CENTER FOR THE STUDY OF DEMOCRACY

HOW TO DEAL WITH KREMLIN'S DESIRE TO STARVE EUROPE OF ENERGY: THE CASE OF NORD STREAM 1 AND BEYOND

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The fast-approaching winter in the face of the ever more real possibility of a complete cut-off of gas supply from Russia is pushing the EU tighter into a trap of its own making. Believing the Kremlin's blatant dishonesty vis-à-vis Europe and sleepwalking into a growing over-reliance on Russian gas after the Crimea incurs and annexation of 2014 has **severely eroded the energy security of the EU**. Germany and Italy led the way, **underwriting the Kremlin Playbook in Central and Southeast Europe** and undermining the European Commission efforts at diversification and market liberalization (see Figure 1).

The neglect of the energy security aspects of the energy transition by key European national governments has led to **poor individual and collective strategic decision making** about critical infrastructure, such as the endorsement of Kremlin's pincer strategy geopolitical projects Nord Stream and Turk Stream or abandoning the EU's Nabucco pipeline, to name just a few.

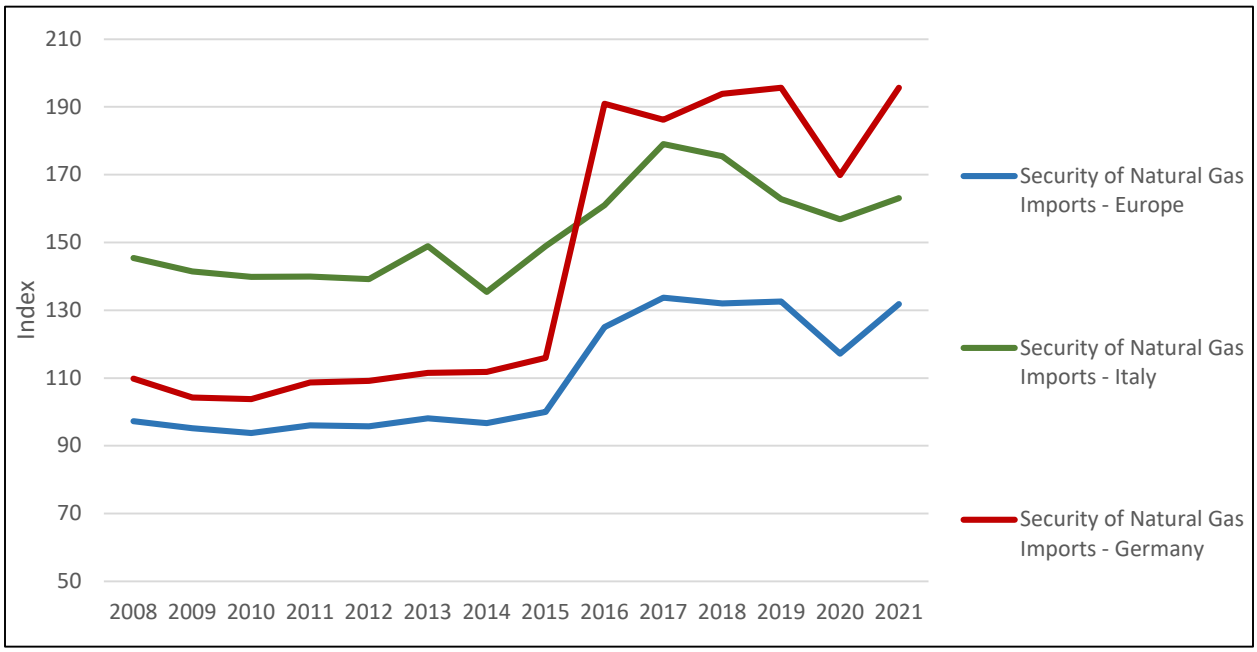
To top it off, this poor decision making was accompanied by the lack of development of proper information, analytical and decision-making tools to handle a crisis like the current gas blackmail from Russia. So even if an earnest effort to make the right decision were to be applied, the outcome could have been based on guestimates.

KEY POINTS

- **Russia cannot be trusted anymore** as a supplier of energy to Europe. And the only way to avoid being open to energy blackmail in the future is to **build an unequivocal ability to contain and mitigate the blackmailer's action**.
- Russia's reasoning for a cut of gas supply to the EU via Nord Stream 1 to 20% of the pipeline's capacity due to purported compressor station issues, is **entirely fabricated** and does not stand up to even a cursory technical check-up.
- **The EU should be better prepared to deal with gas supply risks** driven by purely political, non-cooperative or even hostile reasoning, down to full cut-off of Russian gas supply.
- Invoking solidarity and agreeing to voluntarily reduce gas consumption by 15%, with mandatory cuts to follow, if necessary, is a good tool, but will not be used to its proper extent without **applying the relevant tools on the gas supply side and the infrastructure serving that supply** as well.
- The **EU is in a position to know less than Russia about gas supply**, and learn late about decisions on gas supply made outside EU that have a major impact on the EU. **This imbalance of accurate and up-to-date information is even more pronounced at member state and regional level.**
- The EU needs to act immediately on filling these governance gaps. This starts by **countering** robustly the ever more **blatant lies and misinformation tricks** used by the Kremlin to blanket it gas blackmail.

While welcome, the recent initiative by the European Commission with the evocative title "Save gas for safe winter" actually betrays **a deeply worrisome lack of solidarity** regarding the European gas and broader energy market. It is also a reminder of how fragmented this market and its governance remain. The initiative is a good step forward, but unfortunately the chasm is much bigger and the risk of starving Europe of energy, or at least spooking the economy into believing this is inevitable, is a very clear and present danger. The EU needs to act immediately on filling these governance gaps. This starts by **countering robustly the ever more blatant lies and misinformation tricks**, with which the Kremlin blankets it gas blackmail.

Figure 1. Security of Natural Gas Imports in Selected Regions



***Source**: CSD's Energy and Climate Security Risk Index.*

***Note**: The higher the index score, the higher the risk level. Security of natural gas imports take into account diversity of supply and the geopolitical risk associated with each source of supply, as well as the overall reliance on imports for meeting domestic demand.*

Calling Out Kremlin's Sham

On 25 July 2022, Gazprom informed that from 4:00 am on Wednesday, 27 July 2022 the flow of gas to Germany via the Nord Stream 1 pipeline would be cut back to 20% of the capacity of the pipeline, thus halving the already reduced flow. The reason for the cut-back was, in Gazprom's wording, "the discontinuation of the operation of one more Siemens gas turbine at the Portovaya compressor station", due to "reaching the limit of the time between major overhaul (in compliance with the instructions of Rostechnadzor and taking into consideration the actual technical condition of the engine)."[1]

[1] Gazprom's statement as reported by Interfax, "Прокачка по "Северному потоку" со среды сократится до 1/5 мощности", July 25, 2022. Cf. also *Reuters*, "Russia's Gazprom tightens squeeze on gas flow to

But already on the same day, a German economy ministry spokeswoman told AFP news agency: "According to the information we have there is no technical reason for a reduction of deliveries."[2]

On July 26, 2022 Russia sharply increased without prior notice the pressure in the Urengoy-Pomary-Uzhgorod pipeline that delivers Russian gas to Europe through Ukraine, an action that could lead to emergencies including pipeline ruptures. Pipeline operators are obliged to inform each other about such actions in advance[3].

In her opening remarks at the press conference of the Extraordinary Energy Council of 26 July 2022, Commissioner Simson pointed out that "(t)hese are just two examples of arbitrary interruptions of gas supply, **blackmail and the use of energy as a political weapon** by Russia since the war against Ukraine began"[4]. The Extraordinary Energy Council endorsed the Commission's "Save gas for safe winter" plan, including the Regulation on a coordinated demand reduction effort[5].

Russia's Blackmail Explained at the Technical Level

The technical background on the Nord Stream case, outlined below, provides an illustration of the degree to which Russia uses false pretexts for its actions. It is followed by a few suggestions regarding what Europe could do to better deal with the consequences of politically driven Russian gas supply choking. In particular, this brief suggests possible further ways for enhancing the practical actions of the EU and its member states that could help to deal with dwindling and uncertain gas supply and mitigate the effects of rising energy prices.

The pipeline is configured of two 48-inch (1200 mm) parallel strings served by one compressor station (CS, Portovaya near Vyborg in Russia). The CS has eight compressor units, six of which are rated at 52 MW and two at 27 MW, to a total installed capacity of 366 MW. The CS pumps gas over a distance of 1222 km via the two parallel strings and has no outlets until reaching Germany. The internal diameter of the strings is 1153 mm. The design pressure at the outlet of the CS is 220 bars and the design capacity of the line is 55 billion cubic meters p.a.[6]

So, the Russian claim boils down to the following: taking out two turbines (out of the eight) limits the flow to 20% of the pipeline's capacity. Really?

A cursory technical check based on first principles of pipeline engineering and compressor station design will reveal that the absorbed power needed to achieve 100% of the design capacity of the Nord Stream 1 line at the Portovaya CS would be ca. 220 MW or about 60% of the installed capacity. This means that **using four out of the six 52 MW turbines available at Portovaya CS will allow the line to be charged at 100% of design capacity** – not 40%, not 20%, but 100%. Not to even mention that there would still be two 27 MW turbines available in a stand-by mode. And the availability of redundant capacity at the Portovaya CS when the line is charged at 100% is totally compliant to the basic principles of gas pipeline design and risk management.[7]

It does not come as a surprise that the CEO of Wintershall DEA, a company that owns a 15.5% stake in Nord Stream 1, had some comments to share: "Over the last couple of weeks, Gazprom,

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Europe", July 25, 2022, and Meierhans, J., "Gazprom: Nord Stream 1 supply to EU to be cut further", BBC News, July 25, 2022.

[2] As quoted by Reuters and BBC, cf. op. cit.

[3] Cf. Reuters, "Ukraine says Russia increased gas pipeline pressure without prior", July 26, 2022.

[4] Cf. European Commission, Press Corner, *Opening remarks of Commissioner Simson at the press conference of the Extraordinary Energy Council of 26 July*, July 26, 2022.

[5] Based on article 122 of the Lisbon Treaty.

[6] Cf. Nord Stream, Facts Newsletter, Issue 24, November 2012, and Nord Stream, Background Information, August 2016.

[7] See details at the end of this paper.

with the reductions and disruptions of supply, has destroyed the trust in Russia as a reliable supplier of energy for Europe… A trust that has been built over decades, and that is a very depressing news I have to say."[8]

Right. **Russia cannot be trusted** anymore as a supplier of energy to Europe. **And the only way to avoid being open to energy blackmail in the future is to have an unequivocal ability to contain the blackmailer's action without too much trouble**. Demand-side actions such as those foreseen in the "Save gas for safe winter" plan do help. Increasing domestic energy supply and enhancing international energy supply help, too. But making sure that the impact on the economy and the consumer is avoided or minimized matters the most.

Governance gaps will not be bridged in a fog of false information, half-truths and evasiveness driven by short-term political gains. So, it starts with making sure that the right information for proper decision making is available on demand, in a trustful and transparent way, and at all levels – member states, regions, EU.

Worst Case Scenario: More Tools to Take in Hand

The risk of complete cut-off of gas supply from Russia to the EU is quite tangible and may very well materialize at any time now. The risk increases as winter, the season during which gas demand is highest, approaches. Furthermore, the risk is complemented by Russia's ability (and demonstrated use of that ability) to manipulate gas supply by route, delivery point, and counterparty. **This ability is used by Russia for inducing asymmetric positions of EU member states regarding EU-level solidarity** and possible responses to the use of gas by Russia for political and economic divisions and gains, thus watering down the effects of EU's sanctions on Russia.

Both risks (shortage of gas and lack of solidarity) lead to higher gas prices that reverberate throughout the EU's economy by pushing up overall energy prices, inflation, depressing the economy, eroding real incomes and promoting destructive, egoistic behavior by interested parties, groups, and political voices who seek short-term populist gains.

The major tools deployed by the EU so far for the purpose of mitigating these risks refer to solidarity. These are jointly agreed tools based on the usual legal formats, chains of decision-making and responsibility, and ways of implementation. Of these, the "Save gas for safe winter" plan is just the most recent one.

However, **the reality of the EU gas markets differs from the otherwise noble and commendable idea of solidarity**. A major reason for that mismatch is the physical outlay of EU's gas infrastructure. Today, it is unable to support moving gas from many of EU's regions and member states to other regions and member states. In essence, this means that the idea of a pan-EU gas market is not supported by the ability to actually move supply to where it is in demand. For example, what happens on the Iberian Peninsula (where a very large chunk of EU's LNG regasification capacity is located) in terms of gas supply and demand balance is not likely to have much of an impact beyond Iberia. The existing pipelines between Iberia and other locations and the LNG terminals in those locations do not have adequate capacity to accept gas from Iberian destinations. Ditto moving gas from Southeast to Northeast Europe and vv., or from the Baltics to Southeast Europe and vv. – and so on.

[8] As quoted by Weiss, P., "Wintershall Dea looks to domestic production as Russia has 'destroyed' trust", *Reuters*, July 26, 2022.

To wit, one may use the reported capacities at interconnection points and LNG terminals as informed, for example, by ENTSOG[9], and compare those capacities to any voids in supply resulting from cut-backs by Russia. And this does not even take into account the issue of assessing actually available (not contracted or contracted but re-assignable) capacity or the extra cost that moving gas through the systems of two or more transmission system operators (TSOs) would involve.

Besides, in many member states the **regulatory bodies do not even have the ability to carry out system modelling**, relying instead on the TSOs that they have to monitor and regulate, or on ad-hoc consultant services which also use TSO system data for their analyses. The TSOs, on the other hand, do have SCADAs[10] in place that support such modelling for operational and system planning purposes, but only at national level. At higher level (regional and pan-EU), maybe the only entity which does have such a capability is EU's Joint Research Center (JRC). However, it is obvious that in this case, too, **near real-time data about gas flows at system entry points will be lacking**, along with some details of the system topology.

Moreover, Russia and Gazprom do have the ability to model, control, and forecast the operational parameters of its system in near real-time mode, as well as to assess various options for operational and system development purposes. In the past, **Gazprom also attempted to set up a "regional dispatch unit" covering Southeast Europe** and seated in Sofia, known as "Topenergy", which was to manage all the gas transmission systems in the region. After considerable controversy, the idea was abandoned.

In addition, the Ministry of Oil Industry of Russia created already in 1985 a Central Dispatch Unit, initially in charge for operational issues related to oil products. In 1999, the unit's area of responsibility was expanded to include the collection and processing of all operational data in all fossil energy sectors (oil, gas, coal), and in 2019 the unit was made part of the Russian Energy Agency, itself part of Russia's Ministry of Energy. The unit collects 24/7, processes, and analyses operational data for all fossil fuel sectors in the country, and provides system development support services.[11]

The **EU is thus in a position to know less than Russia about gas supply**, be excluded from making decisions, and learn late about such decisions made outside EU that have a major impact on EU's gas supply. The EU is also less well-informed about infrastructure effects than its Russian counterparty. **This imbalance of accurate and up-to-date information is even more pronounced at member state and regional level**, leading to plenty of temptations for Russia to manipulate various parties, as no one really knows where, when and to what extent gas supply could be impacted by Russia's actions, and if it were indeed to be impacted, then what the best line of action for mitigating the impact should be.

Besides, being in such a position of asymmetric information introduces a propensity within the EU to **choose among tools related to gas demand rather than supply**, as gas demand is a better-known territory in comparison with gas supply, in particular supply from Russia. Invoking solidarity and agreeing to voluntarily reduce gas consumption by 15%, with mandatory cuts to follow, if necessary, is a good tool, but will not be used to its proper extent without applying the relevant tools on the gas supply side as well. While **supply-side tools** have also been deployed, more and better ones are needed:

- The current framework for dealing with actual and possible future cut-backs of Russian gas

[9] Cf., for example https://transparency.entsog.eu/#/map and other data available from ENTSOG.

[10] Supervisory Control and Data Acquisition systems.

[11] Cf. Центральное диспетчерское управление топливно-энергетического комплекса.

supply requires **an adequate assessment of gas infrastructure features**. The framework needs to fully take into account the limits of available gas handling capacity, the patterns of flow at system entry points for Russian and non-Russian gas (both imported and domestic), and the patterns of demand at gas destinations.

- In the context of the tools already deployed for dealing with the cut-backs, it is difficult to assess the merits of various derogations, exemptions, gas demand targets and other ways to deal with the issue in specific member states. This requires a **reliable bird's eye assessment of supply, demand, and infrastructure features under different cut-back scenarios in EU's member states and at regional level.** Another reason is the lack of near real-time data for actual gas supply, with a breakdown by TSO entry point, both for import and for domestically produced gas.
- To help resolve the issue of lacking reliable and transparent assessments of the ability to deal with reduced gas supply from Russia at system level in member states, at regional level, and at EU level, there is a need to **incorporate in the assessments detailed system level (hydraulic) analyses** on the basis of gas supply data covering all TSO system entry and exit points. The party to carry out such analyses should be independent, have the ability to obtain, store, process, and analyze the required data, on a confidential basis where needed. **Parties that could be considered for the purpose could include the Joint Research Center, ENTSOG, the Agency for the Cooperation of Energy Regulators, or a cross-party platform with their participation.**
- The analyses should not be for generic cases of possible reduced gas supply, but for **specific scenarios for a complete cut-back of Russian gas deliveries at an entry point, combinations of several entry points, or all entry points**. The results of such analyses could then serve as the basis for recommending action needed to mitigate the effects of the cut-back of Russian gas supply by member state, region, and at EU level, by also considering the cost-benefit effects and the degree of impact on consumers, prices, and overall economic activity.
- Once available, the results of the analyses should be used to set **a specific binding action plan** in each member state, at regional level, and at EU level, both short-term (annual) and long-term. The long-term plan of action should have the specific objective of achieving the **ability to fully contain and mitigate the effects of a unilateral complete (100%) cut-back** of Russian gas supply without prior warning, by each entry point to the TSOs' systems, combinations thereof, and all entry points.
- Such containment and mitigation should be based on the **principle of achieving best cost-benefit ratio while incurring minimum negative impact on gas consumers, prices, and overall economic activity.** The plan of action should thus consider not just gas industry and gas market features and effects, but **potential synergies and effects throughout the energy sector, both supply- and demand-side**. Examples of such wider energy sector considerations would include primary energy supply patterns, cross-fuel substitution effects, energy efficiency effects, and environmental impacts, among others. Considerations related to the positioning of the EU vis-à-vis other gas suppliers should also be included.
- A starting platform for action leading to the implementation of such a framework of additional tools addressing the worst-case scenario for Russian gas supply could be the already established **five regional groups within the EU Energy Platform** which are looking into demand aggregation and coordinated use of infrastructure.

Box 1. How Does Gas Move in a Pipeline or Why Kremlin's Statements about NORD stream 1 are false?

Actually, what moves in the pipeline is a mixture of gases that contains mostly methane, but not only. Other hydrocarbon gases are present as well in minor quantities (e.g. ethane and higher order hydrocarbons such as propane and butane), along with very small quantities of non-hydrocarbon gases (e.g. nitrogen, CO2, oxygen, helium, SO2, water vapor, etc.). This mixture is known as "natural gas" when used for residential, commercial and industrial purposes. It is a processed product that complies with certain strict technical standards known as "pipe specs" for gas. Specifically for Russian gas, one can get an idea about some such specifications in GOST 5542—2022 (Natural gas for commercial and domestic use. Specifications) which was adopted recently and will be in force from January 1, 2023.[12]

In practical terms, what this means is that engineers had to figure out a way to calculate the technical and operating parameters of a pipeline and the compressor stations, as applicable to moving a complex mixture of compressible fluids (gases) over large-diameter, long-distance, high-pressure gas pipelines. The solution was manifestly practical: formulas were designed that consider the features of the pipeline, the gases, and the natural environment of the operations (diameter, length, inside and outside temperature and pressure, gas composition, maximum and continuous operation pressure, flow properties – velocity, turbulence, efficiency envelopes, and so on).

And this is not even 20th century science: in Europe gas pipelines date back to early 19th c. England and Dr. Pole came up with the first proposed equations in 1851! Here, we only point out that one and the same set of methods of designing and operating gas pipelines is now in common use by engineers throughout the world, be it Russia, Germany or any other country, territory or unclaimed piece of our world. Physics, people.[13]

And yes, you can give a try at calculating the parameters of gas flow in a pipeline and the required power of compressor stations by using one of the many available online utilities[14] – try it now if you feel like it. Our calculations[15] indicate that the absorbed power needed to achieve 100% of the design capacity of the Nord Stream 1 line at the Portovaya CS would be ca. 220 MW, or about 60% of the installed capacity. This means that using four out of the six 52 MW turbines available at Portovaya CS will allow the line to be charged at 100% of design capacity – not 40%, not 20%, but 100%! Not to even mention that there would still be two 27 MW turbines available in a stand-by mode!

[12] Cf. Interstate Council for Standardization, Metrology and Certification, *Газ природный Промы ш ленного и коммунальнобытового назначения*, Москва: Российский институт стандартизации, 2022.

[13] Pipe flow equations are available, for example, here: Schroeder, D., *A Tutorial on Pipe Flow Equations*, Carlisle, Pennsylvani: Stoner Associates, Inc., August 16, 2021.

[14] For example, LMNO Engineering, Weymouth, Panhandle A and B equations for Compressible Gas Flow, 2015, or Excel Calculations, The Panhandle A and B Equations for Natural Gas Flow.

[15] Based on a set of equations as published here: Nitzov, B., "Prospects for Gas Supply and Demand and Their Implication with Reference to Transit Countries and Their Policy", - In: *Security of Natural Gas Supply through Transit Countries*, NATO Science Series II: Mathematics, Physics and Chemistry (NAII, volume 149), Springer, 2004.

And for those who wonder why there would be so much inoperative (stand-by, under maintenance, etc.) capacity at the Portovaya CS when Nord Stream 1 is operating at 100% of its design capacity, we'd recommend a few primers on risk management and pipeline system resilience.[16] For illustration, please consider this regarding compressor station configuration: "In general, natural gas compressor stations are designed with more than a single compressor unit. Each unit has the capacity to individually meet the majority of contracted natural gas demand. This is intentional to support scheduled and unscheduled unit maintenance or repair while not impacting system delivery."[17]

The decision on compression redundancy, notably number on units and standby power availability requirements, is thus driven not only by factors such as cost and emissions, but also by considering the factors that impact the availability of the station, i.e. its ability to move gas at the design capacity of the pipeline at all times and thus meet all contractual obligations of the pipeline user. Such assessments will typically consider the mechanical reliability of the equipment (regular maintenance periods and their duration, probability of failure and duration of repairs), the outlay of the system (e.g. whether the CS in the only one on the route like in Nord Stream 1, or not), cost-benefit analyses (comparisons of the cost for ensuring the enhanced availability of the CS and the cost of its potential non-availability), etc., and will typically include risk-based analyses (e.g. Monte Carlo, Gambler's Ruin, etc.).[18]

It is really hard to believe that the Portovaya CS was designed and built to specifications that would not allow it to operate in compliance to such basic requirements of the global – including the Russian – oil and gas industry, but rather necessitate a cut-back of capacity to 40% or just 20% of the design capacity if one or two turbines are not available, out of eight. **It is just not the case.**

[16] Cf. for example: Fioravanti, A. et al., *Compressor Station Facility Failure Modes: Causes, Taxonomy and Effects*, EUR 30265 EN, Luxembourg, Publications Office of the European Union, 2020.

[17] Cf. Downstream Natural Gas Supply Chain.

[18] Cf., for example Managing Compressor Station Availability.