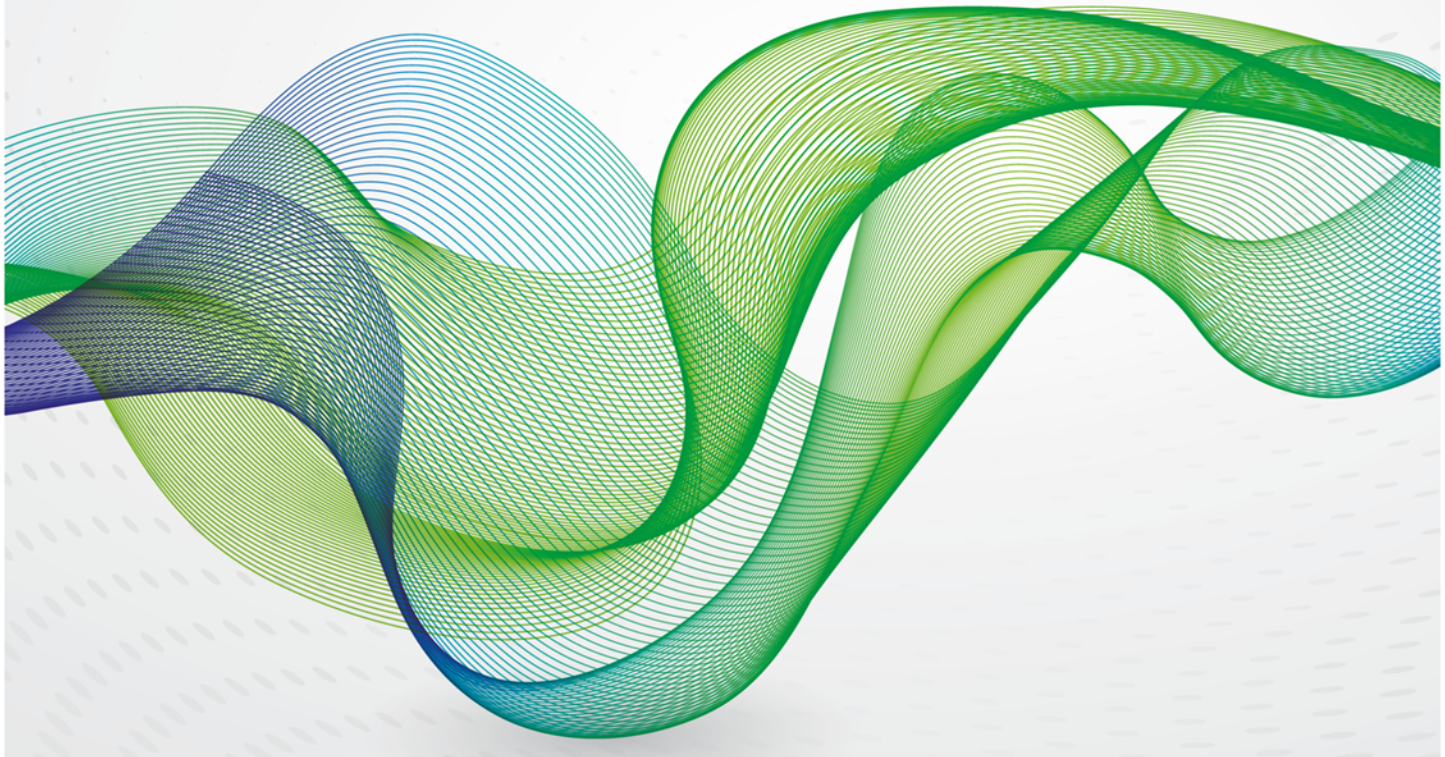
THE OXFORD INSTITUTE FOR ENERGY STUDIES

September 2020

Russian Gas: the year of living dangerously

Key Takeaways for 2020 and Beyond



Oxford Energy Comment

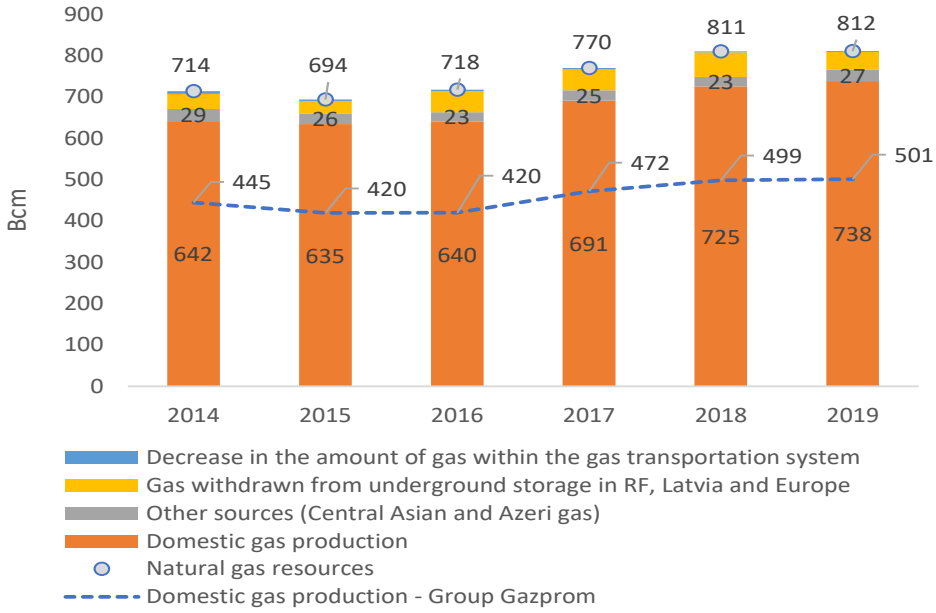
Vitaly Yermakov, Senior Research Fellow OIES

2020 has been a tough year for Russian gas. The world is struggling with the consequences of COVID-19, but the headwinds for the industry are not limited to the pandemic. Structural crises in oil and gas markets stemming from accumulated distortions on the supply side have coupled with the existential threat to hydrocarbons on the demand side as radical narratives of energy transition to a carbon-neutral world are gaining momentum. Intense geopolitical rivalries among the great powers are spilling into energy relations in the form of sanctions and trade wars. The combination of multiple crises has created a 'perfect storm', the most serious economic challenge to mankind since the Great Depression of the last century. This paper reviews the impact of the crisis on exports of Russian pipeline gas to Europe in 2020 and assesses the economics of these supplies under the wide price range that we have seen occurring in the past months. In essence, it reveals a 'live experiment', testing the pain threshold levels of both Gazprom and other suppliers of gas to Europe.

The calm before the storm: Russia's gas balance and position in Europe in 2019

Russia's pre-crisis gas situation looked solid. Production was increasing reflecting a higher call on gas abroad and at home.[1] Gazprom's output bounced back as new gas from Yamal (Bovanenkovo) reached its planned levels. (See Figure 1)

Figure 1: Russia's gas balance: supply sources



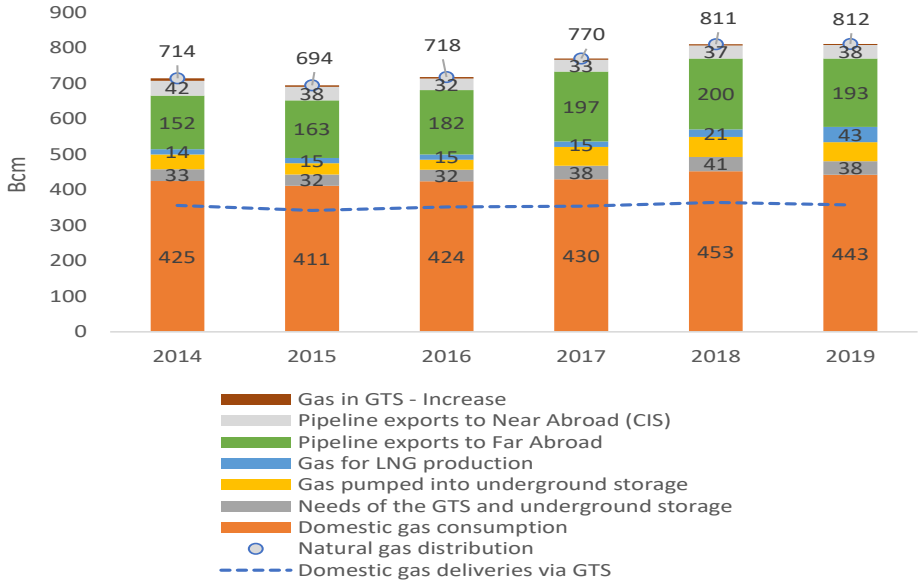
Source: OIES, data from Gazprom

On the distribution side, gross domestic gas consumption and gas deliveries to final consumers in 2019 via the unified Gas Transportation System (GTS) were lower than in 2018 but remained at historically high levels of 443 Bcm and 358 Bcm correspondingly. Technical gas used by the GTS compressor stations to move volumes through the extended pipeline and gas storage network amounted to 38 Bcm. Gas volumes delivered to the liquefaction plants went up sharply to 43 Bcm (up 106 per cent year-on-year) after Yamal LNG ramped up to its full capacity and even exceeded it. The statistics form for Russia's gas balance does not contain a separate line for exports of LNG, but most of the gas sent to liquefaction facilities was exported – 39.4 Bcm (29 million tons), up 76 per cent year-on-year.[2] Exports

[1] The volumes of gas in this report are based on the Russian standards.
[2] The difference between reported amounts of gas sent for liquefaction and reported LNG exports is apparently due to technological losses and own use.

of pipeline gas to the so-called 'Far Abroad' amounted to 193 Bcm, while exports to CIS countries rose to 38 Bcm. (See Figure 2)

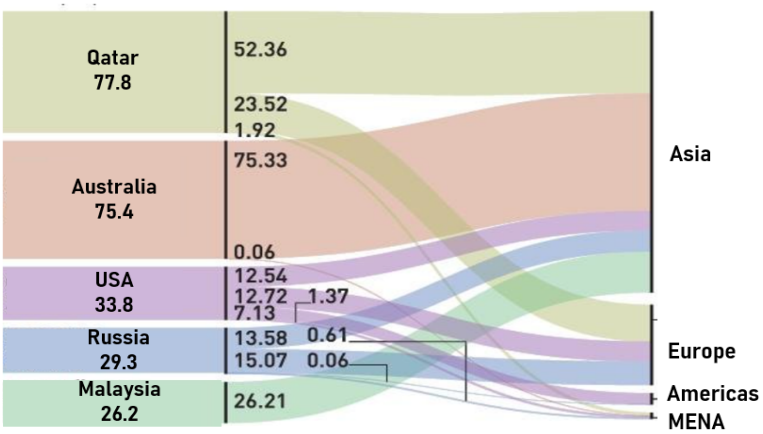
Figure 2: Russia's gas balance: distribution



Source: OIES, data from Gazprom

According to GIIGNL, Russian LNG exports were relatively equally distributed between Europe (15 million tons) and Asia (13.6 million tons) in 2019. (See Figure 3)

Figure 3. Top 5 Global LNG Exporters in 2019 (flows of LNG in million ton)



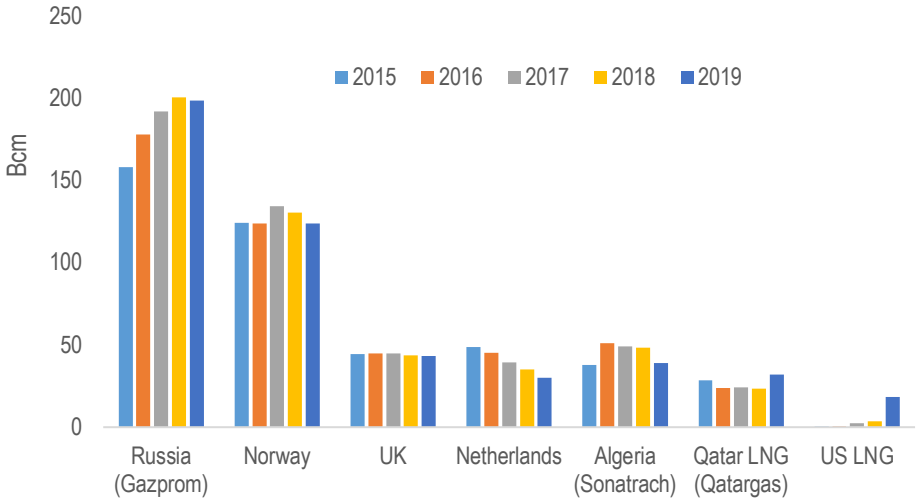
Source: GIIGNL Annual Report, 2020

In the race for a share of the European LNG market in 2019, Qatar was well ahead with 23.5 million tons, while Russia (15.1 million tons) and the US (12.7 million tons) ended the year practically neck and neck.

Russia' overall competitive position in the European gas market strengthened during 2015-2019 on the back of rising demand and falling indigenous production in the Netherlands.[3] (See Figure 4)

[3] The data presented in Figures 4 and 5 was reported by Gazprom in its 2019 Annual Report. Its sources include national statistics offices of various countries, Eurostat, and industry consultants. Gazprom converted the data to Russian standards (calorific value of 8,850 kcal/cu m at 20°C).

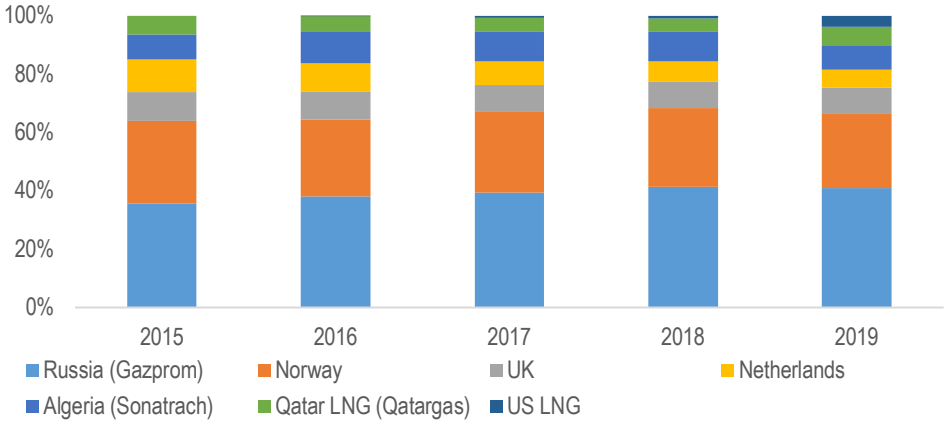
Figure 4: Main suppliers of natural gas to Europe



Source: OIES, data from Gazprom

Russia's pipeline gas share of the European gas market peaked at 36.6 per cent in 2018 and remained robust at 35.5 per cent in 2019. (See Figure 5)

Figure 5. Market shares for main natural gas suppliers in the European market



Source: OIES, data from Gazprom

Additionally, Russian LNG projects delivered 20.5 Bcm of LNG to Europe in 2019.[4] Including LNG from Russia, the share of European consumption supplied by Russian gas reached an all-time high of 39 per cent in 2019.

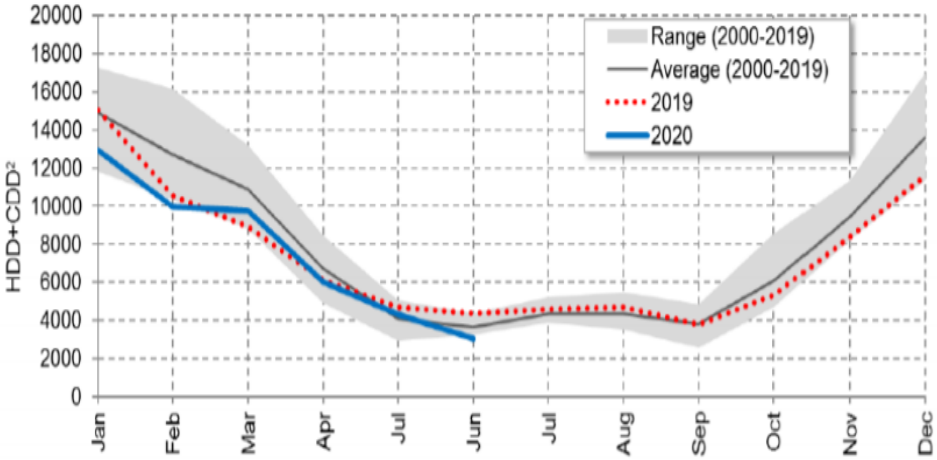
Exports of Russian pipeline gas in 2020: Gazprom loses market share in H1, hopes for recovery in H2

The winter of 2019/2020 was one of the warmest on record, reducing the need for gas used for heating in buildings as well as heating-related electricity consumption. The weather index for Europe calculated

[4] This included 12.8 Bcm (9.4 million tons) of Russian LNG delivered to Norway for re-loading.

as the sum of heating and cooling degree days registered the temperature conditions in the first half of 2020 at the bottom of the range of measurements collated over the past twenty years. (See Figure 6)

Figure 6: Weather index for Europe (sum of heating and cooling degree days)



Source: Gazprom

The triple whammy of a warm and windy winter, record European storage levels, and readily available LNG at exceptionally low prices reduced Europe's call on Russian pipeline gas in 2020. Gazprom's latest guidance suggests that Russian pipeline gas exports to 'Far Abroad' will be around 167 Bcm this year compared with around 200 Bcm in 2018 and 2019 (down 33 Bcm, or 16.4 per cent year-on-year).[5] As a result, Gazprom would account for almost all of the expected annual decline in European gas consumption this year (see below).

The gas glut in Europe emerged even before the full extent of the COVID-19 threat became obvious. The global gas market had been oversupplied for some time due to the emergence of new LNG supply during 2018-2019 from projects which took investment decisions in the mid-2010s. These supply additions have entered the market at a time when global demand failed to meet growth expectations.[6] As the COVID-19 lockdowns unfolded in March-April, the already existing overabundance of gas was exacerbated. This resulted in record levels of European gas storage by the beginning of spring 2020 and downward pressure on European hub prices. It is noteworthy that gas in storage by the start of heating season of 2019/20 was already at high levels. At the end of December 2019, an end-of-year record of 91.5 Bcm – 20 Bcm higher than at the end of 2018 – was registered.[7] This can be partially explained by the fact that fears of "no deal" over transit with Ukraine at the end of 2019 had incentivized Europeans to purchase Russian gas over and above 'normal' levels and put it in storage; the flip side of this was reduced deliveries at the beginning of 2020 when the transit deal with Ukraine removed the supply risks.[8]

Following a mild winter, Europe ended Q1 2020 with record storage stocks for that time of year (56.0 Bcm). That was significantly higher than both storage stocks at the end of Q1 2019 (41.6 Bcm) and the

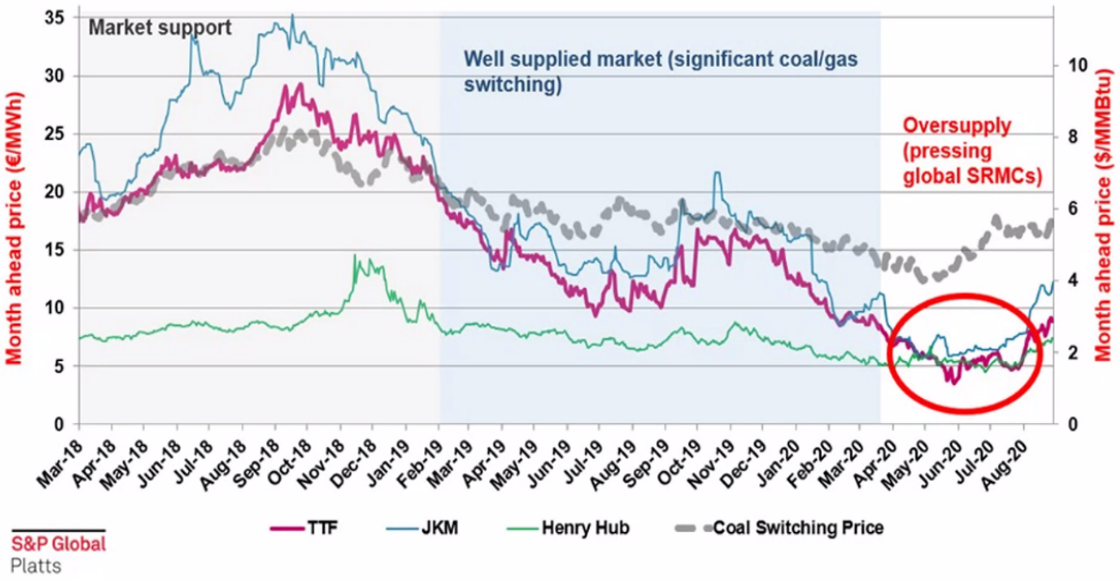
[5] https://www.rbc.ru/business/29/04/2020/5ea99db99a7947568919a8b0
[6] OIES Quarterly Gas Review, May 2020
https://www.oxfordenergy.org/wpcms/wp-content/uploads/2020/05/Quarterly-Gas-Review-Issue-9.pdf
[7] Op.cit, p.16
[8] See Pirani S., Sharples J., Yafimava K., Yermakov V. *Implications of the Russia-Ukraine gas transit deal for alternative pipeline routes and the Ukrainian and European markets.* OIES Insight, March 2020
https://www.oxfordenergy.org/publications/implications-of-the-russia-ukraine-gas-transit-deal-for-alternative-pipeline-routes-and-the-ukrainian-and-european-markets/

average for the end of Q1 in the period 2015-2020 (33.8 Bcm).[9] This caused concern that European storage levels might reach full capacity over the summer of 2020, well ahead of the start of the withdrawal season. In June, however, the pace of storage injections slowed. Nonetheless, as of July 1 2020, the amount held in storage (83.3 Bcm) was 12 per cent higher than the amount held in storage on the same date in 2019 (74.7 Bcm). For gas storage across Europe as a whole, stocks were at 80.5 per cent of capacity at the end of Q2.[10]

Since March, when the COVID-19 restrictions hit Europe, gas demand has experienced a major shock. Current estimates by OIES suggest that in the first five months of 2020, natural gas demand in Europe declined by about 8 per cent or 19 Bcm year on year due to the successive impacts of mild temperatures, high renewables usage in power generation and the consequences of COVID-19. Despite this sharp fall, it was still above levels seen in 2014 and 2015 when gas demand was at its lowest for over two decades due to limited gas use in heating and power generation.[11] For the year as a whole, OIES expects that Europe's gas demand will decline by about 7 percent, or by approximately 35 Bcm year-on-year.[12]

Meanwhile, gas prices at the European gas hubs crashed through the $3/MMBtu level in April and went below the $2/MMBtu level in May. Similarly, spot gas prices in Asia went into a deep dive in spring and by June prices at all key benchmarks – Henry Hub, TTF and Asia spot – had converged at sub-$2/MMBtu levels. The differential between TTF and Henry Hub became negative in summer, closing the transatlantic arbitrage for US LNG (See Figure 7). Spot prices in Asia bounced back in August on the back of robust growth of gas demand in China and India where the demand growth trajectory is now above 2019 levels. In absolute terms, however, JKM is still less than $4/MMBtu.

Figure 7: Gas prices for main traded market benchmarks



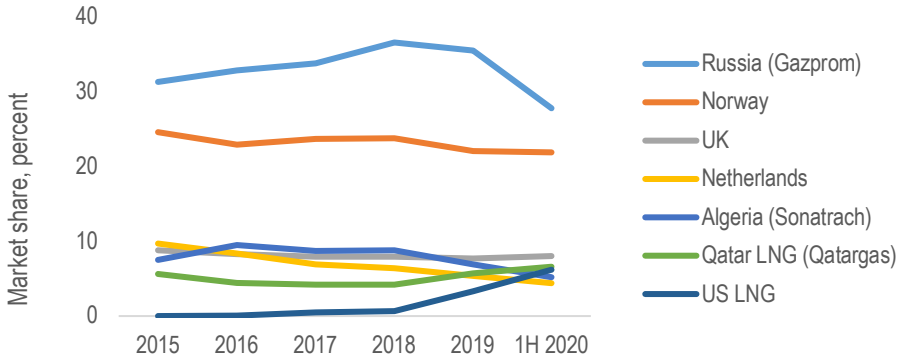
Source: S&P Global

[9] OIES Quarterly Gas Review, July 2020, p.8
https://www.oxfordenergy.org/wpcms/wp-content/uploads/2020/07/Quarterly-Gas-Review-Issue-10.pdf
[10] Op.cit. p.9
[11] Honore A. *Natural Demand in Europe: The Impacts of COVID-19 and Other Influences in 2020*. Oxford Energy Comment, June 2020, p.2
https://www.oxfordenergy.org/wpcms/wp-content/uploads/2020/06/Natural-gas-demand-in-Europe-the-impacts-of-COVID-19-and-other-influences-in-2020.pdf
[12] Op.cit, pp.11-12

In the European gas market, however, the TTF versus Henry Hub forward curves are indicating that the differential could remain at levels which would make exports of US LNG to Europe loss-making, even with regards to the cash costs of the exporters, for the remainder of the year. Overall, the gas glut has been pressuring suppliers who have been struggling to cover their short-run marginal costs (SRMC) and taking heavy losses with regards to total costs. These price pressures are expected to remain at least until early 2021.[13]

In these circumstances Russian gas exports to Europe emerged as a key balancing factor, with Gazprom's market share dwindling to 27.8 per cent in 1H 2020. (See Figure 8)

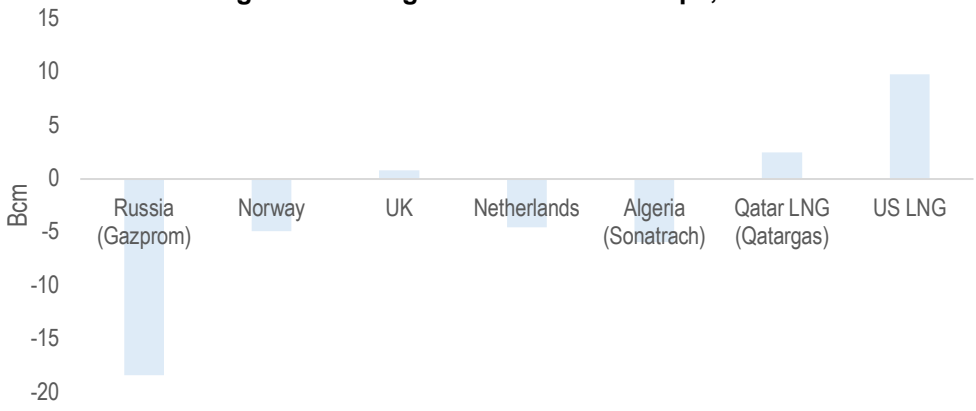
Figure 8: Market shares of main natural gas suppliers to Europe



Source: OIES, data from Gazprom

This is a striking result which calls for an explanation. First, it is noteworthy that all suppliers of pipeline natural gas to Europe (with the exception of the UK) reduced their deliveries in 1H 2020. Gazprom experienced the largest swing (minus 18.4 Bcm) and has become the main source of accommodation for the growing supplies of LNG that have entered Europe as a market of last resort. European hubs have been an important clearing mechanism for the LNG market and have been influencing LNG spot prices. Exporters of LNG from Qatar and the US gained market share in Europe in the first half of the year: US LNG saw the biggest advances with the incremental increase in deliveries amounting to 9.8 Bcm. (See Figure 9)

Figure 9: Incremental change in natural gas deliveries to Europe, 1H 2020 over 1H 2019

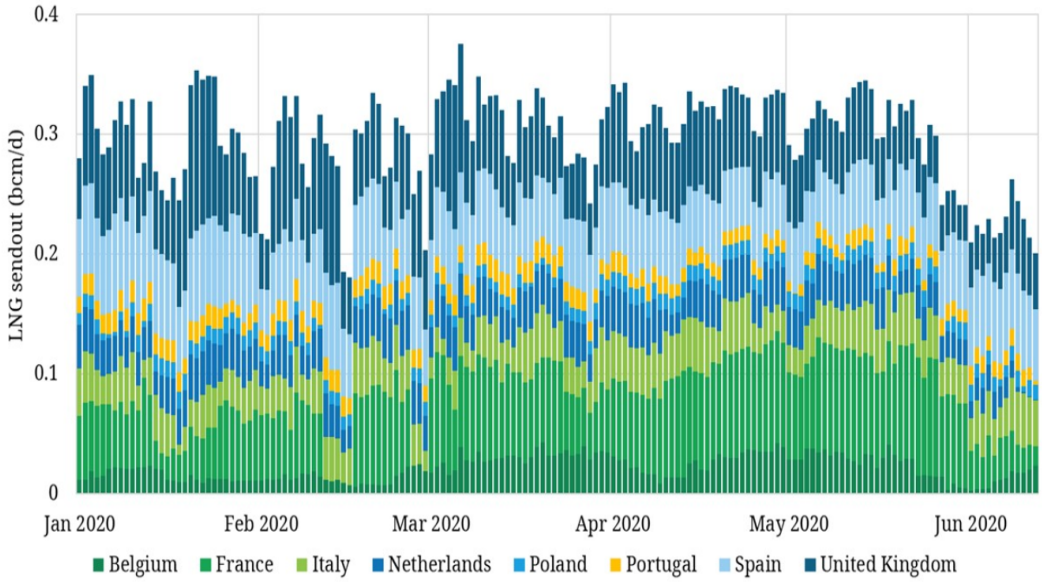


Source: OIES, data from Gazprom

[13] Fulwood, M., Sharples, J. *$2 Gas in Europe (Part III): Down, Down, Deeper and Down*. Oxford Energy Comment, June 2020 https://www.oxfordenergy.org/publications/2-gas-in-europe-part-iii-down-down-deeper-and-down/

This was, however, a Pyrrhic victory for US LNG, driven by the desperate need to deal with the rising tide of new projects coming onstream amid the greatest gas demand shock. Deliveries to Europe could not make money for US LNG exporters but could only minimize the mounting losses of the US LNG tolling business model. A clear price signal from Europe to US LNG producers to reduce deliveries came when the TTF price dropped below Henry Hub in late spring 2020. As a result, the picture for the first half of 2020 is somewhat misleading as it exaggerates a situation that was relatively short-term and unsustainable under lower prices. As a harbinger of things to come in 2H 2020, deliveries of LNG to European regasification terminals in June declined sharply owing to shut-ins at US LNG facilities and a return of LNG demand in Asia. (See Figure 10)

Figure 10: Send-out volumes for European regasification terminals



Source: Timera Energy

Still, the question remains: why has Gazprom given up so easily? The answer is complex, but the key explanation is simple: Gazprom no longer has market power in Europe.

Russia is one of the lowest cost suppliers, but even for Gazprom the sub-$2 gas price in Europe does not cover short-run marginal costs (as demonstrated in the next section of this report). Additionally, for the bulk of its European gas exports, Gazprom has to meet nominations from its European buyers and is effectively demand-constrained. This stems from one of the key characteristics of Gazprom's long-term contracts: the embedded flexibility in take-or-pay clauses provided by the wide delta between minimum contracted volumes that buyers may nominate and maximum contracted volumes that Gazprom has to supply should buyers make the nominations. Furthermore, if buyers do not take the minimum contracted volumes in any given year, they can pay and take the volumes over the next several years (the so-called 'make-up' gas).

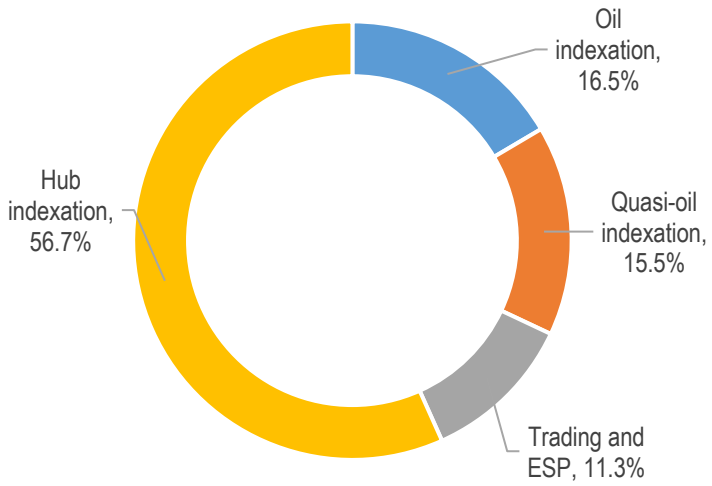
Another reason why Russia's gas exports to Europe might have been affected disproportionately in the first six-nine months of the year compared to other major suppliers, such as Norway and Algeria, could concern contract portfolio optimization/arbitrage. Russian gas export contracts are set on a calendar year basis, whereas Norwegian and Algerian contracts refer to the 'gas year' (October to September). At the end of September, midstream offtakers with a varied supply portfolio prefer to fulfill their minimum offtake requirements under long-term contracts set on a gas year basis, postponing offtake under contracts set on a calendar year basis for later.

As in previous gas demand crises in Europe (2010, when Russia's gas share in Europe fell to 23 per cent from 28 per cent in the previous year is the most vivid example), Russia demonstrated that it could assume the role of a short-term market balancer and substantially swing its gas production in response

to shifts in demand. At the same time, the evidence from this year clearly shows that Gazprom does not want to engage in a price war in a situation of falling demand which it considers painful but transitory. Expecting demand recovery, Gazprom has been patiently acting as a price taker and has been optimizing its sales strategy in order to minimize losses.

It is also noteworthy that the developments in the European gas market have forced Gazprom to accept gas-on-gas pricing which has taken over from oil indexation in the majority of Gazprom's contracts. Currently, Gazprom sells most of its gas in Europe under long-term contracts with mixed pricing mechanisms.[14] As a result, Gazprom now has to accept not only the volume risk, but the price risk as well. (See Figure 11)

Figure 11: Types of pricing mechanism in Gazprom contracts in 2019



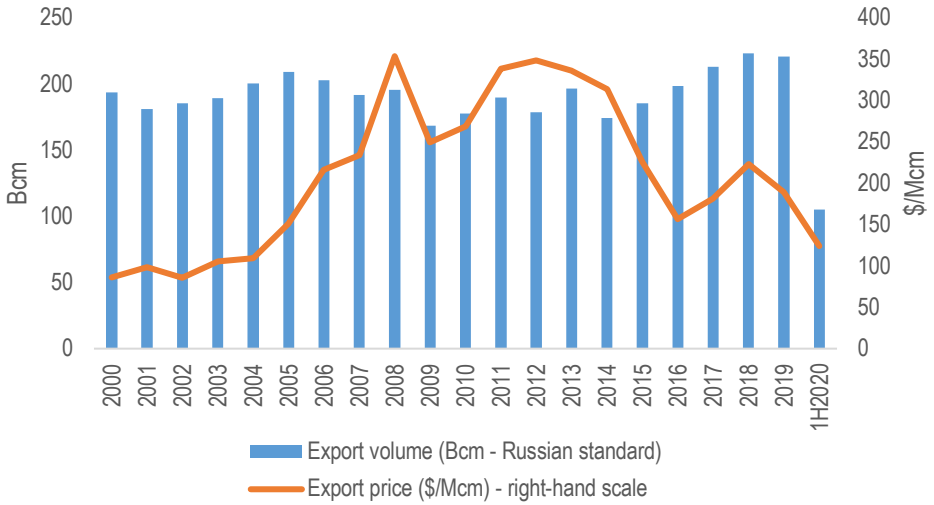
Source: Gazprom

In 2019 more than half of the volumes delivered to Gazprom customers abroad were sold under long-term contracts with a direct link to different trading hub indices, including spot and forward markets. Another important segment (11.3 per cent) was accounted for by trading operations and sales via the electronic platform. Less than one-third of volumes has remained in the categories of oil indexation and quasi-oil indexation.[15]

Russia's national customs statistics, one of the few remaining sources of publicly available information about Russian natural gas exports, is presently available through to July 2020. It contains the aggregate numbers for volumes and value (and, therefore, the effective average sales price) of total Russian gas exports to 'Far Abroad' (primarily Europe, since Russian pipeline gas deliveries to China only started this year and currently account for less than 2 per cent of the total) and to CIS countries. To put the price dynamics of 1H 2020 in perspective, Gazprom has not experienced such low prices since the beginning of the 2000s. (See Figure 12)

[14] https://www.gazprom.ru/f/posts/64/716836/investor-day-2020-presentation.pdf
[15] The cryptic definition of quasi-oil indexation has not been explained by Gazprom in detail. Some statements by top managers at GazpromExport suggest that this pricing method refers to a pricing formula that is part hub-indexed and part oil-indexed.

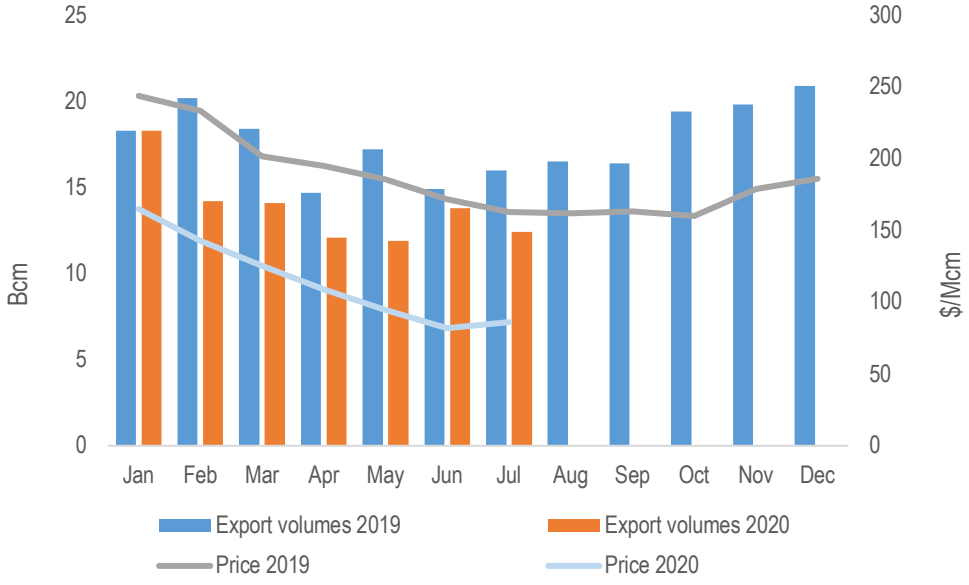
Figure 12: Total Russian natural gas pipeline exports and average export price



Source: OIES, data from Russia's Central Bank and Russian Customs Service

As can be seen in Figure 12, the price decline in 2020 has been dramatic, not seen since the early 2000s. In fact, the monthly price dynamics are even more revealing: in May 2020, the average export price crashed through the $100/Mcm level which is believed to represent the minimum threshold for SRMC for Gazprom's pipeline gas exports to Europe. It fell further to $82/Mcm in June and recovered only slightly to $86/Mcm in July.[16] (See Figure 13)

Figure 13: Russian exports of pipeline natural gas: volume and price dynamics, 2019-2020

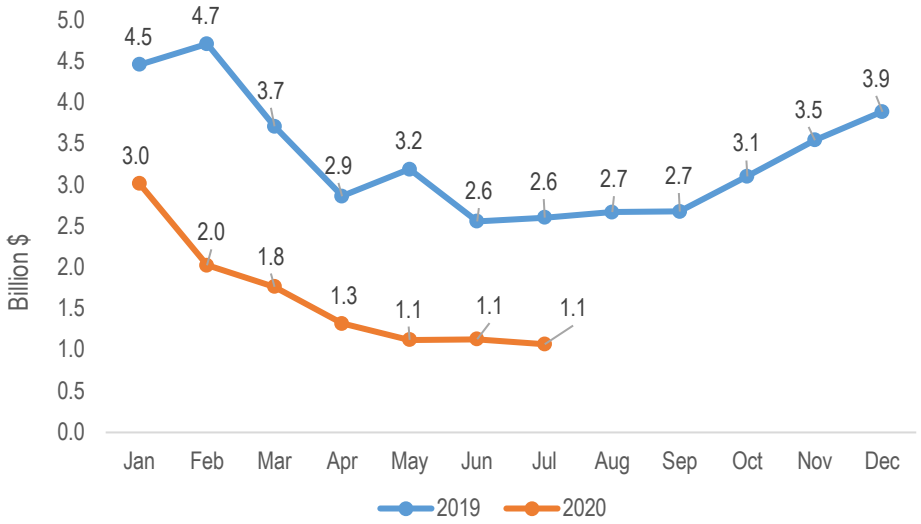


Source: OIES, data from Russia's Customs Service

[16] As stated earlier, Russia's customs statistics provide the average price for total Russian pipeline gas exports, to both 'Far Abroad', and the CIS countries. Among the latter category, Belarus has been the largest importer of Russian gas by far, accounting for about 10 per cent of total pipeline exports. The price of Russian gas for Belarus has been fixed at $127/Mcm in 2020. Adjusting for this factor, the average Russian gas export price from sales to Europe (excluding sales to Belarus) has been higher than the average reported price in January-March (by 3 per cent in January), but lower than the average from April-July (by 2 per cent in April, 4 per cent in May, 6 per cent in June, and 5 per cent in July).

As a result, Gazprom's export revenues dwindled in 2020. In May-July 2020, export revenues from pipeline gas exports amounted to only $1.1 billion per month – 2.4 times lower compared to the same months of 2019. (See Figure 14)

Figure 14: Russia's revenues from exports of pipeline natural gas



Source: OIES, data from Russia's Customs Service

However, gas prices at the European gas hubs started to increase in August, and it appears that the June and July numbers may have represented the worst of this year for Gazprom.

Gazprom data on pipeline gas exports to individual countries (currently available through the first half of 2020) demonstrates a significant drop in total pipeline export deliveries, by 20.8 Bcm or 22 per cent. (See Table 1).

Exports to all the largest purchasers of Gazprom gas in Western Europe were down in the first six months of 2020 compared with the same period of 2019: minus 6.9 Bcm (down 25 per cent) in Germany, minus 1.7 Bcm (down 15 per cent) in Italy, minus 3.4 Bcm (down 42 per cent in Turkey), and minus 3.1 Bcm (down 50 per cent) in the UK. In contrast, exports to the Netherlands in 1H 2020 went up by 1.9 Bcm (51 per cent) year-on-year as gas production at the Groningen field sank.

In Central Europe, the largest year-on-year declines during 1H 2020 were registered in Hungary (minus 1.6 Bcm, down 30 per cent) and in Czechia (minus 1.6 Bcm, down 38 per cent). The main reason appears to be the effect of "over-deliveries" to these countries in 2019 caused by concerns over the uncertain (at that time) future of Russia's gas transit via Ukraine. In contrast, Russian gas deliveries to Slovakia during the first half of this year increased. This reflected the fact that for the first time Ukraine could import gas from Slovakia using virtual reverse flow. Ukraine has been capitalizing on its vast gas storage capacity while the favourable time differentials of the futures curve during spring and summer incentivized storage injection.[17]

In the near abroad, Belarus reduced its gas purchases by 1.1 Bcm (down 11 per cent). Gazprom also reported zero exports to the Donetsk and Lugansk regions in Ukraine this year compared with 1.5 Bcm exported in the first six months of 2019.

[17] See Pirani S., Sharples J. *European gas storage: backhaul helps open the Ukrainian safely valve*. OIES Energy Comment, May 2020
https://www.oxfordenergy.org/publications/european-gas-storage-backhaul-helps-open-the-ukrainian-safety-valve/

Table 1: Russian pipeline gas exports, 1H 2020

	6m2020, Bcm	6m2019, Bcm	Incremetal Change, Bcm	Percentage change
Western Europe	**60.1**	**75.3**	**-15.2**	**-20%**
Germany	20.1	27.0	-6.9	-25%
Italy	10.0	11.7	-1.7	-15%
Turkey	4.7	8.1	-3.4	-42%
France	5.7	6.5	-0.8	-12%
Finland	0.8	1.4	-0.6	-44%
Austria	6.6	7.4	-0.8	-11%
Greece	1.3	1.5	-0.2	-11%
Netherlands	5.6	3.7	1.9	51%
Switzerland	0.1	0.1	0.0	-1%
Denmark	0.8	0.7	0.1	8%
Great Britain	3.0	6.1	-3.1	-50%
Belgium	1.3	1.1	0.2	18%
Central Europe	**17.7**	**20.9**	**-3.2**	**-15%**
Hungary	3.7	5.3	-1.6	-30%
Poland	4.4	4.3	0.1	1%
Slovakia	3.8	2.4	1.4	60%
Czechia	2.6	4.2	-1.6	-38%
Romania	0.3	0.5	-0.1	-27%
Bulgaria	1.0	1.4	-0.3	-24%
Serbia	0.5	1.0	-0.5	-49%
Slovenia	0.1	0.1	0.0	24%
Bosnia	0.1	0.1	0.0	-14%
Macedonia	0.1	0.1	0.0	-17%
Croatia	1.0	1.4	-0.5	-33%
Near Abroad	**14.5**	**18.1**	**-3.6**	**-20%**
Ukraine	0.0	1.5	-1.5	-100%
Belarus	9.1	10.1	-1.1	-11%
Moldova	1.5	1.5	0.0	-1%
Lithuania	0.3	0.7	-0.4	-58%
Latvia	0.7	0.6	0.1	16%
Estonia	0.2	0.2	0.0	-7%
Kazakhstan	1.7	1.6	0.1	9%
Armenia	1.1	1.0	0.0	3%
Azerbajan	0.0	0.8	-0.8	-100%
China	**1.6**	**0.0**	**1.6**	**15600%**
Total	**93.9**	**114.3**	**-20.4**	**22%**

Source: OIES, data from Gazprom

Stress-test for Russian gas: anomalous export netbacks versus domestic prices and cost of supply

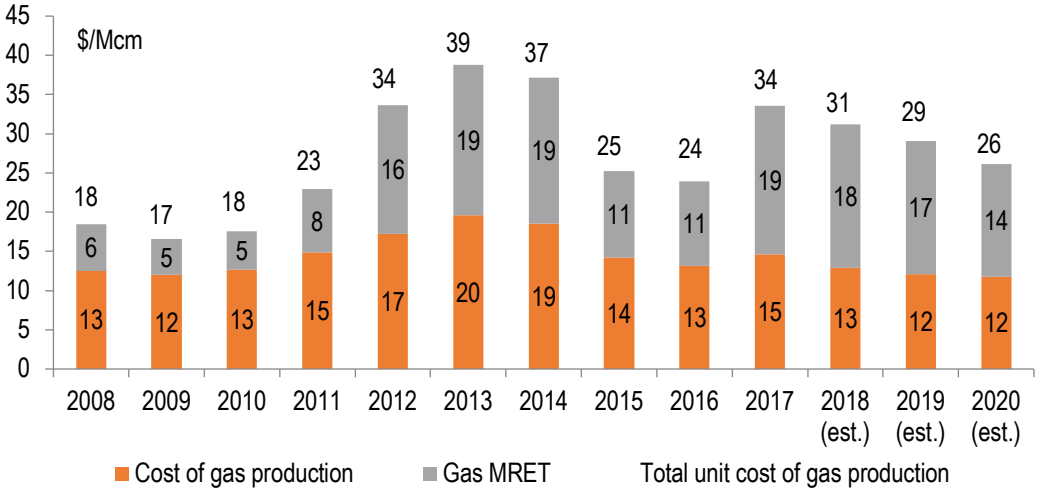
An obvious result of the 'perfect storm' affecting the European and global gas markets has been the price shock: $2 gas has been hurting all supplies. At this price level even cash costs for most gas suppliers cannot be covered, let alone full costs.

Russia enjoys one of the lowest total costs of supply among its competitors. The gas glut, however, has shifted the competition to SRMC levels for LNG suppliers. In this sense, market developments are forcing Gazprom to participate in a game with new rules in which the motto for participants is 'survive another day' rather than 'conduct sustainable business with stable returns'. It appears that Gazprom is not considering competing at the level of cash costs as a viable scenario for the company and is taking total operating costs into account when measuring its competitive position and making decisions regarding its market share strategy.[18]

In the section below we review the reported information on Russian gas costs and then calculate export netbacks and compare them with domestic regulated prices in the regions at Russia's western border to arrive at an export margin for Gazprom. We also compare export netbacks at the border to the average cost of supply to these points (on the basis of reported average costs for Gazprom gas at the wellhead and the reported average unit cost of transportation for the company).

For many years Gazprom reported the average unit cost of gas production (in rubles per Mcm) for its main upstream subsidiaries in its presentations to investors, with a split between prime upstream costs and the mineral extraction tax (MET) for natural gas (the latter works as an equivalent to a mineral royalty). Since 2017, however, these numbers have not been disclosed. As a result, for 2018-20 we have had to estimate the average upstream production cost per unit on the basis of other information provided by Gazprom in its annual reports and other disclosures.[19] (See Figure 15)

Figure 15: Average upstream production unit costs for Gazprom



For 2008-17 based on Gazprom reported data, for 2018-2020 - author's calculations

Source: OIES

[18] The largest components of Gazprom's cash costs are the Russian mineral extraction tax and the export duty. Another significant element of the cash cost is the transit fees paid to third parties abroad. Variable costs of production and transportation in Russia are relatively low.

[19] In particular, from 2015 Gazprom started to report net of tax average unit cost of production as part of its KPIs. These series exclude the mineral extraction tax (MET) component. In its presentations to investors Gazprom also reported the amounts of gas MET paid in billion rubles in 2018 and 2019.

Figure 15 contains several important points. First, it is obvious that despite a significant increase in upstream tax as a proportion of overall production costs since 2012, Gazprom has managed to keep overall costs under control. We estimate that in 2020 the average production cost for Gazprom will be $26.2/Mcm (Russian standard) or about $0.75/MMBtu inclusive of MET. Secondly, net of tax production costs in dollar terms were rising between 2009-2013, but since then the trend has been reversed reflecting significant ruble depreciation in 2014-2020. When measured in rubles, upstream production costs net of MET went up from 312 rubles per Mcm in 2008 (when the average annual ruble to dollar exchange rate was $1=24.9 rubles) to a peak of 879 rubles per Mcm in 2016 (average annual exchange rate of $1=66.8 rubles) and slightly declined to 827 rubles per Mcm by 2020 (average exchange rate for January-August of $1=70.4 rubles). Thus, despite an almost three-fold increase in net of tax production costs for Gazprom in ruble terms since 2008, the dollar costs in 2020 have remained almost the same as in 2008.[20]

Another important element of Russian supply costs to Europe is the cost of gas transportation. Most of Russia's gas reserves (and the bulk of production) are located deep inland and far from consuming markets both home and abroad. This makes transporting natural gas from points of production to points of export or domestic sales one of the most significant cost items for Russia's natural gas producers. Gazprom is the owner and operator of the Unified Gas System (UGS), an extensive network of high-pressure, large-diameter trunk gas pipelines connecting the main production areas in northern West Siberia with domestic consuming regions in the European part of Russia and extending west to export markets in Europe and the CIS countries. UGS comprises three main transportation corridors: the Central, the Northern, and the Southern. The Central and Southern corridors carry natural gas from the legacy gas fields in the Nadym-Pur-Taz (NPT) region that have been producing since Soviet times (some started their production in the early 1970s). The Northern corridor currently sources most of the supply from a new gas province on the Yamal peninsula. The new Bovanenkovo-Ukhta and Ukhta-Torzhok pipelines were built to evacuate new gas from the super-giant Bovanenkovskoye field on the Yamal peninsula (where production reached 92.3 Bcm in 2019) and to bring it to Russia's northwest and on to Germany via Nord Stream 1 and (in the future) via Nord Stream 2. This route is a new shortcut from Yamal to Europe, providing Gazprom with significant cost savings owing to the reduced transportation distance to the target market.

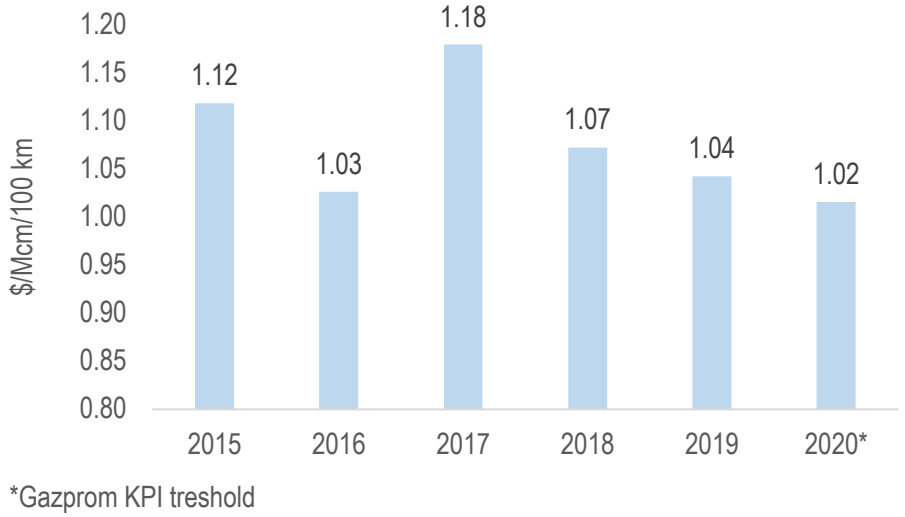
Gazprom sets internal transfer prices for its transportation subsidiaries allowing for cross-subsidization within the system. These transfer prices are not disclosed publicly. However, since 2015 Gazprom has reported its average unit cost of gas transmission in rubles per Mcm per 100 kilometers in Russia as part of its KPIs.[21] We have converted these numbers into US dollars using average annual exchange rates. (See Figure 16)

Gazprom inherited long-term supply contracts to Europe in which the delivery points for title transfer were generally locations along the borders between the countries of the former Soviet bloc in Eastern Europe and Western Europe. The most important of these for Gazprom are Baumgarten in Austria adjacent to the Slovakian border (for flows of Russian gas to Central Europe transiting Ukraine and Slovakia); Mallnow on the German border with Poland (for flows of Russian gas to northwest Europe via Belarus and Poland); and Greifswald for direct deliveries of Russian gas to Germany via Nord Stream 1.

[20] For a detailed review of Russian gas taxation see Yermakov V. and Kirova D. *Gas and Taxes: The Impact of Russia's Tinkering with Upstream Gas Taxes on State Revenues and Decline Rates for Legacy Gas Fields.* Oxford Energy Insight, 2017 https://www.oxfordenergy.org/publications/gas-taxes-impact-russias-tinkering-upstream-gas-taxes-state-revenues-decline-rates-legacy-gas-fields/

[21] This information is disclosed in Gazprom annual reports.

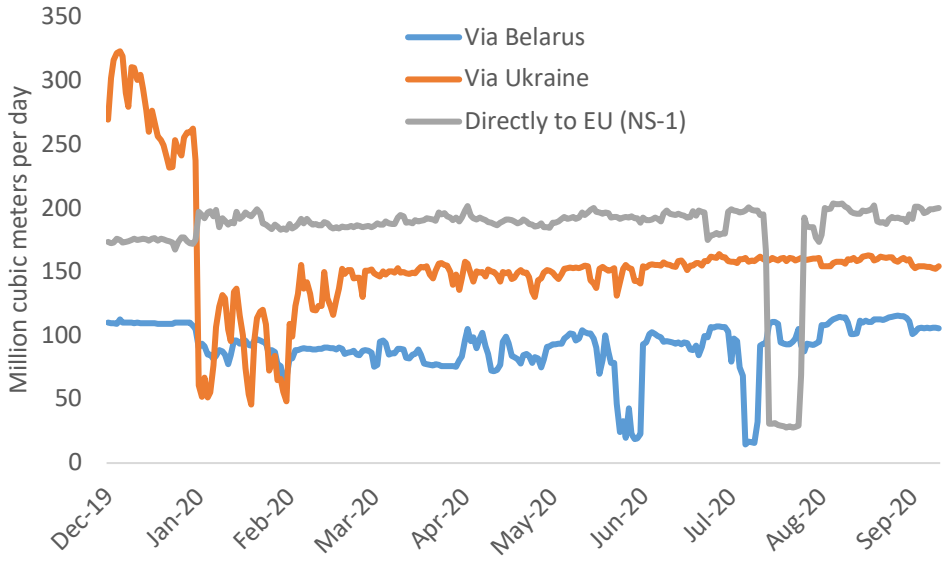
Figure 16. Average unit cost of gas transportation for Gazprom



Source: OIES, data from Gazprom

Gazprom's reported data on the flows via the main routes in 2020 demonstrates that Nord Stream remains the top priority for loading while Ukraine and Belarus/Poland generally have lower utilization year-on-year. (See Figure 17)

Figure 17: Gazprom pipeline gas flows to the EU via main routes in 2020



Source: OIES, data from Gazprom

Depending on a particular route, gas from production sites in northern West Siberia typically travels from 3,200 to 3,700 kilometers to reach different export points at Russia's western border. Applying average reported unit transmission costs to these distances results in a cost range of $32-37/Mcm ($0.9-1.1/MMBtu) for transporting gas from the wellhead in Russia to the export points on the border.

Combining the average Gazprom upstream and transportation costs results in a total cost of gas supply to Russia's western border of $1.7-1.9/MMBtu. It is noteworthy that Russian regulated domestic prices are currently about the same as the cost of supply, reflecting the regulator's attempt to keep domestic tariffs at levels that are just enough to cover costs: in the Kursk region bordering Ukraine, the regulated

price for industrial users is 4911 rubles per Mcm (about $2/MMBtu) while the regulated price for residential users is 3921 rubles per Mcm (about $1.6/MMBtu).

Low gas prices in Europe throughout the summer of 2020 created a situation previously unseen whereby sales in the Russian domestic market were giving Gazprom better netbacks than export sales. With regards to export netbacks, Gazprom pays 30 per cent of the customs value of natural gas as an export duty and it also needs to pay transit fees to transit companies in Eastern Europe that ship Russian gas. Gazprom reports the volumes of natural gas shipped via major routes to Europe as well as the amounts of money paid to European shipping companies for transit.

- Nord Stream 1. In 2019 Gazprom reported shipments of 58.5 Bcm via Nord Stream 1, achieving a higher utilization (106 per cent) than the nameplate capacity of the pipeline which is listed at 55 Bcm per annum. It paid 77.4 billion rubles ($1.2 billion) to Nord Stream AG for transit services.[22] The average effective unit cost of transporting gas via the 1,242 km Nord Stream 1 pipeline in 2019 is calculated at $20.5/Mcm for the whole route or $1.67/Mcm/100 km.[23] During 2020 the utilization of Nord Stream remained, on average, at extremely high levels, exceeding those of 2019.
- Transit via Poland and Belarus. In 2019 Gazprom transited 33.7 Bcm via Europol and paid Europol AO 12.9 billion rubles ($0.2 billion) for transit services.[24] The average unit cost of transporting gas via the 683 km Europol pipeline in 2019 was, therefore, $5.9/Mcm for the whole route, or $0.9/Mcm/100 km. The long-term transit contract between Gazprom and Poland expired on 31 May 2020, and now Gazprom participates in the pipeline capacity auctions organized by Gaz System, the operator of the Polish gas network. For Q3 2020 Gazprom bought Europol capacity and will be paying for transit under a new entry-exit tariff rule. The combined entry and exit tariff to ship natural gas via Europol amounted to $7.2/Mcm for the route, or $1.05/Mcm/100 km.[25] Before entering the Europol transit system in Poland, Russian gas has to cross Belarus. The Belarussian gas system was sold to Gazprom in 2011 and is currently operated by Gazprom Transgaz Belarus. According to the information from the Gazprom Board of Directors meeting in August 2020, the transit fees for transporting Russian gas via Belarus in 2020 will amount to $345 million.[26] According to Gazprom in its Figures publication, gas transit via Belarus in 2019 amounted to 40.5 Bcm. This year, up until the beginning of September, the average daily transit flows via Belarus were about 90 million m3, 14 per cent lower year-on-year. Assuming the same dynamics for the rest of the year, the unit transit tariff for Gazprom via Belarus in 2020 is estimated to be about $10/Mcm for the 575 km-long route or $1.75/Mcm/100 km.
- Transit via Ukraine and Slovakia. Ukraine used to be the main balancing route for Gazprom since the transit fee was not dependent on the volume of transit. The new deal with Ukraine signed at the end of 2019, however, is different. According to this agreement, the transit payment terms are not flexible because the annual booked capacity of 65 Bcm in 2020 and 40 Bcm in 2021-2024 has been spread over equal daily bookings: 178.1 million cubic metres/day in 2020 and 109.6 million cubic metres/day in 2021-2024. Gazprom has to pay a relatively high transit fee of $31.7/Mcm for the whole transit route ($2.66/Mcm/per 100 km) for the booked transit irrespective of actual transit volumes; the contract, therefore, works as a classical ship-

[22] Gazprom IFRS for 2019; Gazprom in Figures, 2019

[23] Note that under ship-or-pay arrangements, the effective unit transit tariff via Nord Stream is sensitive to the utilization of the route. At 85 per cent utilization of the nameplate capacity of the pipeline, which is the industry standard, the effective unit tariff would be $2.1/Mcm/100 km. By utilizing the pipeline at a higher rate than the nameplate capacity of Nord Stream 1, Gazprom effectively lowers the unit transit fee.

[24] Gazprom IFRS for 2019; Gazprom in Figures 2019

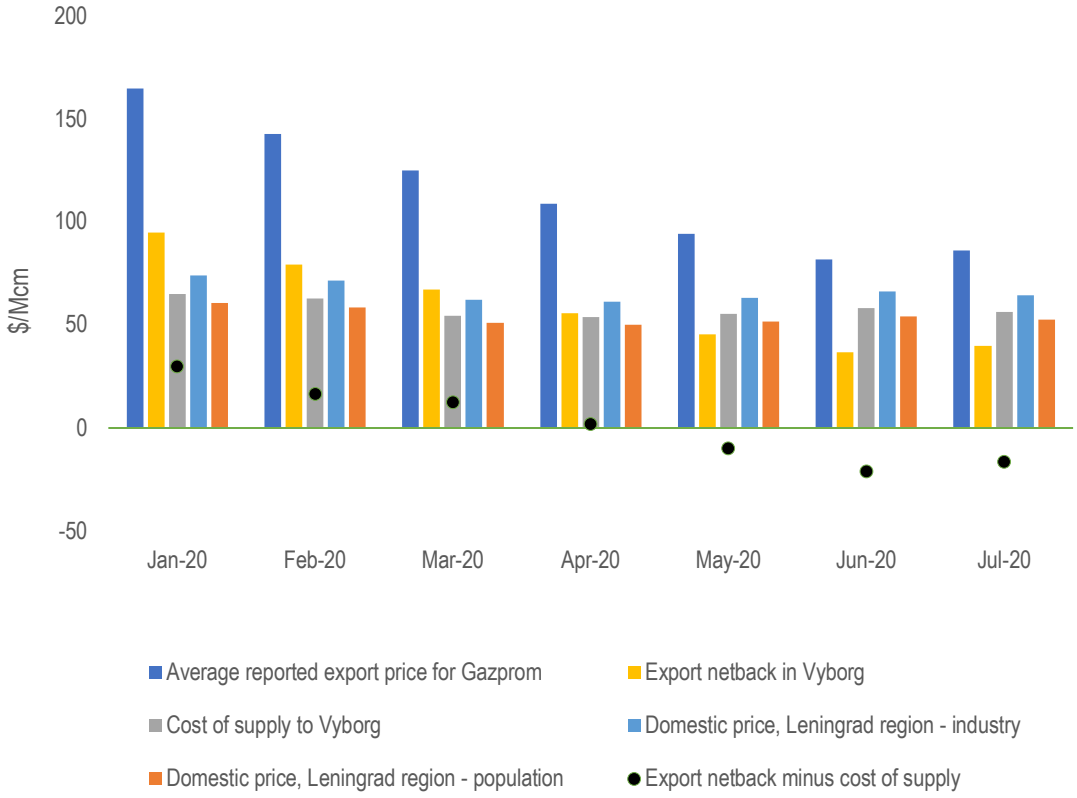
[25] See also Yermakov V., Sobczak K. Russia-Poland Gas Relationship: Risk and Uncertainties of the Ever After. Oxford Energy Insight, June 2020. https://www.oxfordenergy.org/wpcms/wp-content/uploads/2020/06/Russian-Poland-gas-relationship-risks-and-uncertainties-Insight-70.pdf

[26] https://tass.ru/ekonomika/9107649

or-pay arrangement. In effect, Ukraine has managed to secure transit revenue irrespective of actual flows of Russian gas via its system through to the end of 2024. The effective ship-or-pay arrangement means that the effective unit tariff via Ukraine for Gazprom depends on the utilization levels of the pre-booked capacity. So far in 2020, through to September 10, the average daily utilization of the Ukrainian route amounted to 144 million cubic metres/day, or 81 per cent of the pre-booked volumes. Thus, the effective unit transit fee for the Ukrainian route for Gazprom in 2020 has been $39.2/Mcm or $3.3/Mcm/100 km – almost twice as high as transit via Nord Stream. The transit via Slovakia to reach Baumgarten is based on an entry tariff at Velke Kapusany of EUR 119.8/MWh/d/year and an exit tariff at Baumgarten of EUR 166.7/MWh/d/year paid to Eustream, the Slovakian gas pipeline TSO.[27] This translates into approximately $5.2/Mcm for the 463 km route, or about $1.13/Mcm/100 km. Eustream has a long-term ship-or-pay transit contract with Gazprom for 50 Bcm per annum until 2028[28] and Gazprom has extended this long-term contract until 2050.[29]

Figures 18 and 19 present the illustrative economics of gas deliveries via Nord Stream and via Ukraine.

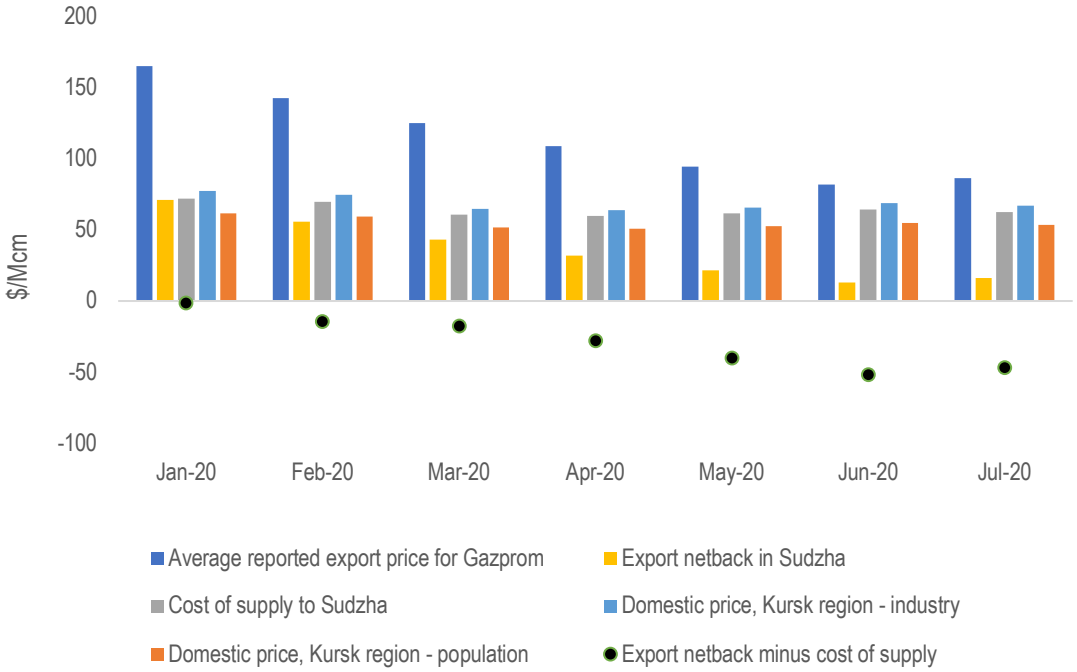
Figure 18: Economics of Gazprom export gas deliveries via Nord Stream



Source: OIES, calculations by the author

[27] http://www.urso.gov.sk:8088/CISRES/Agenda.nsf/0/4BA72BEF1317C270C1258409002B0E9E/$FILE/0040_2019_P_eustream.pdf
[28] https://www.fitchratings.com/research/corporate-finance/eustream-as-03-04-2020
[29] https://spectator.sme.sk/c/20507556/gazprom-and-eustream-sign-deal-on-gas-transports.html

Figure 19: Economics of Gazprom export gas deliveries via Ukraine



Source: OIES, calculations by the author

In January 2020, when the average export price for Russian gas was $165/Mcm ($4.7 MMBtu) for gas exports via Nord Stream, it was business as usual: the export netback was higher than domestic prices, providing Gazprom with a healthy export margin, which was significantly higher than the cost of producing gas at Bovanenkovo and transporting it to Russia's border. The situation with exports via Yamal-Europe was similar, but by contrast, gas exports via Ukraine looked less rosy. The export netback on gas deliveries to Baumgarten via Ukraine and Slovakia was barely sufficient to cover the cost of supply and on a par with domestic regulated prices. The key difference was the higher transportation costs to reach Baumgarten, both in Russia, owing to the distance effect, and abroad, because of a significantly higher transit tariff via Ukraine. The situation has been exacerbated by the flat daily transit fee Ukraine is charging based on full utilization of 65 Bcm per annum pre-booked capacity for 2020. Given that Gazprom has not been able to utilize this capacity due to the slack demand in Europe, the effective unit transit fee was even higher than the agreed tariff.[30]

The economics of Nord Stream were holding until May, but when export prices fell below $100/Mcm ($2.8/MMBtu), the export margin turned negative, and export netbacks became significantly lower than the full cost of supply. With regards to exports via Ukraine, Gazprom has been in the red since February with losses (measured as the difference between the cost of supply and the export netbacks) becoming incredibly significant in the spring and summer months of 2020 (See Figure 19 above).

In fact, the price dynamics of natural gas in Europe in 2020 have introduced a 'live experiment' that, over a time span of seven months, has tested the stress-levels of Russian gas exports as never before. Table 2 presents our calculation of the export margin (export netback at Russia's western border minus the regulated price in border regions) and the difference between the export netback at Russia's western border and the cost of supply to the border (wellhead costs inclusive of MET and transportation costs in Russia) for Gazprom by main routes in 2020 for a range of gas prices from $200 to $50/Mcm.

[30] In our calculation of the effective unit transit tariff via Ukraine we apply an 81 per cent utilization factor to 178.1 million m^3/day pre-booked capacity based on the average reported daily flows for this year through September 1, 2020.

(Recall from Figure 13 that the gas price dynamics in Europe in 2020 actually tested both ends of this price range.)

Table 2: Price sensitivity of Russian gas exports to Europe by route

European gas price sensitivity range ($/Mcm)	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200
Export margin at Russia's western border (export netback minus domestic price for industries)																
Via Nord Stream delivered to Greifswald	-52.6	-45.6	-38.6	-31.6	-24.6	-17.6	-10.6	-3.6	3.4	10.4	17.4	24.4	31.4	38.4	45.4	52.4
Via Yamal-Europe delivered to Mallnow	-49.8	-42.8	-35.8	-28.8	-21.8	-14.8	-7.8	-0.8	6.2	13.2	20.2	27.2	34.2	41.2	48.2	55.2
Via Ukraine delivered to Baumgarten -100% utilization of pre-booked capacity	-71.6	-64.6	-57.6	-50.6	-43.6	-36.6	-29.6	-22.6	-15.6	-8.6	-1.6	5.4	12.4	19.4	26.4	33.4
Via Ukraine delivered to Baumgarten - effective 81% utilization of pre-booked capacity in 2020	-79.1	-72.1	-65.1	-58.1	-51.1	-44.1	-37.1	-30.1	-23.1	-16.1	-9.1	-2.1	4.9	11.9	18.9	25.9
Export netback minus average cost of supply																
Greifswald (Nord Stream) from Bovanenkovo	-42.7	-35.7	-28.7	-21.7	-14.7	-7.7	-0.7	6.3	13.3	20.3	27.3	34.3	41.3	48.3	55.3	62.3
Mallnow (via Belarus and Poland)	-41.0	-34.0	-27.0	-20.0	-13.0	-6.0	1.0	8.0	15.0	22.0	29.0	36.0	43.0	50.0	57.0	64.0
Baumgarten (via Ukraine and Slovakia) -100% utilization of pre-booked capacity	-65.2	-58.2	-51.2	-44.2	-37.2	-30.2	-23.2	-16.2	-9.2	-2.2	4.8	11.8	18.8	25.8	32.8	39.8
Baumgarten (via Ukraine and Slovakia) -81% effective utilization of pre-booked capacity	-72.7	-65.7	-58.7	-51.7	-44.7	-37.7	-30.7	-23.7	-16.7	-9.7	-2.7	4.3	11.3	18.3	25.3	32.3

Source: OIES, author's calculations

Since August, gas prices have been recovering both in Europe and globally but remain at historically low levels. The key takeaway from the troubling experiences of 2020 for Gazprom is a reminder of the importance of Russia's domestic market, twice the size of Russia's gas exports and suddenly providing better economic returns than exports (or rather, not generating losses). Since the spring, Russia's authorities have been actively working on streamlining the rules that would allow Gazprom to intensify gasification efforts at home. The OIES Natural Gas programme will monitor these efforts and cover them in future research.

Conclusion

The obvious stresses of 2020 have put Gazprom on the defensive. Despite the heavy toll from extremely low gas prices this year, Gazprom has evidently adopted a strategy of gradual adaptation to a loose market in Europe and hopes to last longer than most of its competitors. To address the negative economics of its European exports, on September 11 Gazprom optimized its investment program for 2020.[31] The total amount of investment was reduced by 16.5 per cent from 1.1 trillion rubles to 0.9 trillion rubles (or from $14.7 billion to $12.3 billion at today's $1=75 rubles exchange rate). Its capital expenditures program was cut by 22.8 per cent from 0.933 trillion to 0.720 trillion rubles ($12.4 billion to $9.6 billion). The $2.8 billion savings on capex are, essentially, the amount of export revenue lost during the low point of the price cycle this year.

Gazprom's experience with the crises of 2009 and 2015 may suggest that the strategy of optimizing costs and proceeding with its most important counter-cyclical investments may bear fruit. However severe they may be, the cyclical crises pass; the strongest survive and enjoy the upper part of the cycle. But this narrative does not match Europe's latest energy policy ambition of a fast shift to a carbon-neutral economy. The big leap from the expectations of the 'Golden Age' of gas in Europe to the idea of carbon neutrality in which natural gas is undesirable and merely a near-term, stop-gap solution represents the biggest structural change for the gas industry on the continent in this century.

[31] https://www.gazprom.com/press/news/2020/september/article512791/

Europe's about-face on gas may undermine the prospects of long-term, mutually beneficial gas trade between Russia and Europe. Russia's response can be expected to be both adaptive and pre-emptive. For the time being, Russia can rely on a price recovery to sustainable levels of $5-7/MMBtu in Europe and the cost competitiveness of its gas in this price range. At the same time, Gazprom has been investigating the technology of methane pyrolysis that results in the production of hydrogen and carbon black and thus resolves the problem of CO_2 emissions. It plans to develop capabilities in producing hydrogen and be part of Europe's decarbonization agenda.

However, Russia is also likely to intensify its efforts to diversify away from its dependence on the European gas market both in terms of methods of gas delivery and target markets. This means the end of the era of new upstream investments targeting Europe and new gas pipelines from Russia to Europe. Instead, Russia might focus on developing new LNG capabilities and accelerate its Pivot East. The deepening of Russia-China gas cooperation could address the security concerns of both sides: for Russia it would help deal with the security of demand issue that the new European policies are undermining; for China, Russian gas delivered by inland pipelines or LNG delivered via the Northern Sea Route represents an insurance against a possible interruption of vital energy supplies should trade tensions between China and the US escalate.

De-globalization forces the breakup of old alliances and forming of new partnerships. But while these processes may be beyond human control as general trends, they must not be left to chance with regards to the possible negative effects of hectic and irrational decision-making. Gas trade between Russia and Europe has had its ups and downs for over half a century but has brought tremendous benefits to both sides. This story is unlikely to be repeated in the next fifty years, as Russia and Europe are quickly drifting apart under the pressures of global rivalries and different visions of the energy future. The best-case scenario in these circumstances is to avoid a disruptive and abrupt halt to Russia-Europe gas trade and hope that common sense prevails.