UNIVERSITY OF GOTHENBURG

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FLOW SECURITY THEORY:

A new perspective on the implications of Nord Stream 2 for EU-Russia energy relations.

Scott Nichol

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Supervisor:	Adrian Hyde-Price

Abstract

Energy security presents a longstanding, constantly evolving challenge for both the State and multilateral institutions. Despite commonality in the challenges they face, their approaches remain divergent. In Europe, this is most apparent in the energy relationship between the EU and Russia; whilst the EU has implemented market-based measures in order to attain a broad set of energy security aims, some Member States view bilateral engagement as the best means of guaranteeing a secure supply of energy. Natural gas is Europe's main energy source, and the Nord Stream 2 pipeline that runs from Russia to Germany is the latest example of Europe's broader dependency on Russian gas.

Understanding and explaining energy security remains difficult, given the existence of two competing theoretical frameworks: one centred around geopolitics, and the other the markets. This thesis demonstrates the value of going beyond these generalist theoretical viewpoints by instead adopting a comprehensive and synthesising approach, represented by the theory of Flow Security. Flow Security reconfigures an analytical approach with the flow of energy at its core, whilst encompassing key components of previous theories that consider the role of the State and the market.

Using the Nord Stream 2 pipeline as the case study, this thesis applies the theory of Flow Security and demonstrates its utility as a middle range theory. It finds that Flow Security theory allows for a more fine-grained analysis of energy supply networks by placing focus on the more technical aspects of energy security missed by more broad brush theoretical frameworks.

Keywords: Energy Security | Flow Security | Nord Stream 2 | Russia | EU

Contents

1. Introduction

Energy security has posed a distinct challenge for policy makers since its conception at the beginning of the 20th century. Strategic approaches to energy security have evolved in the context of the supply, demand and crisis of energy resources (Hughes & Lipscy, 2013). In the process, scholarly debate has found itself dominated by two exclusive schools, the geopolitical and the market-based governance approach. The former views energy security as a largely political and strategic issue, to be managed through the exercise of state-based power and control over energy assets; whilst the latter sees energy security in economic terms, to be addressed with tools such as global governance regimes and non-state actors (Cherp & Jewell, 2011).

Both the market-based and geo-political approaches to energy security have shortcomings. The market-based institutional approach advocated by the EU and a number of its Member States can be effective at maintaining regulatory alignment to ensure a fair and secure supply of energy, yet can prove ineffective at responding to geo-political disruption. Equally, leaving the facilitation of energy security arrangements up to states leads to fragmentation and instability. The stagnated establishment of an internal European energy market has already shown the consequences of this, as states with sufficient negotiating power such as Germany have been able to pull out in front and ensure more favourable pricing on natural gas than many states in Central and Eastern Europe.

The debate around energy security is an important one, yet the two most prominent approaches to dealing with its challenges differ, both in how they frame the problem and the solutions they propose to deal with it. This has given rise to a fragmented and highly polarised debate on energy security. The dichotomy of politics versus the economy that has dominated this field of study has short-changed the ability of policy makers to formulate comprehensive responses to the challenges of energy security. This thesis intends to demonstrate the utility of a more integrated approach to energy security through the application of Flow Security theory – a novel and emerging theory that has gained traction within Dutch and Transatlantic security policy circles (Sweijs et al., 2018; Brattberg & Hamilton, 2014). The theory takes a joined-up approach to security and the economy by acknowledging the central role of both the state and the market in facilitating and maintaining cross border flows.

In the context of the EU, concerns about energy security are at their most potent in its energy relationship with Russia. Uncertainty on both sides about the future state of their relationship has stymied either side's attempts to diversify or consolidate their respective positions. Nowhere more apparent are these contemporary challenges than in the ongoing construction of the Nord Stream 2 pipeline that runs directly from Russia to Germany via the Baltic Sea. This flow is significant in that it signals a European commitment to Russian gas for the short to medium term. It also engages with many of the key elements of the existing debate on energy security, such as security of supply. For this reason, it will serve as the flow of focus for this study. Russia's geo-political stance in countenance to the EU's more liberal market-based approach has led to increased conflict and heightened tension in the last decade.

By examining Nord Stream 2 through the prism of Flow Security theory, it is hoped that this will help illustrate that there is the capacity for a more fine-grained analysis of energy flows when synthesising the two opposing schools of thought. The hope is that this thesis will produce a viable framework that is operational beyond the scope of this study.

1.1. Aim and Research Question

The two most common approaches to dealing with energy security are divergent, and attempting to understand the challenges of the EU-Russia energy relationship through either approach in isolation fails to capture the full picture in terms of the problems faced and solutions required. What is lacking is a sufficient means of synthesising the key elements of the geo-political and market-based approaches into a framework that also captures the complex realities of managing cross-border energy networks and infrastructure.

The aim of this thesis will be to establish whether the theory of Flow Security can help us to better understand the implications of Nord Stream 2 for EU-Russia energy relations and the challenges it poses. This will be achieved by offering an encompassing framework that acknowledges the continued role of the state, as well as the need for a liberal market in order to manage new power brokers of energy flows such as corporations. It is intended that the framework will reiterate the need to understand energy relations at both a national and regional level, and appreciate that energy security has evolved into a mixture of old and new dynamics.

In order to achieve the aim of this paper, it is crucial that a focus is placed on the flow of energy, rather than a specific state.

The research question that will guide this study is:

What distinctive insights does Flow Security theory give us in understanding the implications of Nord Stream 2 for EU-Russia energy relations?

1.2. Outline

This study will begin with a literature review that considers the Russia-EU energy relationship and how the two parties have set out to deal with its challenges. The following section will set out a theoretical framework that considers the limitations of previous theoretical applications and why Flow Security theory is different. The operationalisation of the theory in the context of this paper will then be explained. A methods section will follow, setting out case selection, data collection and analysis, and the materials of study. An empirical analysis of the data in line with the theory will then follow. A final section will conclude on the results of the empirical analysis and set out the overall position in response to the research question that has led the study.

2. Literature review

This chapter will be divided into two sections. The first section will set out the position of the Russia-EU energy relationship. What the challenges are, why they exist, and the current state of play. The second section will lay out the current approaches taken by both parties to try and address the challenges of energy security and their respective limitations.

2.1. The Russia-EU energy relationship

The Russia-EU energy relationship clashes with the mainstream assumption that interdependency acts as a means of improving political relations (Krickovic, 2015). The two parties are seen to be mutually dependent in a key area of their economic relationship, energy, and it is possible to characterise this aspect of their relationship as one of symmetry (Krickovic, 2015). However, this interdependence between the two does not extend beyond energy into other areas. This means that their economic relationship on the whole lacks complexity (Krickovic, 2015).

Deudney & Ikenberry (1999) have suggested that when interdependence between parties lacks complexity, it can have the opposite effect of fostering peace and stability. Instances of complex interdependency make it harder to measure who is more dependent on whom, given that dependencies are spread out across a number of different areas (Deudney & Ikenberry, 1999). Therefore, when that is lacking and focus is placed on one single area, such is the case with the EU- Russia energy relationship, then concerns about that relationship moving into one of asymmetry – where one party becomes more dependent on the relationship than the other – are more likely to emerge (Keohane & Nye, 1989).

The isolated interdependency of energy in the Russia-EU relationship has prevented attempts by either side to reduce their reliance upon one another. Steps taken by one side to reduce their dependency could be seen as an attempt to tip the scales in their favour. This represents what is known as a ‘classic security dilemma’, where a party is unable to take steps to increase its security without threatening the security of the other party (Jervis, 1978).

The construction of the Nord Stream 2 pipeline, which channels Russian gas directly into the EU via Germany, could be seen as the latest contribution to this growing interdependence. The pipeline has been seen to galvanise what was an already expansive debate about the challenges of furthering EU dependence on Russian Gas, and what it means for European energy security (Balčiūnienė, 2018). The European Commission sees the pipeline as somewhat antithetical to their wider aims of a diverse and secure European energy mix (Abnett, 2021). Many states across the EU and in Central and Eastern Europe see the project as one that largely serves German interests – prioritising its energy relationship with Russia ahead of European solidarity and security (Umbach, 2017).

Concerns about the project stem from what will be an increased German dependency on Russian gas. The likelihood is that this will entrench a vulnerability to Russian pressure in Central and Eastern Europe that was opened up by the first Nord Stream pipeline – where transit from the East diminished as gas flow began to concentrate more West to East, reducing the reliance on Eastern states for natural gas transit (Sziklai et al., 2020). Many across the EU and US have also expressed concern that an increased German dependency on Russian gas may have implications for how Germany responds to Russian assertiveness in the future (Hackenbroich & Liik, 2021). Though the domestic position in Germany is also not one of consensus, with opinion divided amongst those within Angela Merkel's Christian Democratic Union (CDU) Party (Åslund, 2021). The German Greens, currently the main challengers to the CDU and the Christian Social Union at the forthcoming parliamentary elections, have been the clearest in their intentions, vowing to block the pipeline's completion if attaining power (Francis, 2021).

Though the EU has sought to reduce its overall dependency on Russian gas through the pursuit of an internal energy market, Russia, in cognisance of this, has pursued an 'Energy Security Doctrine', which seeks to bypass restrictive market measures. Relations between the two are further exacerbated by several contributing factors such as a heightened pessimism about the relationship's continuity, and a divergence of state expectations for the future (Copeland, 1996). The EU's intentions regarding its future energy relationship with Russia are clear; the diversification of supply routes that bypass Russia and efforts toward market liberalisation are enough to spur Russian pessimism about the future of its energy sector. This is likely to prompt Russian anxiety, leading to hostile responses from Russia and its state-backed actors in order

to protect its oligopolistic position and interests as a key energy supplier to Europe. Russian-EU interdependency therefore finds itself in a form of grid lock, with each party unable to take substantial action that tips the scales in their favour, for fear of retaliation, whether through market-based measures designed to address a Russian energy monopoly in Europe or state-based responses such as protectionist policies and supply disruption (Krickovic, 2015).

2.2. Approaches to energy security and their limitations

Beyond these challenges, there is the issue of how the parties themselves approach energy security at large. The current landscape of energy security sits awkwardly between two schools: the geopolitical and the market. The former emphasises the role of the state in ensuring security of supply and views energy dependence as a largely geopolitical problem, with states possessing the balance of power, in which they exercise energy diplomacy in order to address the bulk of their energy security challenges (Herranz-Surrallés, 2015). The latter affords a greater role for markets, by using regulations and fair competition as means of ensuring a steady and sufficient supply of energy. This school sees the issue of maintaining energy security as less about energy dependence and more about a sufficient market and regulatory regime to oversee the actions of producer and transit countries. Approaching energy security in this manner could be conceptualised as a form of energy governance (Herranz-Surrallés, 2015).

The EU has largely sought to address matters of energy security through various tools of liberal energy governance, including multilateral treaties and regulations, such as the Energy Community and Energy Charter Treaty, and seeking to project a liberal energy market through rules and reforms that affect within and beyond its borders to ensure free and fair competition. Where this approach falls short is in its ability to fully implement these measures in practice. Though the EU's market-based approach can direct states towards a strategy that seeks to realise a wider goal of secure and diverse energy flows, it is ultimately Member States who decide the extent to which they oblige.

Though the EU has become increasingly aware of its deteriorating political relations with Russia over the last decade and has been conscious of its need to embrace a more geo-political approach when dealing with its main energy partner (Kuzemko, 2014). Signs of an emerging EU energy diplomacy have been apparent for some time, with the decision to embark on

initiatives that provided an alternative to Russian gas, such as the Southern Gas Corridor. The more recent development of a Baltic pipeline that connects Poland to the gas supply of the Norwegian North Sea could be seen largely as a 'counterweight' to the lack of diversity offered by Nord Stream 2 (Bielecki, 2019). The construction of pipelines is no longer seen by the EU as a purely economic endeavour, but rather one that tends to have an unavoidable place in politics. This fresh perspective is apparent with Ursula von der Leyen, President of the European Commission, branding her Commission as a geo-political one (Bayer, 2019), emphasising the need for a more defined role for the state in facilitating and securing energy flows.

A lack of cohesiveness amongst Member States on energy policy has been driven by both a shared competency over energy policy afforded by the EU treaties (Treaty on the Functioning of the European Union, Art. 194.2), and the perceived economic benefits of individual means of engagement with supplier countries. Russia can see value along the path of energy diplomacy, as Gazprom, the Russian-state owned energy corporation, negotiates individual contracts on favourable pricing terms within a fragmented European energy market. The Nord Stream 2 project was conceived under these conditions, as a state-backed, and to some, premeditated Russian geopolitical project (Wintour, 2021), though the portion of the project located in the European domain now appears to be largely guided by the institutional hand of the EU's market rules – made evident through the application of the EU's Gas Directive and Anti-Trust Regulations (European Commission, 2018; Council of the EU, 2019).

Whilst EU and Russian strategies towards energy security tend to lean towards the markets and geo-politics respectively, neither party has been impervious to the draw of their counterpart's approaches. Gazprom, and by extension, Russia, cannot escape the restraint of the growing body EU rules and regulations, which are in turn enforced by the courts (Abnett, 2020). Equally, the EU has also been drawn into the realm of energy diplomacy as a means of dealing with the amorphous nature of Gazprom and the Russian state behind it (Metais, 2013). Russia views the EU's moves towards an internal market as a deliberate threat to one of its key industries, whilst the EU's reluctance to engage geo-politically stems from a desire to play to its strengths using a more normative liberal approach. Each approach tends to drift towards a more liberal or realist perspective, which is where we observe a key challenge.

It is clear that there is a significant overlap between the two approaches, and isolating market and state from one another does little more than jeopardise a broader attempt to ensure the overall security of key energy flows such as Nord Stream 2. The EU has made clear that it will not seek to halt the project should it go ahead in compliance with EU law, whilst Germany has not refuted the applicability of EU directives on the project, even transposing many into national law (Geropoulos, 2021). This is evident of how the duality of market and state can operate in tandem in an effort to guarantee secure cross-border flows – exposing the shortcomings of a traditionally one-sided approach. Prontera (2017) has suggested that viewing energy security through a dichotomy of geopolitics versus economics has emphasised either the high or the low politics, causing us to miss the important dynamics that occur in the middle. This issue is not unique to the field of energy security, but in fact part of a wider debate about the short-sightedness of using exclusive analytical approach (Ripsman and Paul, 2005). When trying to understand energy security challenges through an exclusively realist or liberal paradigm, the lens becomes narrowed by the fact that the two approaches are counterposed. Consideration should thus be given to the role of the state, the market and everything in between.

Herein lies the justification for a more integrated approach that synthesises the role of the markets, transnational actors and states going forward. An understanding of the challenges of energy security at the European level must go beyond the two currently oversimplified perspectives that fail to capture its complex dynamics. Studies have tended to view geo-political and market strategies with a degree of exclusivity, framing them as schools of thought that produce strategic approaches that work against one another, rather than with much degree of harmony (Cherp & Jewell, 2011; Herranz-Surrallés, 2015; Krickovic, 2015). The debate around energy security has become polarised by the idea that the market-based and geo-political are two different ways to deal with the same problem. Flow Security theory avoids this pitfall by synthesising key aspects of both approaches and drawing out the role they play in maintaining the more technical aspects of a flow, or what Prontera (2017) would argue are the important ‘middle’ dynamics.

3. Theoretical framework

Flow Security theory takes an integrated approach to security and the economy, and this paper seeks to demonstrate the utility of this theoretical synthesis. Its application in this paper aims to refute previous claims that a solitary theoretical framework is unable to address and capture all of the challenges of energy security effectively (Johnson, 2016; Cherp & Jewell, 2011). The novelty of this theory lies in its ability to take a systems-based approach to the global movement of flows, drawing on the role of both economic and security policy in ensuring adequate facilitation and maintenance of flows. Whilst remaining tightly focused on the flow of energy, the theory also brings in key elements of both the geopolitical and market-based approaches. It is through its systems-based approach that the framework provides the ability to analyse the individual components of a flow network, whilst also appreciating the broader role played by the market and the state in bringing about a more secure flow system.

The theory carries an awareness that states continue to deliberate their security arrangements along a more traditional line based on territory. Yet, it also recognises the effect of globalisation, which has led to a more fluid state of global interconnectedness that often transcends national borders. Flow Security is compatible with a wider scholarly consensus that territory has not become redundant, but has rather emerged with a reconfigured role in the face of globalisation (Hay, 2014; Kohl, 2018). The nature of today's complex global supply chains means that critical global flows such as energy go beyond the confines of the state and their control manifests in multiple actors. Here, Flow Security provides a fresh perspective; by placing focus on the 'flow' rather than individual actors, it is possible to envisage a conceptual apparatus built around the flow. Instead of looking at fragmented approaches towards the same issue, Flow Security encompasses both market and state-based approaches, allowing for a sounder and more focused field of understanding.

3.1. Operationalisation of theory

Flow Security as a distinct security challenge analyses the geo-political environment, taking a systems approach that views everything as interrelated and interdependent (Sweijs et al., 2018). In doing so, it is necessary to map out global value chains and recognise interdependencies within them, making note of both vulnerabilities and opportunities from within. It is appropriate

to ensure policies in relation to these flows are designed in consideration of flow design principles to ensure resilience and robustness.

In order to fully understand Flow Security theory, it is necessary to set out the key operational terms relating to it, and how these interact with the wider set of principles that help to underpin it.

Flows themselves are best understood as global transboundary arteries that carry ***Flow Particles*** such as goods, people and services across multiple jurisdictional ***Flow Domains***, interacting with a number of different ***Flow Stakeholders*** in the process. By taking this anatomical view, one can better envisage the various physical infrastructure, in the form of ***Flow Hubs***, which are required to facilitate the logistical processes relevant to maintaining these flows. A flows dynamic may also be susceptible to disruptions, which are broadly seen as ***Threats to the Flow***. Negative external factors may also be derived from the flow itself, as a result of either its movement or the object it is transporting; these are seen to be ***Threats from the Flow***.

The principle of ***Diversity and Redundancy*** should be built into a flow system at every level, by ensuring both a broad range of sources and the sufficient means to offset the effects of shocks and disruptions. This will help to ensure the second principle is maintained, through the provision of a response system that exerts both ***Robustness and Resilience*** in light of an impending attack or disruption. By instilling a flow system with ***Layered Segmentation***, in which vital parts of a system function independent from one another, it is possible to ensure that a whole system does not collapse in the event of one part's failure. It is thus important to map out parts of a flow that are deemed vital to its continued functioning, and these should be afforded ***Critical Node Protection***. Overall, the aim is to achieve a ***Dynamic System***, one where the flow is resilient to change and not rigid in its ability to react.

Methods of categorisation applied in the data-gathering stage of my qualitative content analysis will develop a flow profile based on the various operational terms outlined above. The theory will then be operationalised by assessing the flow's profile in line with the above principles. This will guide the analytical process by seeking to better understand the challenges of the

relationship and whether the specific flow of choice is a useful case study through which to test that.

4. Methodology

Applying the theory of Flow Security in the context of the Russia-EU energy relationship requires a novel approach that centres analysis around flows rather than states. The position of this paper will not be to focus on the specific interactions amongst states and actors through a broad-brush conception energy security – within the context of the EU-Russia – but rather to focus on a single 'flow' from which various branches of analysis will stem. Whilst the interaction of actors will remain relevant to the analysis, the overarching focus will be on the flow itself.

4.1. Case Study Design and Selection

In establishing the goal that the case study aims to achieve, the typology of Gerring & Cojocaru (2016) has been applied (Gerring, 2017). The design of this paper will be a single case study of descriptive nature that seeks to better understand the complexities of the EU-Russia relationship by analysing the Nord Stream 2 pipeline through the prism of Flow Security. By using a case study design, it is hoped that this will allow for a focused empirical enquiry into the specific complexities of the relationship and help to ascertain the compatibility of Flow Security theory in understanding and addressing the challenges of EU-Russia energy relations (Yin, 2009). This study will seek to take a deductive approach, taking broader generalisations of Flow Security theory and applying them in the context of energy security and the flow of natural gas between the EU and Russia, as well as refining the data collection process (Bryman, 2016).

The case in focus will be the Nord Stream 2 pipeline. In identifying this as the most suitable case for this study, the work of Gerring (2008) was consulted. Flow Security theory was developed with energy flows in mind, and for that reason, this thesis does not seek to test the theory's applicability in that regard. Instead, it will take an established applicability in the context of energy flows and develop it further in light of the energy security challenges faced between the EU and Russia in respect of Nord Stream 2. To do this, the case in focus should not be a 'crucial' one, given that it does not need a 'most difficult scenario' to test the theory's wider applicability. It is also clear that the use of a 'typical case' would simply provide a representative example of energy flows, which would not serve the purposes of this study – as the focus is specifically on the issue of energy security. The Nord Stream 2 pipeline is arguably the most contentious flow of energy in Europe and is seen to engage with a number of key

energy security concerns. The pipeline could thus be characterised as an 'extreme case', as it corresponds as a case that is paradigmatic of the challenges of energy security and bears great significance on relations between EU and Russia (Gerring, 2008). Opting for a case of this nature allows for a richer and more in-depth analysis of energy security and EU-Russia energy relations in particular.

The justification for picking the Nord Stream 2 pipeline lies in a number of factors; the pipeline is ongoing and thus is the most up-to-date real-time case whereby the energy security challenges of the Russia-EU relationship are being played out. The pipeline's construction is evident of a commitment to Russian natural gas for at least the short to medium term; therefore, developing a greater understanding of the dynamics around this flow is vital for understanding the wider debate about energy security in Europe. The pipeline has drawn controversy from within the EU, the US and Germany itself, given its broader implications for European security. This case's engagement with a multitude of actors, as well as key challenges and vulnerabilities of energy security in Europe, could be seen to characterise it as an outlier compared with other energy flows within Europe. Whilst the case's specificity may elicit findings that are unique to this flow, it is intended that the findings will give rise to an adequate groundwork for a more general analytical evaluation of energy flows beyond the Nord Stream 2 pipeline.

4.2. Data collection and analysis

The data that will be analysed will be a range of documents including academic papers relating to the flow in question, EU energy policy, legislation, legal cases relating to the pipeline, operational documents from corporations and TNAs that are involved in the flow's facilitation, and agreements between parties. This data will help to build a profile for the flow, which will then be tested against key principles for maintaining and securing a flow. The form of analysis that will be undertaken in this paper will be qualitative content analysis with an analyst-oriented strategy that seeks to derive patterns and particularities from text (Boréus & Bergstrom, 2017). This approach will allow for a systematic and fully-encompassing consideration of the data collected, whilst ensuring it is appropriately refined in focus of the research question at hand (Schreier, 2014). The intention of the theory is also to guide the coding process through which content will be gathered and analysed.

The development of a Flow profile will constitute the basis upon which data will be coded and categories will be determined. A paper by The Hague Centre for Strategic Studies (2018) will be used to inform both the categories and overall coding frame for analysis. The categories will differ in the scope of information they seek to ascertain from the data, and will include information relating to: the Flow Particle; the Flow's relevance from both an economic and societal perspective and its impacts; Flow Domains and Hubs (domains are via land etc./hubs are points at which the particle is transported before successfully reaching its endpoint); Flow characteristics; Threats to and from the Flow; and Flow Stakeholders.

4.3. Material

By first looking to the ***Flow Particle*** in question, natural gas, the aim will be to gather information relating to the particle's outlook and dependency in the context of the EU-Russia Relations. Documents from the International Energy Agency and Eurostat, the European Union Statistical office, will provide clear and impartial data in this regard.

In order to establish the various ***Flow Domains and Flow Hubs***, operational data that maps out the infrastructure of the pipeline will be consulted. This will come in the form of diagrams and maps from company documents provided by Gazprom and Nord Stream 2 official. This information will be supplemented, where needed, by data and reports provided by leading energy consultancies.

In seeking to understand the specific ***Flow Characteristics***, documents from a range of sources will be consulted. This will involve setting out the political and economic implications of the flow. In seeking to develop this section, a range documents including EU and Member State policy documents, and academic literature on the topic, will provide comprehensive insight into this category.

Threats to the Flow will be examined using a number of sources. Reports from energy consultancies and official Nord Stream 2 documents will help capture technical aspects of risk that may be lacking in other sources – such as risk assessment reports – whilst national and supranational government policy in respect of things such as critical infrastructure and energy will also help to further compound broader areas of perceived threat.

The ***Flow Stakeholders*** will be broken down into states and companies. Establishing the countries involved will require looking to those who interact with the flow's movement, and this will largely draw on the information previously gathered in respect of Flow Hubs and Flow Domains. Information on companies involved will be gathered, but will require consultation of a more diverse range of sources. Company websites, including those of Gazprom and Nord Stream 2 official, will provide basic information on companies involved. It will also be important to establish where parastatals are present. This will prove vital in seeking to examine the extent to which the flow principles are being adequately met. In doing so, it is likely that I will engage with sources that try to map the structures of the companies involved, such as reports of a more investigative nature.

Threats from the Flow will be analysed from a number of perspectives. These are discussed widely within national government security policy circles. In light of this, documents from Member States and the EU on the topic of energy security will be consulted. Academic literature on energy security and Nord Stream 2 in particular will help to complement national government and EU sources.

5. Flow Profile

This section will compile and formulate a profile based on the information gathered from materials discussed in the previous section.

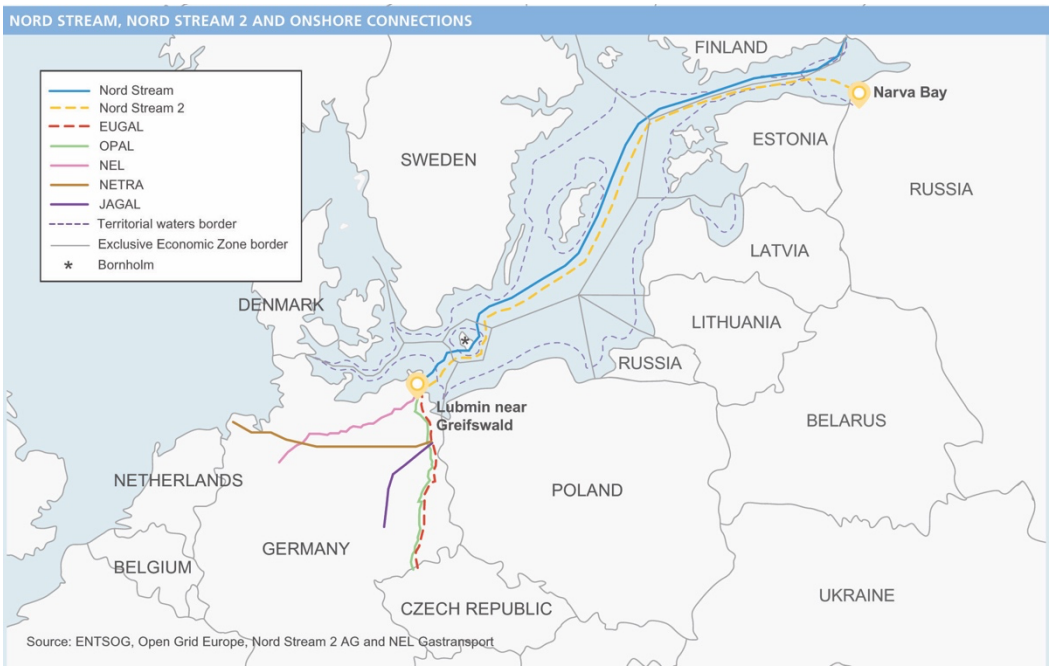
5.1. Flow Particle

In the broadest sense, the flow particle of focus in this paper is energy, but more specifically, it is natural gas and its journey from Russia to Germany via the Baltic Sea through the Nord Stream 2 pipeline.

In 2018, natural gas was the second largest energy source in the EU's energy mix, with only 9.8% coming from inside the EU. From the remaining 90.2% of natural gas imported into the EU, two-thirds of this came from Russia (Eurostat, 2020). Where the EU's own production of natural gas is expected to fall, projections show an increased rate of reliance on the fuel. The retiring of coal and nuclear plants in tandem with new pipelines and LNG projects means that the EU will need to increase its imports by 2025 in order to cover up to a third of its consumption. Projections have also suggested that Russia is in a strong position to remain as Europe's primary source of gas (International Energy Agency, 2019). At present, imports of natural gas are received into Europe from Russian sources via 13 pipelines. If completed, the Nord Stream 2 pipeline, together with Nord Stream, would be the single point of arrival for more than 30% of Europe's natural gas, leading to a greater concentration of routes along the Baltic Corridor (Atlantic Council, 2020; Sziklai et al., 2020).

5.2. Flow Domains

The Nord Stream 2 pipeline carries gas from the natural gas field of Bovanenkovo in Russia. It leaves landfall from Narva Bay in Russia, landing in Greifswald, Germany via the Baltic Sea. En route, the pipeline crosses through the territorial waters and exclusive economic zones of five countries: Russia, Finland, Sweden, Denmark, and Germany (Zogopoulos, 2019). Unlike any other pipelines that provide gas to Europe via Russia, the Nord Stream pipelines are offshore and without compressor stations along their route, only at the landfall end points.



Nord Stream, Nord Stream 2 and Onshore Connections | **Source**: ENTSOG, Open Grid Europe, Nord Stream 2 AG and NEL Gastransport.

The Nord Stream pipelines are unique for European gas supply in that they do not rely on transit via third countries, thus they are not open to the same political or technical risks posed by, for example, the pipelines that enter the EU via Ukraine.

Gas transit route	Capacity	Status
Western Siberia to Germany, via Belarus and Poland	33 bcm/y (Yamal pipeline)	completed 2006
Russia to Turkey	16 bcm/y (Blue Stream)	completed 2003
Viborg (Russia) to Greifswald (Germany)	55 bcm/y (Nord Stream)	completed 2012
	55 bcm/y (Nord Stream 2)	scheduled for 2019
Transit through Ukraine	>100 bcm/y (Brotherhood)	completed 1967
Russia to Finland and Baltic region	5 bcm/y	n.a.

Gas Transit Routes from Russia to Europe | **Sources**: Gazprom Export, Institute of Energy Economics at the University of Cologne

5.3. Flow Hubs

Flow Hubs constitute infrastructure that act as convergence points and facilitate the logistics of flows. From its start point, gas will be fed into the Nord Stream 2 pipeline from the Slavyansk Compressor Station in Narva Bay, which is operated by Gazprom (Zogopoulos, 2019). At Germany, landfall gas is received from the pipeline into the Lubmin 2 natural gas receiving station, operated by German natural gas operator GASCADE, a joint venture between German chemical company, BASF, and Russian parastatal, Gazprom (EUGAL, 2021).

The ongoing construction of the pipeline and its contentious political nature has meant that contracts for operations and maintenance are still being picked up, and in some instances, dropped in the face of evolving political developments. US opposition to the project has seen German contractor Bilfinger pulling out of a contract to run the pipeline's monitoring and safety systems (Moody, 2021). A number of insurers have also withdrawn from the project in light of increasing pressure from the US (Gardener, 2021). This is likely to mean one of two things – that the US ultimately achieves its goal of halting the project completely, or contractors, who are less deterred and more determined by US opposition (likely of Russian origin), step in to take over key aspects of the project such as its safety and monitoring. It would not be the first time the latter has occurred – in 2019, Swiss firm AllSeas Group SA ceased pipe-laying operations on Nord Stream 2 in light of US sanctions, with Gazprom having to step in to complete the designated section with its own resources (Elliot, 2019).

European Natural Gas Pipelines from Russia | **Source:** Oil & Gas Journal

5.4. Flow Characteristics

Energy is the lifeblood of the modern economy, and for that reason, it is often characterised as an area of high politics. This gives energy flows a particularly distinct set of characteristics, making it the flow from which all other flows are sustained.

When broken down further by energy source, it is possible gain even greater insight into a flow's characteristics. The energy source in the context of this study, natural gas, and the way in which it predominantly flows into Europe, distinguishes it from other energy sources. Natural gas is seen to travel into Europe largely via pipelines. This means considerations about infrastructure and security differ to, for example, oil – where imports into Europe are predominantly transported using vehicles, such as trains and ships. Maritime choke points and bottlenecks are thus less of a concern, whilst supply line cut-offs and infrastructure breakdown are more pressing (Stevens & Emmerson, 2012).

5.5. Threats to the flow

The main threats to the continued flow of natural gas via the Nord Stream 2 pipeline could be grouped into 4 categories: physical attacks, cyber-attacks, ageing infrastructure, and natural disasters (Drossos, 2017).

5.5.1. Physical attacks

Just as tankers at sea transporting oil are vulnerable to the risk of hijack or attack, pipeline infrastructure is also vulnerable to attack. The physical threat to pipelines from terrorist groups or criminals is a concern that has been raised both in academic and policy circles (Ćurčič & Petronic, 2020). Critical energy infrastructure is seen to be a potential target for terrorism, given the importance of continued energy flows to states. During the period of 2010-2014, bombings were the most common type of attack upon energy targets, closely followed by arson and sabotage (UNSC, 2017). Though in the context of Nord Stream 2, the targets for attack are fewer, given that it is a subsea pipeline and not on land. The two most vulnerable areas of physical attack are the compressor stations at either end of the pipeline in Russia and Germany.

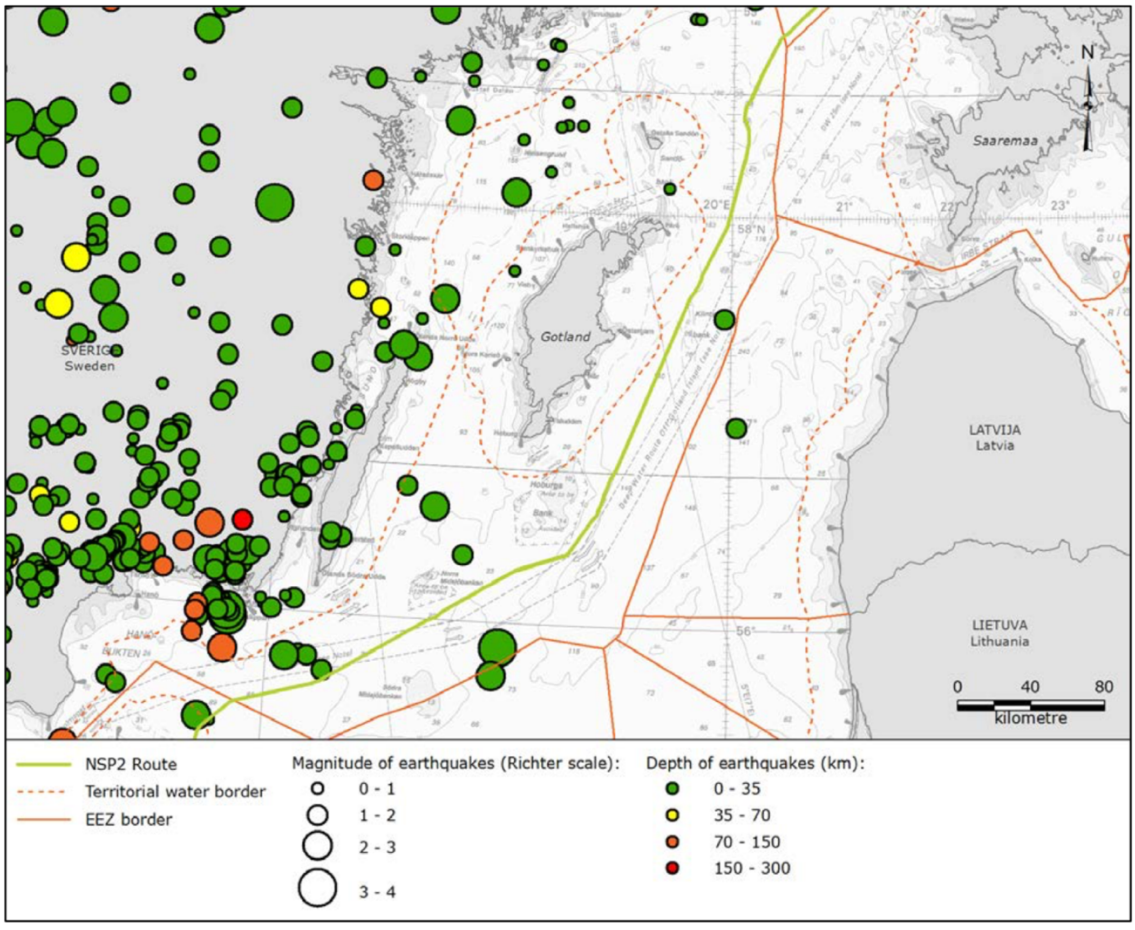
5.5.2. Cyberattacks

The potential for cyberattacks to disrupt or cut the flow of natural gas is also a key concern (Dancy & Dancy, 2017). The real and possible threat of a cyberattack upon energy infrastructure is apparent. In February 2020, an attack was launched on a gas compression facility in the US, causing it to shut down for two days (O'Flaherty, 2020). More recently, in May 2021, the US colonial pipeline – which carries 45% of the East Coast's supply of diesel, gasoline and jet fuel – was subject to a cyber-attack (Russon, 2021). Cyberattacks upon energy infrastructure have also occurred closer to home, with Ukraine suffering two blackouts on their

electricity grid in 2015 and 2016 respectively as a result of Russian hacker groups (Park & Walstrom, 2017). Recommendations put forward by the European Commission in 2019 also suggested that the cybersecurity of energy systems should be given a dedicated sectorial approach due to the mixture of new and old technologies and the cascading effects that disruptions can have (European Commission, 2019).

5.5.3. Natural Disasters

Natural disasters are another potential threat to energy infrastructure and the continuing flow of energy. The Nord Stream pipelines are subsea rather than on land, and situated in what is known as the Tornquist Zone. This is a zone of deformation that has been tectonically active on a number of occasions (Ramboll, 2016). Whilst in global terms, this region is devoid of earthquake activity, there is still the occasional occurrence of seismic activity such as small-scale earthquakes (Ramboll, 2016).



Seismic activity in Baltic Sea region between 2000 – 2016 | **Source**: Ramboll Nord Stream 2 Environmental Study, Sweden.

5.5.4. Ageing infrastructure

The construction of Nord Stream 2 is ongoing, and by this simple fact, it could be seen as superior to many other pipelines that reach into the European gas market. Importantly, if Nord Stream 2 becomes operational, along with the Nord Stream pipeline, it will be less than a decade old and capable of transporting 110 billion cubic metres of gas a year. Rather in contrast to the modern development of Nord Stream 2, two-thirds of all Ukrainian pipelines are over 32 years old. Gas network failures detected in Ukraine since 2013 have been primarily down to technical failures such as gas leaks and pipeline damage (KPMG, 2017). This is particularly significant, given that the Ukrainian Brotherhood route is currently the highest capacity flow for gas into Europe, yet it also one of the oldest.

5.5.5. EU policy on threats to the flow

Policy makers at EU level have sought to address potential threats to gas flow through a number of important regulations. The Security of Gas Supply Regulation 2017 deals with gas supply shortages caused by a number of factors, including cyberattacks, war, terrorism and sabotage. This sets out rules for regional risk assessments and emergency planning, as well as a solidarity mechanism for shortages. Beyond this, the EU has also introduced legislation to deal with the specific threat of cyberattacks. Both the Network and Information Systems (NIS) Directive 2016 and the Cybersecurity Act 2019 compounds the EU's wider cyber security strategy to ensure competent, up to date modes of monitoring, as well as adequate threat notification systems (European Parliament, 2019).

The protection of critical energy infrastructure is also in and of itself a key area of focus for both the EU and Member States. Born out of the European Programme for Critical Infrastructure Protection (EPCIP) launched in 2005, the EU introduced a directive in 2008 on the identification and designation of European Critical Infrastructures and the assessment of the need to improve their protection (Directive 2008/114/EC). Germany, the Member State through which Nord Stream 2 will connect to the wider European Gas network, also has its own National Strategy for Critical Infrastructure Protection (CIP) (Federal Ministry of the Interior, 2009). Additionally, the Portuguese Presidency of the Council of the European Union further reiterated the importance of protecting critical infrastructure in Europe (European Commission, 2021).

5.6. Flow stakeholders

The stakeholders of the Nord Stream 2 flow come largely in two forms. The first is the national and supranational governments' domains or exclusive economic zones through which the flow travels. In this case, that is Russia, Finland, Sweden, Denmark and Germany. The involvement of four EU member states in this flow means the European Union is also seen to be a stakeholder.

Beyond the flow's engagement with national and supranational governments, the second largest set of stakeholders comes in the form of companies involved in the construction, maintenance, operation and funding of the project.

An agreement signed between Russian state-affiliated energy company Gazprom and five European energy companies – E.ON, OMV, Shell, Wintershall, and Engie – shows who the key company stakeholders are (European Parliament, 2016). Gazprom holds a 50% share of the project, with the other 5 having 10% each. It is also important to highlight where the shareholding companies are based. E.ON and Wintershall are both German companies, OMV is Austrian, Shell is British incorporated and Dutch-based, and Engie is French. All of these companies are either owned in part or associated to a degree with the governments of where they are based. This would suggest the Austrian, British, Dutch, and French governments could be considered further stakeholders, given they are likely to be beneficiaries of the flow in one form or another.

5.7. Threats from the Flow

Threats in this regard are largely subjective, and for that reason, the flow's stakeholders bare a particular relevance. Threats that are perceived to stem from the flow can largely be derived from the polarised debate around the implications of Nord Stream 2 for security and energy dependence. These concerns are manifested largely in the security policy deliberations of the EU and some of its Member States, as well as the US. The biggest threat that is seen to stem from the flow is Russian leverage over Europe.

Across all institutions of the EU, there has been concerns raised about the threat to the wider EU energy strategy, as well as the potential of Russian leverage as a result of increased dependence. The European Parliament adopted a resolution in January 2021 calling for a halt

to the project on the basis that the EU should not be a welcoming place for the wealth and business of the Russian Regime (European Parliament, 2021). The European Commission has also been vocal in its lack of enthusiasm for the pipelines, seeing it as a direct threat to the diversity and security of supply objectives of the EU's energy strategy (Geropoulos, 2021).

The concerns about Nord Stream 2 are seen to mirror much those of that were raised about the first Nord Stream pipeline. This saw Nord Stream as a Trojan horse, which undermined EU-wide attempts towards greater energy diversification (European Policy Strategy Centre, 2016). The concerns held about Nord Stream 2 by many Member States in Central and Eastern Europe culminated in a letter signed in 2016 by eight leaders (Czech Republic, Estonia, Latvia, Hungary, Poland, Slovakia, Romania and Lithuania). The letter stated concerns that the Nord Stream 2 pipeline would bring about "potentially destabilising geo-political consequences" due to the fact that the project would strongly affect the gas market development and gas transit departments in the Central and Eastern European region.

Looking more deeply at specific states in Central and Eastern Europe, and the deliberations of their national security policy in respect of Nord Stream 2, there is a recurring theme of concern around both dependency and the threat to the overall security of the state. Poland has proven to be one of most ardent opponents of Nord Stream 2, perceiving the pipeline as furthering dependence on Russian gas and sustaining an already operational Russian instrument for political pressure (National Security Strategy of the Republic of Poland, 2020). The current role played by many Eastern European states as transit countries for the wider European gas market has been likened to an insurance policy against Russian meddling (Goldthau, 2016). It is therefore no surprise that Poland, Slovakia and the Czech Republic have been increasingly concerned about what Nord Stream 2 will mean for its future economic and physical security (Wettengel, 2021).

6. Empirical Analysis

The aim of this research is to assess the extent to which Flow Security theory can provide us with distinctive insights into the implications of Nord Stream 2 for EU-Russia energy relations. The broader process of ensuring adequate Flow Security will be underpinned by testing Nord Stream 2's 'Flow Profile' against five key principles. Through these tests, the intention is to draw out challenges that are specific to the flow and its implications for the relationship between the EU and Russia.

The five principles are diversity and redundancy; robustness and resilience; layered segmentation; critical node protection; and dynamic systems.

6.1. Diversity and Redundancy

The principle of diversity and redundancy is built on the idea that flows are developed with resilience in mind. Energy security is concerned with both ensuring an uninterrupted availability of energy sources at affordable prices, and being able to react promptly to sudden changes in supply balance (IEA, 2019). In light of this, ample consideration should be given to the dependence and concentration of energy sources, as well as the mechanisms in place to deal with shocks.

If we look at what Nord Stream 2 means for dependence and concentration of gas supply into Europe, once operational, together with Nord Stream, it will account for around 30% of gas flow into Europe. This is a relatively high degree of concentration along the Baltic Corridor, at just under one-third of supply. Though there are alternative gas flows into Europe that match Nord Stream's capacity, such as those that come via Ukraine, this is simply a diversity of routes, not a diversity of supplier. This could be seen as a symptom of more state-based geopolitical endeavours undertaken by Member States when seeking to manage and develop their energy mix. Whilst a slowing natural gas production within the EU warrants an expansion of alternative energy sources, a furthering of dependency on Russian gas, in the way that Nord Stream 2 does, only seeks to lessen the extent to which an overall diversity of energy flows is achieved.

The EU has sought to offset this lack of diversity through a number of legislative energy packages. These have been designed to implement a degree of market-based governance to ensure that the energy markets of the EU move towards a more secure and diverse source of

supply. The EU introduced the security of gas supply regulation in 2010, following the gas crises of 2006 and 2009. The legislation required Member States to undertake risk assessments of supply, develop preventative action and emergency plans, and regularly monitor security of supply at the national level (EU Regulation 994/2010). A further legislative package in 2017 bolstered this with the addition of a solidarity clause. The clause stated that Member States are obliged to take certain pre-defined solidarity measures in a gas crisis (Regulation (EU) 2017/1938, Art 13).

The EU has also sought to put in backstops for potential gas disruptions through the use of Liquefied Natural Gas (LNG) reserves, which allow it to store gas for later use. It is important to highlight that this method currently has its limitations. Whilst LNG imports into the EU is expected to grow, many EU states are still in the process of developing LNG regasification capacity. Furthermore, up to 40% of EU's LNG regasification capacity is also unable to be accessed by neighbouring states, with many in Central and Eastern Europe limited in their access to alternative sources of supply (IEA, 2019).

Whilst the EU's market-based approach has been able to sculpt a path towards diverse and redundant flows of energy on paper, realising this in a practical sense is largely dependent upon the goodwill and agency of Member States to meet their obligations. To a large extent, taking a market approach towards achieving diversity and redundancy means providing measures, obligations and rules to do so, yet this is only halfway to meeting this principle. States have to exercise discretion in decisions about their energy mix and ensure they are in line with wider institutional obligations. Nord Stream 2 has shown the shortcomings of state deviation from these obligations. It runs counter to the aims and ambitions of the EU's wider plan for European Energy Security, whilst offering up no new energy supplier and continuing to rely heavily on an uptake of natural gas (Giuli, 2018).

Therein lies a key issue for the energy relations of EU and Russia in the context of Nord Stream 2; the EU can only go so far as to provide regulatory cover for a project that it sees as counter to the aims of a secure and diverse energy mix. Even by the EU's own admission, the decision to assess this flow as sufficient for European wider energy aims lies at state level, and so too does the decision to call quits on the project overall (Abnett, 2021).

6.2. Robustness and Resilience

The principle of robustness and resilience is concerned with the capabilities of a flow to withstand attacks and disruptions, as well as its ability to rebound and quickly begin functioning again. The extent to which the principle of diversity and redundancy is achieved can also have a bearing on how robust and resilient a flow is.

It could be argued that for the most part, the Nord Stream 2 pipeline is robust in the fact that it is majority subsea, which shields it to a large extent from deliberate physical attacks. In comparison to other natural gas pipelines, it is also a new development and thus is naturally not subject to the same degradation as other pipelines in Europe, though this does reduce the reliability of older alternative routes in the event of a cut off via the Nord Stream pipelines.

What is more likely to challenge this flow's robustness and resilience is the occurrence of either a natural disaster or cyberattack. In this event, a number of factors will determine the degree to which this principle is met. Addressing a shortage via alternative routes is one way to mitigate a cut-off, but this would depend on the cause. A natural disaster that cuts Nord Stream's supply would allow the use of alternative routes into Europe and solidarity measures to rebound and address shortages. However, the ability to mitigate a disruption could become severely diminished in the face of a co-ordinated cyberattack upon Russian-sourced gas pipelines, or deliberate foul play from the state itself.

Whilst market-based attempts to develop procedure and protocol for protecting key infrastructure from cyberattacks can be useful, there requires a degree of state and market collaboration to ensure that national security and defence policy is implemented in a co-ordinated and effective way. The operators of energy systems are not state actors, and they are likely to require the states' capabilities to identify and respond to attacks (Energy Expert Cyber Security Platform, 2017). Therefore, it is pertinent that in order to ensure the most robust and resilient of flow systems, there exists a degree of open collaboration between state, corporations and their respective systems operators.

The institutional market reach of the EU in respect of Nord Stream 2 can seek to ensure that Member States such as Germany and businesses operating in its domain adhere to directives that seek to ensure a robust and resilient response to cyberattacks. Yet, it cannot go as far as to dictate to a third country, such as Russia or its businesses, how best to implement policy against

cyberattacks. There is thus a degree of state to state collaboration and information sharing required to ensure common procedures and best practices are in place.

It is clear that if left to the mercy of company operators, the resilience and robustness of the Nord Stream 2 flow system would be inadequate. Though operators can often be obligated to adhere to a framework of best practice in ensuring protection from cyberattacks – such as the Directive on Security of Network and Information Systems – they are not sufficiently equipped to deal with the fallout from supply cut offs; that is primarily the responsibility of the State. Nord Stream 2 faces difficulty in that it is dependent upon the Russian State for ensuring that adequate protection is afforded by the compressors operators at their end. At present, the contractor responsible for the pipeline's overall operation and maintenance is also unknown. Whether that operator turns out to be Russian-affiliated or European-based is likely to have a bearing on the level of confidence in how well this flow achieves the principle of robustness and resilience.

6.3. Layered segmentation

Layered segmentation is about installing a degree of variation in a flow system. In doing so, it is possible to ensure that vital parts of a system are separated out to avoid the potential for the whole system to fail, jeopardising the overall integrity flow.

The Nord Stream 2 pipeline and its broader system can be seen to function mainly across three components – a compressor station located in Russia, a compressor station located in Germany, and its wider operational and technical maintenance system. Whilst Gazprom operates the compressor station in Russia, it also jointly operates the compressor station in Germany through GASCADE – a joint venture between BASF and Gazprom. German contractor Bilfinger was set to provide the operational and technical maintenance for the pipeline but has since withdrawn in the face of US sanctions. The issue now is who will take over; US sanctions means it is unlikely any European or American company would step in, so it may fall to a Russian-affiliated company to take over the contract. Overall, this could lead to Russian energy parastatals being responsible, in some capacity, for all parts of the Nord Stream 2 flow system.

From the state-based perspective of Germany and Russia, there is at least the perception that the completion of Nord Stream 2 will provide some economic and political benefit. It has thus largely fallen upon the EU to try and maintain a degree of institutional market control over the

way in which the energy networks of the pipeline will operate. The EU gas directive adopted in 2009 set out requirements for the unbundling of energy supply arrangements. This sought to ensure the full independence of network operation from supply and production interests (Directive 2009/73/EC).

This directive was subsequently amended in 2019 to apply to gas pipelines involving third countries, bringing the EU section of Nord Stream 2 directly under its unbundling requirements. Whilst the wider intention was to include the whole of the pipeline, negotiations between France and Germany led to an agreement that the gas directive amendment should be restricted to the territory and territorial sea of the Member State where the first interconnection point is located (The Oxford Institute for Energy Studies, 2019). The German state subsequently implemented this directive into national law (Elliot, 2019). Though the gas directive's intention was to capture the whole pipeline under its unbundling requirements, state-based deliberations at European Council level meant that this reality was subverted (Council of the European Union, 2019).

In order to sufficiently achieve layered segmentation, it is incumbent upon states to ensure that national laws in respect of energy policy are geared towards maintaining diversity in a flow system. It is evident that the EU has attempted, through market-based means, to direct the composition of the Nord Stream 2 flow system towards one that separates out vital parts of the system. Though it has been effective at implementing and defending its position, it has only managed to do so as far as German territory extends (Hall, 2020). The flow of gas is one way, from Russia to Europe, as such institutional market requirements should extend the whole length of the pipeline. Yet, it is as a result of state actions that these rules stop short of being fully effective. Sweeping applicability of the Gas Directive and its unbundling requirements would help to guarantee layered segmentation and a greater degree of Flow Security. Therefore, it falls upon states to decide what is more important when it comes to key energy flows, investment case or security. For Russia, this flow is more likely to be about investment case and political leverage, rather than ensuring Europeans are provided with safe and secure energy flows.

6.4. Critical node protection

Critical nodes can largely be characterised as the key infrastructure or convergence points in a flow that are of paramount importance to its continued facilitation. The flow of energy via Nord Stream 2 is distinct from that of any other gas flow into Europe – given its distinct lack of transit countries prior to it reaching Europe. This has the twin effect of reducing the number of critical nodes, but also concentrating vulnerability. The two key nodes in this flow are located in Russia and Germany, the points at which the gas is compressed and received, and then sent along the line and distributed respectively.

On the German end, Nord Stream 2 could be seen as covered by the EU-wide critical infrastructure protection strategy, which would afford the compressor station located in Lubmin with the status of European Critical Infrastructure (ECI) (Directive 2008/114/EC). This protection is reaffirmed at national level too – with the German Critical Infrastructure protection strategy providing protection for critical infrastructure. Both strategies work in tandem with the purpose of providing preparedness and responsiveness in the event of attacks upon key infrastructure. Though responsibility does not lie solely with states and institutions, a large proportion of critical infrastructure, such as Nord Stream 2, is owned and operated by private-sector companies (Anglmayer, 2021). Therefore, ensuring adequate protection of a flow's critical infrastructure requires the close collaboration of the public and private sector. Whilst institutions like the EU can develop policy for the protection of key infrastructure, and states can provide the adequate response mechanisms, a degree of responsibility lies with private sector operators to ensure that they do all they can to ensure protection standards are met.

The challenge for Nord Stream 2 is that the requirements for critical infrastructure protection only extend to the territory of the EU. Therefore, the extent to which critical node protection is achieved in respect of Nord Stream 2 is diminished by the fact that a critical node of the flow is located in the Russian domain – out of reach from EU ECI guidance and protection. The strength of this principle could diminish in light of a lack of interstate policy co-operation and general lack of knowledge about the Russian approach to critical infrastructure protection (Pursiainen, 2020).

This is where the reach and abilities of markets and institutions is severely stunted. Whilst it can highlight and guide both state and corporations on areas for protection against physical and

cyber threats, it is ultimately states who deliberate and implement the defence and security policies that deal with substantive responses in this area. It is also state action that would serve as the most adequate response in light of an impending threat. Therefore, it is possible to appreciate that there is a certain synergy required between markets and states in order to guarantee sufficient protection of the Nord Stream 2 flow. Ultimately, what is taking place is institutional guidance and state-based action on what is effectively security policy. On this particular principle, states can be seen to go where the markets cannot. This principle in particular draws attention to Russia's central role, and a lack of knowledge about its security operations. This severely diminishes the ability to guarantee that this flow principle is being met.

6.5. Dynamic system

A dynamic flow system is one that that can adapt and be resilient in response to changes. In respect of natural gas, this is largely about responding to gas shortages and cut-offs. High natural gas dependency and concentrated sources as a result of Nord Stream 2 leaves little room for flexibility in the event of cut-offs or shortages. If the problem of supply is related to supplier or source, then alternative routes provide little help – this is exactly the issue with the current natural gas networks in Europe. Even if the alternative routes are used, they may not be fully reliable or without issues (KPMG, 2017). Any routes that do exist with an alternative supplier, such as the Southern Gas Corridor, are dwarfed by the level of capacity dependence on Russian Gas (Cohen, 2021).

The Nord Stream 2 pipeline is also seen to reconfigure the balance and direction of gas flow in the EU. The twin operation of both Nord Stream pipelines is likely to result in the diminished input of gas via Ukrainian/Belarusian pipelines. This has the effect of turning the flow of gas from East-West to West-East. Gas cut-offs and shortages have long been a particular concern in Eastern Europe; therefore, having adequate technology to address this forms part of ensuring a dynamic system. This has largely taken shape in the form of reverse flows, which allows European Member States to reverse the flow of energy without much difficulty, allowing them to share gas with ease (Russell, 2017).

An issue that diminishes the dynamism of the overall system is the lack of coherence amongst Member States and their energy mix, and approaches to ensuring a secure supply. EU Member States have dealt with the potential increase in dependence along the Baltic Corridor in different ways, leading to a lack of joined-up thinking in response to changes (Pérez et al., 2019). This is particularly so for countries in Central and Eastern Europe, who have divergent dependencies on energy sources, and thus reduce their ability to work in solidarity. An example of this is the energy policies of Hungary, which are seen to gravitate towards nuclear power and natural gas, both with Russian input, whilst Poland is still heavily reliant on coal and lacks a diverse and clear path for its energy policy. The dynamism of Nord Stream 2 and the view that it provides greater energy security is seen to diminish in light of EU Member States' divergent energy mixes.

7. Conclusion

The aim of this thesis was to establish whether the theory of Flow Security can help to broaden our understanding of the implications of Nord Stream 2 on the EU-Russia energy relationship.

The empirical analysis has shown that Flow Security theory is able to capture what the more broad-brush generalist approaches of the market and geopolitics have missed, and that is how we manage the specific components of energy distribution and supply. By offering a set of concepts that drill into particulars such as infrastructure security, system diversity and response mechanisms, it is possible to produce a more fine-grained analysis of the energy security landscape.

Analysing the Nord Stream 2 flow against the five principles of Flow Security has reaffirmed the continued need to acknowledge the role of the markets in setting clear rules and regulations in order to protect and preserve key energy flows. It also acknowledges the geo-political reality of operating in a world where not everyone co-operates, and highlights the need to instil a degree of resilience and diversity into a flow system, so if one player does not step in, there are viable alternatives.

The EU's engagement with the five flow principles is apparent. On diversity and redundancy, it has set out a strategy for attaining greater energy diversity and security across Europe. Similarly, its efforts to achieve robustness and resilience, as well as critical node protection, has seen it designate best practice on procedure and protocol in light of threats and disruptions. On layered segmentation, it has gone as far as to try and ensure that the Nord Stream 2 pipeline is constructed without one actor monopolising the flow's supply and operation. The regulatory apparatus that the EU has developed around the Nord Stream 2 flow is indicative of its wider aspirations of achieving a dynamic energy system for Europe.

Yet, Flow Security theory has shown us in greater detail why energy security cannot be sustained by the market alone. It is important to remain cognisant of the geo-political reality that it is states who ultimately deliberate their energy mix, as this has a significant bearing on the extent to which the principle of diversity and redundancy can be met overall. Furthermore, Nord Stream 2's robustness and resilience is also dependent on the ability of states and

corporations to exercise agency in implementing procedure and protocol on the ground. States must have a clear strategy in response to attacks and disruptions, whilst also being able to depend upon the private operators of flows to take precautions in respect of Flow Security.

It has also allowed us to gain greater insights into the specifics of having Russia as an energy partner and how that affects the security of a flow. Whilst a geo-political approach simply focuses on the fact that Russia is an authoritarian actor who may use power and leverage to get what it wants, the markets tend to be concerned with containing and preventing its monopolistic practices. Flow Security theory considers both of these in tandem and applies them to specific areas. The ambiguity of the Russian state and its associated energy parastatals means that we know very little about the procedures it has to protect critical energy infrastructure. The market dominance of companies such as Gazprom also diminishes the diversity of the Nord Stream 2 flow system, whilst the overall concentration of supply source reduces the dynamism and resilience of the flow in the face of cut-offs and disruption.

The utility of Flow Security lies in its ability to move beyond what the states and the markets can do in isolation to sustain energy security, and focuses on how each has a role in ensuring that the security of networks of energy supply and distribution are sustained. This more holistic picture brings together perspectives that were previously counterposed and applies them in a more concentrated framework.

Through Flow Security theory, it is possible to see how the markets and states are both responsible for determining the degree to which flow principles are met. This could be seen to play out in the market-based approach of the EU, which pushed for the expansion of its gas directive to include the whole Nord Stream 2 pipeline under its supply and distribution unbundling requirements, whilst it was the geo-political reality of negotiations between France and Germany that prevented these rules applying beyond German territory.

Flow Security is seen to go beyond what the implications of both market and state-based action means for energy security more broadly, and looks specifically at how they affect individual aspects of a flow. Focusing in on layered segmentation and diversity makes it possible to draw out how the EU's inability to extend its regulatory reach beyond German territory has left much of the pipeline in the hands of one stakeholder (Gazprom), jeopardising efforts to achieve an

adequate level of layered segmentation, whilst a dynamic system is only possible when Member States take it upon themselves to adhere to a more diverse and resilient supply strategy laid down by the market based approach of the EU.

Flow Security theory emerges as an effective middle range theory that proves to be useful at explaining the challenges of energy security at micro level, compared to the previous meta theories of the market and geopolitics. It is clear that the market approach to energy security sees open competition, clear rules and regulations, and all parties joining together, as conducive to the efficient functioning of energy flows, whilst geo-political approach to energy security is mindful of the fact that some actors do not play by the rules, with state enterprises operating within markets in a way that creates monopolistic control for political and strategic pressure. These notions are of course relevant, but do little to help develop our understanding of the specific problems faced in respect of securing specific energy flows. Flow Security theory assesses the technical aspects of a flow and how the markets and states around it can work towards ensuring they are adequately protected.

The analytical framework applied to Nord Stream 2 in this paper could be applied across any number of energy flows in order to test their ability to satisfy the five principles of Flow Security. Furthermore, this research has shown that no flow operates in isolation, and doubts about the reliability and security of one flow can ultimately spill over into another. This research could thus be seen to form part of a much wider picture of the European energy landscape and the security of global energy flow systems. It is possible to envision how with each flow examined under this framework, our knowledge and understanding about the integrity and security of global flow systems becomes more enriched.

Lastly, future research is not confined to energy flows and there are grounds to expand this analytical approach out to all of the five critical flows, including goods and services; capital; information and tech; and people. The dependence of the global economy on the continuation of these flows is an unavoidable reality.

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