that will be required at these levels of gross imports.



For the period 2020-25, on which this paper is focused, the “high Asian LNG demand” scenario shows gross volumes of Russian pipeline gas arriving in Europe in a range of 176-212 bcm, and the “low Asian LNG demand” scenario shows those flows in a range of 171-181 bcm. This equates to a flow into the pipelines, measured at the Russian standard, under the “high Asian LNG demand” scenario in a range of 187-225 bcm, and in the “low Asian LNG demand” scenario in a range of 181-192 bcm. The discussion of pipeline capacities that follows focuses on the “high Asian LNG demand” scenario.

Table 3: Projections of Russian Gross and Net Pipeline Gas Imports to Europe, bcm

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
High Asian LNG demand scenario																
Gross imports to Europe	155	174	194	194	192	176	182	212	199	176	176	176	176	196	214	216
Net European Imports of Russian Gas	143	160	178	181	180	163	170	199	186	163	163	163	164	183	201	203
Gross exports to Europe (flow into pipelines, measured at Russian standard)	165	184	206	205	204	187	194	225	211	187	187	187	187	208	227	229
Low Asian LNG demand scenario																
Gross imports to Europe	155	174	194	194	182	174	176	181	177	171	176	176	176	176	176	180
Net European imports of Russian Gas	143	160	178	181	169	161	163	168	165	158	163	163	163	163	163	167
Gross exports to Europe (flow into pipelines, measured at Russian standard)	165	184	206	205	193	185	186	192	188	181	187	187	187	187	187	191

Source: Howard Rogers, OIES

Estimates of transit capacity requirements

Table 4 shows estimates, by Katja Yafimava at OIES, of the non-Ukrainian transit capacity available for Russian gas exports to Europe in 2020-25, depending on whether, and how rapidly, transit diversification projects are completed. The table shows estimates of the volumes of gas that may require transit, above and beyond the non-Ukrainian capacity available. The first row shows estimates assuming a very minimal level of exports, i.e. restricted to deliveries required by long-term contracts, at 70% of take-or-pay levels (i.e. flows into the pipelines, measured at the Russian standard, of 138 bcm in 2020, 119 bcm in 2022 and 114 bcm in 2025). This level of export could be maintained if – as is likely in 2020 – Turkish Stream 1 has been commissioned, but not any of the other transit diversification pipelines (i.e. Scenario A). Three further rows show the extent to which non-Ukrainian capacity could provide for exports (flows into the pipelines, measured at the Russian standard) of 187 bcm/year, 194 bcm/year or 225 bcm/year (i.e. the lower, middle and top end of the range of projected flows). If the Nord Stream 2 project is completed (Scenarios B and C), then volumes up to 190 bcm/year could probably be exported without recourse to Ukrainian transit; if a second string of Turkish Stream is completed (Scenario C), quite comfortably so. But even if and when Nord Stream 2 is completed, total exports of 225 bcm/year could not be accommodated on non-Ukrainian routes.

Table 4: Scenarios of non-Ukrainian transit capacity for Russian gas exports to Europe, 2020-2025

Scenario A = one string of Turkish Stream completed								
Scenario B = one string of Turkish Stream and two strings of Nord Stream II are completed								
Scenario C = two strings of Turkish Stream and two strings of Nord Stream II are completed								
Note. Estimated export volumes to Europe, including Turkey, are gross exports (i.e. including volumes that are supplied by reverse-flow to Ukraine and other destinations)								
		2020	2022			2025		
		A	A	B	C	A	B	C
Non-Ukrainian transit capacity								
To Finland		5	5	5	5	5	5	5
Via Belarus*		43.4	43.4	43.4	43.4	43.4	43.4	43.4
Blue Stream		16	16	16	16	16	16	16
Nord Stream		55	55	110	110	55	110	110
Turkish Stream		15.75	15.75	15.75	31.5	15.75	15.75	31.5
Total		135.2	135.2	190	205.9	135.2	190.2	205.9
Surplus of transit volumes over non-Ukrainian capacity (flows into the pipelines, measured at the Russian standard)								
for long-term contracts, at 70% of take or pay level		2.8	0	0	0	0	0	0
with exports of 187 bcm		51.8	51.8	0	0	51.8	0	0
with exports of 194 bcm		58.8	58.8	3.8	0	58.8	3.8	0
with exports of 225 bcm		89.8	89.8	34.9	19.1	89.8	34.9	19.1

Source: Katja Yafimava, OIES. With Katja's permission I have excerpted these scenarios from a large set of scenarios to be included by her in a forthcoming publication.

* This refers to pipeline capacity across Belarus that reaches European destinations without crossing Ukraine, i.e. the Yamal and Northern Lights pipelines.

6. Capacity utilisation at peak times⁴⁶

Simple arithmetic – adding up the pipeline capacity and comparing it to annual export volumes – is, however, not the end of the matter. The throughput is obviously greater at peak times, e.g. in the coldest parts of winter. For example, in 2017, the peak daily flows of Russian gas to Europe via Nord Stream, Belarus and Ukraine (i.e. excluding routes through Turkey) exceeded 500 million cubic metres per day (mmcm/d) in January and November (plus two days at exactly 500 mmcm/d in October); the low points (just below 380 mmcm/d) were reached in July and September. In Q1 2018, an absolute peak of Russian gas flows to Europe (502 mmcm/d) was reached on 29 March, while deliveries of 492 mmcm/d or higher were recorded on six of the last 10 days of March, as especially cold weather swept across Europe. This seasonality means that the network of pipelines carrying Russian gas to Europe is extremely unlikely to operate at full daily capacity throughout the year. Annual capacity requirements cannot be accurately calculated from annual flows.

At present there is very little spare capacity in the system on peak days, i.e. the existing infrastructure, including pipelines through Ukraine, can deliver the gas required by European customers on the specific days that it is required, but only just.⁴⁷ Throughout Q1 2018, the Nord Stream pipeline and the Yamal-Europe pipeline via Belarus operated at virtually full capacity, as did the pipeline from Ukraine to Poland at the Drozdovichi cross-border point. At Isaccea, on the Ukraine-Romania border,

⁴⁶ The text for this section was drafted by Jack Sharples, and is based on his research

⁴⁷ See also: Jack Sharples, *Ukrainian Gas Transit: still vital for Russian supplies to Europe as other routes reach full capacity* (OIES Oxford Energy Comment, May 2019)



around 90% of capacity was used in January and February, with volumes dropping off in early March and then rising again at the end of the month. At Wysokoje on the Belarus-Poland border, there was significant spare capacity until late February, after which point the pipeline was operating at around 90% capacity. Conversely, at Beregovo on the Ukraine-Hungary border, pipeline utilisation varied from 40-60% until late March, when it dropped to around 25%.

Three points are worth noting. First, Gazprom treats Nord Stream and the Yamal-Europe line – of which it is the majority owner and single owner respectively – as primary (baseload) capacity. It has an interest in maximising their utilisation. This is seen clearly in Q1 2018, with their stable delivery volumes. Second, the cross-border pipelines at Drozdovichi (Ukraine-Poland) and Wysokoje (Belarus-Poland) are small, and used only for the delivery of gas to Poland and not onwards to markets further west. Therefore, these pipelines are less significant in analysing the system's ability to deliver gas to Europe to meet peak winter demand. Third, the pipelines from Ukraine to Hungary and Romania (via interconnection points at Beregovo and Isaccea respectively) also do not contribute to Russian gas supplies to the main European market. Gas delivered via Ukraine to Hungary is delivered onward only to Serbia and Croatia, two small markets. Gas delivered via Ukraine to Romania goes onward to Bulgaria, Greece, and Macedonia, and the much larger Turkish market. The lack of connections between Romania and central Europe means that spare capacity at Isaccea can not be used to meet additional gas demand there – although this is changing (see section 4 above).

Therefore, with Nord Stream and Yamal-Europe operating at full capacity, Drozdovichi and Wysokoje restricted to small volumes, and Beregovo and Isaccea serving a small group of states that are not connected to the broader European market, it is clear that flows from Ukraine to Slovakia via the Uzhgorod/Velke Kapusany interconnection point are the crucial “flex point” for Russian gas supplies to Europe. In Q1 2018, the share of capacity being utilised at Velke Kapusany rose from around 25% in late January to around 80% in late March, as the cold weather stimulated European gas demand. Absolute flows rose from 48 mmcm/d on 23 January to 147 mmcm/d on 25 March. On the peak day of 29 March 2018, the 40 mmcm/d of spare capacity at Velke Kapusany was complemented by 30 mmcm/d at Beregovo, 5 mmcm/d at Isaccea, and 2 mmcm/d at Drozdovichi and Wysokoje combined. Given that gas flows to Beregovo cannot be further directed to the major European gas markets, the spare capacity at Velke Kapusany is the only “headroom” between the peak European imports of Russian gas experienced in Q1 2018, and the maximum capacity of the pipeline network for bringing that gas to the main European market.

The first line of Turkish Stream will enable direct Russian gas deliveries to Turkey, thus displacing volumes delivered via Romania along the Trans-Balkan line. However, the fact that Romania does not have substantial connections with Hungary means that any spare capacity at Isaccea and the Trans-Balkan pipeline is essentially irrelevant for any discussion of Russian gas deliveries to the larger European markets (Germany, France, Italy, and the Netherlands).

The planned 55 bcm/year capacity of Nord Stream 2 equates to 150 mmcm/d. If European demand for Russian gas exports did not rise from the 2017 level in the coming years, then Nord Stream 2, and the planned EUGAL pipeline would be *just about* sufficient to replace gas transit via Ukraine at times of peak daily demand. However, the expectation of higher daily European imports of Russian gas in the coming years suggests that Ukrainian transit will still be needed.

Conclusion. From 1 January 2020, Nord Stream 2 will not be operational at full capacity, and Ukraine will remain crucial for transportation of Russian gas to Europe, especially at times of peak European demand, and especially via Velke Kapusany. If Nord Stream 2 is commissioned at some point before 2025, demand for e.g. 174 bcm/year of Russian gas in Europe (i.e. a requirement for 187 bcm/year of export volumes (flows into the pipelines, measured at the Russian standard)) could probably be transported entirely on non-Ukrainian routes. However, retaining the option of transit via Ukraine would be commercially logical for Gazprom – and the fact that it has its ship-or-pay obligations to use the Slovakian pipelines that are a continuation of the Ukrainian route, which continue to the late 2020s, underlines this point. Russian gas pipeline imports to Europe of 174-212 bcm/year equate to 187-225 bcm/year of export volumes, measured at the Russian standard. If flows are at the higher

end of this range, as they could be – depending mainly on the availability of LNG to meet European gas demand – then Ukrainian transit capacity would be required in any case.

7. Management of the Ukrainian pipeline system and market reform

Whatever role Ukrainian transit plays after 2020, considerable investment will be required in the transportation network. If Nord Stream 2 is completed and the volume of transit through Ukraine is minimised (the most likely scenario, as argued above), it seems inevitable that some of the system will be decommissioned. The parts of the system that remain in use – certainly the Urengoy-Pomary-Uzhgorod pipeline, and some others – will need to be upgraded. It seems unlikely that any comprehensive plan for the system will be adopted before the future of post-2020 transit becomes clearer. In addition, Ukraine's gas transportation system is being unbundled from Naftogaz Ukrainy as part of the gas market reforms, with ownership currently due to be transferred on 1 January 2020. Until that change is made, it is unlikely that investment finance will be arranged on a large scale.

Map 3: The Ukrainian pipeline system



Source: OIES

Transport infrastructure investment requirements

There is no comprehensive information on the physical state of the Ukrainian transport network in the public domain. Like the post-Soviet pipeline system as a whole, it is old: of the 33,200 km of transmission pipelines, 19,998 km are more than 33 years old; 12,752 are 11-33 years old; and 509 km are 10 years old or less. More than four-fifths of the compressor stations are more than 25 years old, and their average efficiency is less than 29%.⁴⁸ The system suffered from years of underinvestment in maintenance and upgrades, during the 1990s and 2000s, but its current condition is unclear. In particular, there is no way of comparing the condition of the Ukrainian part of the system

⁴⁸ Ukrtransgaz, *Plan rozvitku gazotransportnoi systemy PAT Ukrtransgaz na 2018-2027 roki* (Kyiv, 2017), pp. 27-29



to the Russian part, which also suffered from underinvestment, but not to the same degree.⁴⁹ The European Commission funded a survey of the network by Mott MacDonald, completed in 2011, but, despite the obvious political importance of the issue, this has not been made public.⁵⁰ Naftogaz Ukraine's annual reports for 2014-17 have made the company generally far more transparent, but say nothing about the state of the pipelines.

While Naftogaz Ukraine has publicly advocated the cancellation of Nord Stream 2, its investment strategy for the pipeline system recognises, de facto, that both Nord Stream 2 and Turkish Stream are likely to go ahead. A Master Plan published in conjunction with the Energy Charter secretariat envisaged modernisation and reconstruction of three pipelines in the western transit corridor (Soyuz, Urengoy-Pomary-Uzhgorod (UPU) and Progress) and two in the southern transit corridor (Elets-Kremenchuk-Kryvyi Rig and Ananiev-Tyraspol-Izmail).⁵¹ But since 2014, management decisions have taken account of the possible impact of transit diversification. In late 2016, purchase of equipment for the reconstruction of the Ananiev, Zhdaniv and Pivdenobuzka compressor stations on the southern pipeline system taking gas to Romania and Turkey was cancelled, "because of the risks posed by the implementation of the Turkish Stream project", which may replace transit along this pipeline.⁵² A new strategy document, published in 2018 and covering the decade to 2027, is focused on the expansion of interconnections on the western border of Ukraine used for "reverse flow" deliveries from European countries, including the reversal of the Trans Balkan Pipeline.⁵³ On the western transit corridor, reconstruction work is going ahead on the UPU pipeline, supported by a small loan (€150 million) from the EBRD, approved in 2014.⁵⁴

The outlines of a future strategy for the transportation system are becoming clear. The UPU pipeline, and the adjacent Progress pipeline, may be upgraded. The future of other pipelines in the western corridor (Soyuz and Brotherhood) would depend on future volumes of transit; if and when Nord Stream 2 goes ahead, they may be decommissioned. In the southern corridor, preparations are in hand for reversal of flows in the Trans Balkan Pipeline and the southern Ukrainian corridor that is linked to it.

Transportation assets unbundling

The unbundling of Ukraine's gas transportation assets from Naftogaz Ukraine is provided for in the gas market law of 2015. The government decided to postpone implementation of unbundling until the completion of the arbitration proceedings with Gazprom.⁵⁵ There was further delay due to disputes between Naftogaz Ukraine management and government: the former proposed to establish a new holding company for transportation assets, and a separate one for storage assets, of which it would retain ownership until 2020; the latter sought to move the assets to a new vehicle immediately after arbitration was completed. The European Commission, World Bank and European Energy Community, who have prioritised the unbundling in their dealings with Ukraine, preferred the

⁴⁹ For information on the whole post-Soviet system, see: Tatiana Mitrova, Simon Pirani and Jonathan Stern, "Russia, the CIS and Europe: gas trade and transit", in Pirani (ed.), *Russian and CIS Gas Markets and Their Impact on Europe*, pp. 395-441, especially pp. 414-417, and Pirani, *Elusive Potential: Natural Gas Consumption in the CIS and the Quest for Efficiency* (OIES, 2011), pp. 86-90

⁵⁰ Some details from Mott MacDonald's survey have been reported in: KPMG, *Situation of the Ukrainian natural gas market and transit system: market study* (April 2017), pp. 32-35. See < <https://www.nord-stream2.com/media/documents/pdf/en/2017/04/kpmg-situation-of-the-ukrainian-natural-gas-market-and-transit-system-2017-04-10.pdf>>. This report, commissioned and published by Nord Stream 2, a competitor, can not be taken as objective, but readers can judge the material reproduced from Mott MacDonald's work themselves.

⁵¹ *Master Plan: Ukrainian Gas Transmission System (UGTS) Priority Objects Modernisation and Reconstruction* (Ukrtransgaz presentation)

⁵² Naftogaz Ukraine, *Annual Report 2016*, p. 133

⁵³ Ukrtransgaz, *Plan rozvitku gazotransportnoi systemy PAT Ukrtransgaz na 2018-2027 roki*, pp. 33-48

⁵⁴ EBRD press release, 15 December 2014, "EBRD finances key gas pipeline in Ukraine", <<https://www.ebrd.com/news/2014/ebfd-finances-key-gas-pipeline-in-ukraine.html>>

⁵⁵ See government decree no. 496 of 2016, <http://www.naftogaz.com/files/official_documents/CMU-unbundling-resolution-No496-ukr-eng.pdf>



approach that has retained temporary control of the new companies by Naftogaz. At the Berlin talks in July, commissioner Sefcovic said the EC “envisages a two-stage process, under which the future TSO [transmission system operator] is established within the Naftogaz framework in order to prepare the full assumption of its role”;⁵⁶ the EC, World Bank and Energy Community then jointly wrote to the government, advocating a transport system operator be established within Naftogaz and then separated out. The government’s separate vehicle was then effectively abandoned.⁵⁷

Naftogaz Ukrainy management has drawn up a strategy that envisages the new TSO being unbundled on 1 January 2020.⁵⁸ However management has also enumerated conditions that need to be fulfilled for unbundling to be effective and for the TSO to be truly independent, i.e.: (i) control over the TSO should be removed from the Cabinet of Ministers; (ii) a legal framework is needed “that would bring the TSO’s rights to the gas transmission infrastructure as close as possible to ownership rights (including the right to pledge property)”; (iii) “secondary legislation, including network codes (primarily GTS Code of Ukraine, which sets the rules of the market), must comply with EU standard network codes and hence with TEP”; (iv) the issue of the “unviable business model” of heat suppliers and distribution companies, “which use legal loopholes to shift their risks and losses to the TSO” must be solved; (v) the storage business must be optimised, and 4.7 bcm of cushion gas that belongs to Naftogaz purchased from it; and (vi) reform of the energy regulator should be completed.⁵⁹

It is clear from discussions on the market reform that the most difficult condition to fulfil will be (iv), reform of gas and heat provision, which will involve abolition of cross-subsidies and corrupt schemes in those markets. The heat suppliers and distribution companies are deeply indebted not only to the TSO, but also to Naftogaz Ukrainy and to the government, in addition to being a prime site of corrupt misappropriation of gas. The World Bank’s estimate of the economic cost to the Ukrainian state is \$1.7 billion/year; the Energy Community secretariat’s is in the same range.⁶⁰

While management reform of the transportation and storage divisions of Naftogaz Ukrainy is proceeding, and the assets are being unbundled organisationally, it seems at least possible that this process will not be completed by 1 January 2020. But this should have little direct impact on the negotiation of new transit arrangements, which will be conducted by Naftogaz, who will in turn be able to buy in the transportation services from the TSO, regardless of its ownership.

8. Conclusions

Neither Nord Stream 2 nor Turkish Stream will be operational at full capacity by the end of 2019, and therefore Gazprom and its European counterparties will need transit capacity through Ukraine for some period from 1 January 2020, probably in the range of 52-90 bcm/year. If and when these two transit diversification projects are complete, some Ukrainian transit may still be needed, depending on the overall demand for Russian imports to Europe. Research at OIES estimates overall demand for Russian gas in Europe will be in the range 176-212 bcm/year (assuming high Asian LNG demand), or 171-181 bcm/year (assuming low Asian LNG demand). This implies gross exports from Russia (flows into the pipelines, measured at the Russian standard) of 187-225 bcm (assuming high Asian LNG demand) or 181-192 bcm/year (assuming low Asian LNG demand). This suggests that demand for quite a high level of Ukrainian transit capacity is likely.

Any contractual agreement on transit will probably be relatively short term. Tariffs will be set under the entry-exit methodology adopted under Ukrainian legislation, and both the Ukrainian government and

⁵⁶ “EU and Ukraine in tug of war over Naftogaz unbundling”, Euractiv, 17 July 2018

⁵⁷ “EK, VB i Energeticheskoe soobshchestvo trebuets uskorit’ razdelenie Naftogaza”, *Ekonomicheskaya Pravda*, 12 July 2018; “Groisman proigral Kobolevu voynu za upravlenie GTS”, *Ukrainska Pravda*, 19 July 2018

⁵⁸ Naftogaz Ukrainy presentation, *Presentation of the Gas TSO Unbundling Roadmap 2018-2020* (19 September 2018)

⁵⁹ Naftogaz Ukrainy, *Annual Report 2017*, p. 49

⁶⁰ Presentation by Dejan Ostojic, World Bank, at REKK conference, Budapest, 30 May 2018; Chatham House Ukraine Forum event, “Ukraine’s Energy Sector Reforms”, 23 May 2018; Naftogaz Ukrainy, *Annual Report 2017*, pp. 30 and 51-54

the European Commission will press for the agreement to be compliant with the EU third energy package. Naftogaz Ukraine appears to be ready to offer a tariff competitive with alternative routes.

There is a possibility that no deal will be signed, due less to commercial factors than to political ones and the generally poor relations between Russia and Ukraine, and between Russia and the European governments. This could lead to a supply interruption from 1 January 2020, the effect of which would not be as severe as the interruption of January 2009, but would still have potentially serious consequences in south eastern Europe. A supply interruption of more than a few days might also affect Italy. Another consequence of such an outcome would be that Gazprom might have to declare force majeure on some of its supply contracts, raising the issue of shifting delivery points – including to the eastern border of Ukraine – which it has in the past been reluctant to do. This prospect may be an additional impetus for completing a deal. Moreover, such a crisis could seriously undermine the gas industry's efforts to position itself as a central part of Europe's energy supply future.

During 2019, a number of turning-points may serve as indications as to the progress of the talks, and the likelihood of an agreement being reached. The most important of these is the expiry of the European Commission's term of office on 31 October 2019: if no agreement has been reached by then, the risk of no agreement being reached at all will rise significantly. Other turning points include:

- (i) the Ukrainian presidential elections in March 2019, and the Ukrainian parliamentary elections in October 2019, the run-up to both of which may influence the Ukrainian government's attitude to the negotiations;
- (ii) the decision of the European Court of Justice on the Polish appeal against the European Commission's ruling on the use of OPAL pipeline, which is expected in May 2019. It is likely that the court will uphold the Commission's ruling, but if it does not, dependence on Ukrainian transit in the winter of 2019-20, and probably that of 2020-21, will increase; and
- (iii) Numerous legal decisions, both in the Swedish courts in respect of outstanding arbitration claims and appeals, and in other jurisdictions where Naftogaz has applied for arrest of Gazprom assets on the basis of the March 2018 arbitration decision. These could further complicate negotiation of a future deal.

In the period 2020-25 as a whole, demand for Ukrainian transit capacity will fall steeply if and when the transit diversification pipelines are completed, which is the most likely course of events. However, under scenarios in which total gross imports of Russian gas to Europe exceed about 190 bcm/year, some Ukrainian transit capacity would certainly be necessary – but, bearing in mind the limitations to the system at peak times, Ukrainian transit may still be needed at lower levels of total gross imports than that.

Only once the character and scope of demand for Ukrainian transit capacity post-2020 becomes clearer will a long-term strategy for the pipeline infrastructure take shape. It is most likely that the system will be substantially scaled down and parts of it decommissioned. Investment funds are likely to be available for this only when the planned unbundling makes progress.

Appendix. Gas volume measurements and Russia-Europe conversions⁶¹

Natural gas is measured by volume. For large volumes, the common unit is billions of cubic metres (bcm). In this paper, volumes are expressed according to the IEA's standard, unless otherwise stated. The IEA standard assumes that the gas has a calorific value of 40 MJ/m³, and is measured at a temperature of 15 degrees Centigrade, or on the absolute temperature scale, 288 degrees Kelvin.

The Russian standard (based on the former Soviet measuring system, which is used in many former Soviet countries) assumes that the gas has a calorific value of 37.0284 MJ/m³, and is measured at 20 degrees Centigrade, or 293 degrees Kelvin.

Converting from one to the other in terms of energy content and absolute temperature base requires both factors to be taken into account.

A volume of gas, e.g. a cubic metre, measured at the Russian standard, i.e. at 20 degrees Centigrade (293 degrees Kelvin – absolute temperature) must first be normalised to the temperature at which European (IEA) natural gas is measured.

The first step in converting to the European basis is to adjust for the temperature basis, i.e. to 15 degrees Centigrade (288 degrees Kelvin). Thus, the Russian gas quantity we show above is contracted in terms of volume (as this is directly proportional to absolute temperature, degrees Kelvin) – but with the same number of gas molecules – i.e. the same heat potential when burned.

So, if the calorific value of gas measured at the Russian standard is 37.0284 MJ/m³ at 20 degrees C (293 degrees Kelvin) the equivalent at 15 degrees (288 degrees Kelvin) is 37.67125/m³ (i.e. 37.0284* 293/288).

For the same gas volume, the European (IEA) standard is 40MJ/m³, volume being measured at 15 degrees centigrade (288 degrees Kelvin).

Thus, a cubic metre of gas, measured at the Russian standard, having a calorific value of 37.0284 MJ/ m³ measured at 20 degrees C (293 degrees Kelvin), is equal to 0.941781 m³ of natural gas at the European (IEA) standard of 40 MJ/ m³ (i.e. 37.67125/40). Conversely, to convert from 'European (IEA)' gas at 40MJ/ m³ at 15 degrees C to Russian gas at 37.0284 MJ/m³ at 20 degrees C, multiply by 1.061818.

The conversion of measurement of pipeline capacity is slightly more complicated.

The pressure drop through a pipeline (the capacity determining factor) is as follows:

The pressure drop through a pipeline = $mlv^2r/(2d)$, where: m=the coefficient of friction, l= the length of the pipeline, v the velocity of the gas, r the density of the gas and d the diameter of the pipeline.

For the same values of m, l, v (equivalent velocities equalling the same volumetric flow per unit of time) and d; the equation reduces to:

$$\text{Vol (Europe)/Vol (Russian)} = \text{Square Root}((\text{Density Russian gas basis})/(\text{Density Europe Gas basis})).$$

Assuming that the density of natural gas is inversely proportionate to its absolute temperature (Universal Gas Law); then:

For the same pipeline system pressure drop (i.e. pipeline capacity in volumetric terms) the ratio of pipeline capacity in relative European and Russian bases:

$$\text{Vol (Europe)/Vol (Russian)} = \text{Square Root}((273+15)/(273+20)) = 0.9914.$$

In practical terms, therefore, the capacity of pipelines receiving gas from Russia is unrelated to the calorific value or temperature of Russian gas in this range. However, flows of Russian gas at full

⁶¹ The Appendix was drafted by Howard Rogers and is included with his permission.



pipeline or border capacity, when converted to the IEA basis, will equal a lower volume of gas on a calorific and temperature basis available to be consumed within the European market.

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