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The green energy transformation in the EU: A case study of asymmetrical interdependence

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Abstract

Keohane and Nye (2001) highlight that power calculation is even more delicate and deceptive than in previous ages, where interdependent economies, communications, and other human aspects are intertwined in the world as we know it today. However, it can be argued that the traditional realist concept of national security, together with interdependence and international regimes are also present in current global issues. In specific, this research intends to analyze the rationale behind the urge of the European Union to diversify its energy matrix, both to achieve the sustainable goals set on the Fit for 55 Package, but also to overcome the dependency on Russia in the face of the Russia-Ukraine war deployed on February 2022. This new factor implicated a shift in the EU-Russia relationship, having impacts in the energy context.

For this reason, this master's thesis intends to further analyze the EU dependency on energy and its impacts on the EU green energy transformation through the Interdependency Theory lens. Nevertheless, given the scenario and the nature of the process leading the EU to change its energy strategies, is the EU promoting competitiveness in the growing market of sustainable energies according to Porter's (1990) National Competitiveness framework? The findings point out that the Russia-Ukraine war has accelerated the green energy transformation in the EU, and there are significant EU initiatives promoting competitiveness in renewable alternatives, including biofuels that is the focus of analysis.

Keywords: *asymmetrical interdependence, national competitiveness, green energy transformation, Fit for 55 package, biofuels.*

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Chapter 1. Introduction

The relationship between the European Union (EU) and Russia in the energy sector has been a topic of significant interest among policy makers and scholars. The EU's energy security and sustainable goals have driven the need for diversification of energy sources and suppliers that dates back to 1995 when the EU started to be more active regarding sustainable concerns. From then to now, several policy papers, recommendations, regulations, and binding targets were developed along the years[1].

However, the Russian invasion in Ukraine introduced a complex factor due to the close relationship and energy dependency between the EU and Russia. The EU found itself in a vulnerable position as Russia holds a significant share in the European market for oil and gas, each with its own specificities. This thesis, therefore, aims to investigate the asymmetrical interdependency between the EU and Russia, focusing on the impacts of this relationship on the EU's green energy transformation framework.

Drawing upon the Interdependence theory by Keohane and Nye (2001), the thesis considers vulnerability as a crucial concept in understanding modern international relationships. Actors in vulnerable positions are driven to act in order to improve their position within the relationship, which in turn impacts global dynamics and international regimes. The concept of vulnerability is key to comprehending the EU-Russia relationship in this study.

Previous literature on the topic has mainly taken a liberal approach, emphasizing commercial interests and positive trade flows between the EU and Russia. Scholars have assessed the risks and concerns associated with this relationship. However, with the changed context following the Russian invasion, a new reality has emerged, necessitating an updated analysis.

Furthermore, to gain insights into the current state of renewable energy within the EU, the biofuel sector was selected for analysis. This choice was driven by the recognition that the transport sector plays a significant role in pollution with high greenhouse gas emissions, and the EU has been making efforts to regulate the biofuel production[2]. The specific objective is to evaluate how the EU is fostering competitiveness in order to achieve its sustainability targets and reduce energy dependency. To accomplish this, the study will apply Porter's National Competitiveness theory.

[1] European Commission, *An Energy Policy for the European Union* (European Commission, 1996). P. 5.
[2] European Environment Agency, "Greenhouse Gas Emissions from Transport in Europe," European Environment Agency, 2019.

Chapter 2. Methodology

The present chapter is designed to introduce methodological considerations. First, it presents the problem formulation, highlighting the main research questions and the central issue addressed in the master's thesis. Next, the thesis objective is defined, specifying the specific goal and purpose of the research. This objective guides the entire study and helps establish the analysis's scope and focus.

Following, the choice of theories and research design are presented, explaining the sources of information and conceptual frameworks that will be utilized in the analysis. The chapter also acknowledges the study's limitations, recognizing potential constraints or challenges that may impact the research findings.

2.1 Problem Formulation

The European Union has set ambitious goals to transition to green energy as part of its efforts to combat climate change and reduce carbon emissions. This transition is driven by various policies, targets, and funding mechanisms that encourage the adoption of renewable energy sources, energy efficiency measures, and a shift away from fossil fuels.

The EU has set a target of achieving a 55% reduction in greenhouse gas emissions by 2030 compared to 1990, with a long-term goal of achieving net-zero emissions by 2050. The strategies to achieve these goals are set in the Fit for 55 Package, which is the comprehensive plan adopted by the EU. In addition, there are other policies and initiatives, including the European Green Deal, the Renewable Energy Directive, and the Energy Efficiency Directive[3].

However, since the Russia-Ukraine war outbreak, the energy sector has experienced significant changes as Russia sought to use the energy export shortage as a source of power to address the EU support towards Ukraine[4]. Conversely, the EU adopted sanctions to limit revenue toward Russia. Given this scenario, in 2020, before the war, the EU imported 57,5% of the total energy consumed while its stock satisfied only 42,5%[5]. From the total imported, 24,4% of the energy supply came from Russia[6].

In response to Russia's actions, the EU has imposed various sanctions on imports and exports, including restrictions on exporting technological goods and strategic equipment from

[3] Matteo Ciucci, "Energy Policy: General Principles | Fact Sheets on the European Union | European Parliament," www.europarl.europa.eu (European Parliament , September 2022)
[4] Marco Siddi, "EU-Russia Energy Relations," *Handbook of Energy Governance in Europe*, 2022. P. 240.
[5] "EU Energy Mix and Import Dependency," ec.europa.eu, accessed April 11, 2023.
[6] Ibid.

the EU to Russia. The EU has also announced plans to halt crude oil imports from Russia in December 2022 and refined petroleum from February 2023. Additionally, the EU has targeted other vital sectors, such as coal, steel, and gold[7].

Russia, in turn, has limited its gas export to the EU, mainly through the Nord Stream pipeline, which is one of the most significant routes for delivering gas to Europe. This has raised concerns about energy security in the EU, given its high dependence on gas imports and the potential for supply disruptions.

Looking at it from a sustainability standpoint, the EU's heavy reliance on natural gas imports from Russia has put it in a precarious position where it must adapt quickly to avoid an energy shortage for its population. Additionally, there is the risk for the short and medium term of the EU's plans to mitigate greenhouse gas emissions to be jeopardized. Therefore, the scope of this MA thesis is to answer the following:

(i) How does the EU-Russia asymmetrical independence relationship impact the European Union's green energy transformation?

For that, the Interdependence theory will be used as the theoretical framework to analyze the issue and establish the basis for the analysis. Additionally, using the National Competitiveness theory, the research aims to determine

(ii) How is the EU promoting competitive advantage in the biofuel sector?

2.2 Thesis Objective

The European Union's (EU) commitment to combat climate change by reducing carbon emissions by 55% by 2030 and achieving carbon neutrality by 2050 underscores the significant role of the energy sector in achieving these goals[8]. With the energy sector responsible for 75% of the region's greenhouse gas (GHG) emissions, it has become a crucial focus area for the EU's green energy transformation[9].

The green energy transformation is a crucial strategic priority within the EU, encompassing various aspects such as security, trade, sustainability, and economic development. The EU recognizes that transitioning to renewable and sustainable energy sources is essential for achieving its climate objectives while promoting energy security and fostering economic growth.

[7] European Council, "EU Sanctions against Russia Explained," Council of the European Union, 2022.
[8] European Parliament , "Green Deal: Key to a Climate-Neutral and Sustainable EU," June 2022.
[9] European Commission, "Renewable Energy Targets," energy.ec.europa.eu, 2022.

However, the ongoing conflict between the EU and Russia, triggered by the Russian invasion of Ukraine, poses a threat to European energy security. Russia's actions have violated international law and the rules-based international order, challenging the principles of sovereignty and territorial integrity. In response, the EU has implemented a range of sanctions that have impacted the energy market between the two actors. On the Russian side, the gas supply to the EU was cut, putting the EU in a vulnerable position[10].

Given the EU's vulnerability in the energy sector, this thesis aims to explore the impacts of the asymmetrical interdependent relationship between the EU and Russia on the green energy transformation within the EU. The EU needs to diversify and adjust its energy market to reduce dependency on Russia while ensuring a sufficient and reliable energy supply. The challenge lies in avoiding an energy crisis while simultaneously advancing the green energy agenda. In sequence, this paper aims to assess how the EU is promoting competitive advantage to biofuel sector as it is an important market to achieve sustainability in the transport sector.

Through this analysis, the thesis appoints the complexities and implications of the EU-Russia energy relationship, considering its influence on the EU's efforts toward a sustainable and low-carbon future. By examining the dynamics of this relationship, the thesis intends to contribute academically to the ongoing discourse surrounding the green energy transformation in the EU.

The primary objective of this thesis is to put in evidence the various factors at play and their influence on the EU's efforts to transition towards sustainable and low-carbon energy sources. By delving into the interdependencies, challenges, and opportunities within the EU-Russia energy relationship, the thesis seeks to provide valuable insights that can contribute to future developments in the field.

2.3 Choice of Theories

The thesis considers the world view approached by the International Political Economy (IPE) field, where economics and politics affect the world dynamics of actors in the international system. From liberal perspectives to realism, the theoretical chapter explores the nature of international relations and important concepts for the analysis, such as power, state, and globalism, for example. These dynamics are important to be clarified as they have an impact on behavior and actor relationships at the international level.

[10] "Quarterly Report on European Gas Markets Market Observatory for Energy DG Energy Volume 15 (Issue 3, Covering Third Quarter of 2022) Energy," accessed February 21, 2023.

For the first question, Interdependence Theory will be applied to discuss about asymmetrical interdependence and how it affects world politics and the behavior of states. In this case, the EU faced itself in a position of changing policies to respond to the new context after the Russia-Ukraine war outbreak in February 2022. As a result of the asymmetrical interdependence scenario, in which the EU has been reliant on Russia for the supply of mainly fossil fuels and gas, policies have been adopted by both the EU and Russia to adapt and mitigate the associated costs.

Having this scenario in mind, the concept of vulnerability and asymmetrical interdependence as a source of power will be a helpful framework to understand these processes. While governmental actions influence patterns of interdependence and international regimes, the rhetoric of interdependence will also be considered for this present analysis as it is being used as an argument for adopting policies from the EU side.

For the second part, the focus will be on the National Competitiveness theory, which posits that four determinants of the national environment influence the success of an industry on the international stage. However, this theory has been chosen as it frames the role of states in promoting the right conditions for a given industry achieve competitiveness. Hence, it aligns with the EU's accelerated promotion to transition towards renewable energy, including in the context of the biofuels sector. The EU has set targets to increase the share of renewable energy in the transport sector to at least 14%, with a specific minimum share of 3.5% for advanced biofuels[11]. By applying the National Competitiveness framework, the thesis aims to assess whether the biofuels industry is positioned to be competitive in the long term.

For the purpose of this paper, the analysis will be conducted at the State level as the European Union will be treated as a single entity, composed of 28 member states that share common institutions with decision-making power, both at the political and economic levels. This framework will be applied to assess and determine whether the biofuels sector in the EU encompasses the competitive criteria set by Michael E. Porter (1990) and can be considered a competitive and sustainable alternative energy source to meet the fit for 55 package goals.

2.4 Research Design

In this paper, a mixed method has been utilized: qualitative and quantitative. Drawing based on primary and secondary data primarily sourced from (i) academic papers, (ii) journals, (iii)

[11] European Commission, “Biofuels,” energy.ec.europa.eu, accessed May 2023.

private initiative reports and public reports, (iv) regulations, (v) policy briefs, (vi) official statements, and (vii) official data from accredited statical reports. By applying both methods, the qualitative approach offers the understanding development of facts, their reasons, and motivations to uncover trends and phenomena. At the same time, the qualitative method will add numeral data and statical reports to identify hard facts within the analysis. Both will be applied following the deductive approach that aim to confirm the base of the chosen theories.

To address the first research question, the study initiates by conducting a comprehensive review of existing literature related to the case of the EU green energy transformation before and after the Russia-Ukraine war. This literature review encompasses scholarly articles, reports, EU regulations, official statements, and relevant documents that shed light on the subject matter. The research aims to identify key themes, debates, and perspectives regarding the EU's energy context by analyzing this literature.

Building upon the insights gained from the literature review, the study proceeds to apply a theoretical framework within the specific context of the EU's energy dynamics. The chosen theoretical framework provides a conceptual lens to analyze and interpret the interplay between the EU's energy goals, the Russia-Ukraine conflict, and the renewable energy transition.

In the second part of the analysis, the focus will be on assessing the competitiveness of the biofuel sector based on Porter's theory in order to understand its impact on the EU green energy transformation. This sector has been selected for analysis due to its significant contribution, alongside waste, to the renewable energy mix in the EU[12]. The analysis will be based on four criteria, collectively referred to as the "national diamond," including (i) countries' position in the factor of production, (ii) demand conditions, (iii) the presence or absence of related industries and suppliers, and (iv) strategy and structure of companies[13]. The final chapter will combine the findings from both parts of the analysis to provide a comprehensive assessment.

The research design for this study adopts a descriptive approach to collect and analyze relevant data pertaining to the EU's dependency on Russian energy and the renewable energy transition in the context of the Russia-Ukraine conflict. The descriptive approach involves systematically documenting and presenting information, facts, and trends to understand the subject matter comprehensively.

[12] IEA. "Europe – Countries & Regions - Total Energy Supply, 2020," IEA, n.d. Accessed April 2023.
[13] Michael Porter, "Competitive Advantage of Nations," *Competitive Intelligence Review* 1, no. 1 (1990).

Additionally, a problem-solving approach is also employed to identify and explore potential alternatives for reducing the EU's dependency on Russian energy. This approach involves analyzing the biofuels market, challenges, and opportunities associated with the EU-Russia energy relationship.

For that, the research design incorporates the application of the chosen theories and concepts to the empirical case of the renewable's phenomenon in the EU within the context of the Russia-Ukraine conflict. The theoretical framework and concepts provide a foundation for understanding and interpreting the dynamics of the energy relationship, analyzing the drivers and impacts of the renewable energy transition, and assessing the competitiveness of alternative fuels. Hence, a combination of descriptive data collection, problem-solving analysis, and theoretical application.

2.5 Limitations

The author is aware of the limitations relating to the chosen theory of Interdependency, as it does not predict how states will behave in conditions of vulnerability. Keohane and Nye (2001) noted that baring the costs to adapt and create new policies to fight dependency conditions varies according to the willingness. This is not easy to assess as it involves multiple factors that are not exhaustive. However, the focus of this analysis is to understand the impacts of the asymmetrical relationship in the EU green energy transformation and not to assess whether the EU should act in a certain way or not. Therefore, this theory limitation is not relevant for the purpose of the present analysis.

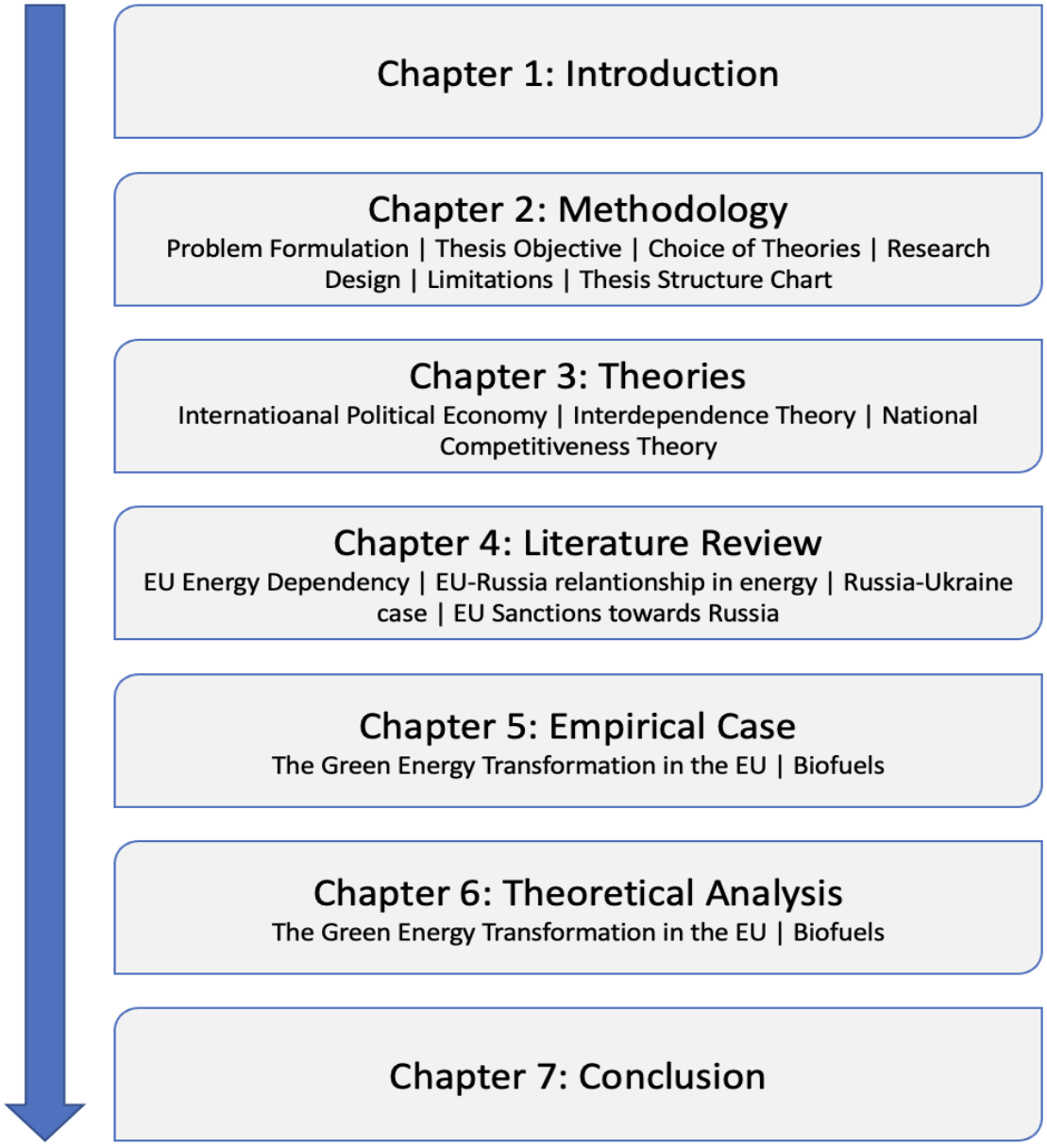
Additionally, the Russia-Ukraine conflict is recent and is still too early to fully assess the actual impacts. Yet, a range of official documents from the EU side provides the needed data to frame trends, and short- and medium-term impacts and analyze the new strategies within energy. However, there might still be a lack of data, especially regarding the framework for the second question referring to the competitiveness of the biofuel sector in the EU.

Some of the aspects considered by Porter's (1990) framework rely on companies' data that are not public, such as firm strategies and technological developments, and recent sector results. Therefore, the focus of analysis in this regard is to assess the state's role in fostering competitiveness in the biofuels sector. In this case, it refers to the role of the EU, that possesses the legitimacy to create and adopt policies within the energy sector.

While these documents provide a foundation for analysis, it is important to remain open to the possibility of new events and developments that may alter the overall scenario and require further examination.

2.6 Thesis Structure Chart

Figure 1.



Chapter 3. Theories

3.1 Discussion on International Political Economy

Before diving into the state's role and its relationship with national competitiveness, it is first important to reflect upon the nature of the International Political Economy (IPE) and key concepts for deepening the discussion. Isolating both areas of study, economics, in the present definition, is characterized by the science that studies human behavior in the decision-making processes under conditions of scarcity and constraints[14]. On the other hand, the political-economic interpretation defines the economy as a social political system composed of actors whose behavior is shaped by multiple political, social, and cultural origins or other variables[15].

However, International political economy (IPE) as a field of study encompasses these two significant areas. It is the intersection between both, that is, a multidisciplinary field within the international context that seeks to understand the market and political relations together, based mainly on shared individual and collective interests[16]. According to Susan Strange, political, social, and economic arrangements affect the global system of production, exchange, and distribution, as well as the values reflected by them. That said, based on a general definition of International Political Economy, several authors argue different perspectives, specific characteristics, and diverse consequences[17]. They can also be divided into different levels of analysis: global level; interstate level; state/society level; and finally, individual level[18].

The political dimension for Georgina Allen involves different actors, groups, and individuals. These actors are responsible for the decision-making process on the distribution of money, security, and innovation, among others[19]. The political side concerns the concept of making rules, that is, it exercises certain control in public and private societies and institutions. The economic dimension involves the allocation of scarce resources in society and how the market works in the logic of driving human behavior. The origin of international political economy as a field of study can be directed to Mercantilism, where the State plays an important role within the economy in order to guarantee welfare from the junction of the two spheres.

Several perspectives emerged to explain and advise how the contact between politics and economics should be made. The three main views are: Liberalism, with the concept that

[14] Robert Gilpin, "Global Political Economy," *Princeton University Press*, January 1, 2001. P. 26.
[15] Ibid. P. 38.
[16] David N Balaam and Bradford Dillman, *Introduction to International Political Economy* (Routledge, 2015). P. 8.
[17] Susan Strange, *States and Markets* (Bloomsbury Publishing, 2015). P. 27.
[18] David N Balaam and Bradford Dillman, *Introduction to International Political Economy* (Routledge, 2015). P. 13.
[19] Ibid. P. 18.

politics and economy are different fields; Mercantilism, with the assumption of political primacy over the economy; And finally, Structuralism involving more complex issues and how the economy in the capitalist system exercises power[20]. According to Timothy C. Lim (2014), power relations cannot be excluded from the study of international politics, regardless of which perspectives are used. The extent that markets and governments play within the international context is directly linked to power relations, "In this process, it is the distribution of power in society that determines, to a very large extent, the rules and values that govern economic and social relations"[21].

In this context, neither politics nor economics can dominate the other, as economics establishes the limits for political actors in terms of available resources, availability and distribution of the national budget, employment, and productivity. In contrast, politics determines the rules of the game within which economics operates, such as taxes and regulations[22]. Additionally, various actors, such as firms and organizations, seek to exert control over one another, while states endeavor to maximize their wealth and power as a means to pursue their broader objectives[23].

Bringing such conceptions to the current context, it is possible to observe the growing change in the international system due to several factors, such as the technological impulse, the international institutions created to guarantee the system's stability, and globalism. All these changes and the maturation of capitalism as a form of production evidenced the resulting crises and problems that affect the two main spheres: economy and politics. Examples such as the real estate crisis in the United States in 2007, which led to several negative consequences such as high unemployment, and the credit crisis, which threatened the large banks and financial institutions, show the fragility of the entire system built from interconnected clusters. International Political Economy, as a field of study, revolves around understanding recurrent crises, both national and international, to discuss possible solutions. "We must use an analytical approach that synthesizes methods and insights derived from economics, political science, and sociology as conditioned by an understanding of history and philosophy"[24].The methods used

[20] Timothy C. Lim, *International Political Economy: An Introduction to Approaches, Regimes, and Issues* (The Taylor Foundation, 2014). P. 52-53.
[21] Ibid. P. 36.
[22] Robert O. Keohane, *After Hegemony : Cooperation and Discord in the World Political Economy* (Princeton: Princeton University Press, 2001). P. 18-19.
[23] Ibid.
[24] David N Balaam and Bradford Dillman, *Introduction to International Political Economy* (Routledge, 2015). P. 6.

by IPE involve multiple academic fields in order to better explain the complex and real problems of the world.

Nevertheless, it is important to emphasize that politics is influenced by economic development, and the economy is dependent on social and political relations. The evolution of the conception of what would be political economy as an interrelated field of study has undergone several changes, from the conception of John Stuart Mill that political economy is the science that teaches the State how to get rich to that of the Chicago School, in which behavior can be explained from individual efforts to maximize, satisfy, or optimize their own interests[25].

That said, like any other field of study, there have also been several changes with the presence of different perspectives, but all of which seek to understand the relationships between the private and the public. Susan Strange (2015) states there is no separation between political and economic power since the economic decision-making process is directly linked to the political authority in force within that context. Politics and the market can maximize or minimize the power between them. The financial system and globalism are factors that exemplify and highlight the relationship within the capitalist structure, where the creation of credit is controlled by the political authority upon which the financial structure is rooted[26].

Within the international scope, certain mechanisms are also necessary to provide the same effectiveness or at least the minimum conditions for operating flows of capital and commodities. Globalization makes everything more complex when it involves different sovereign actors and different political and economic agendas. The international debate and the means by which institutions function are directly linked to the economic-political relationship, regarding agreements between the private and the public, for example[27].

Hence, International Political Economy is a fundamental field of study within International Relations since it covers several areas that are important for the functioning of the international system and the relations of political and economic power. According to Susan Strange, it involves four different structures, of which the international political economy encompasses production and trade, money and finance, knowledge and technology, and security[28]. In practice, all these areas are intertwined and represent a large part of the international relations between States and Institutions at the global level. Therefore, it is not

[25] Robert Gilpin, "Global Political Economy," *Princeton University Press*, January 1, 2001. P. 25-31.
[26] Susan Strange, *States and Markets* (Bloomsbury Publishing, 2015). P. 24-29.
[27] Timothy C. Lim, *International Political Economy: An Introduction to Approaches, Regimes, and Issues* (The Taylor Foundation, 2014). P. 25-26.
[28] Susan Strange, *States and Markets* (Bloomsbury Publishing, 2015). P. 29-32.

possible to detach the study of EPI from understanding the evolution of the international system as well as its current situation.

This case study explores the effects of an asymmetrical interdependent relationship in a political and economic framework, specifically in relation to the EU's current gas shortage from Russia. The scarcity and limitations caused by this situation have resulted in shifts in behavior at both the state and systemic levels. Particularly thinking about the European Union's strategy to accelerate the green energy transformation and secure the sustainable goals. Consequently, the EU has responded as a unified entity, impacting international regimes beyond its borders. As such, this case falls within the scope of the International Political Economy discipline.

3.2.1 State and Power in International Political Economy

There are multiple arguments to define what is the main motivation that drives states and individuals to act. On the economic side, the Chicago School and Neoclassical Institutionalism interpret that human behavior can be explained by the effort of individuals to maximize, satisfy, or optimize their self-interest. Many economic approaches and other social academics related to economics attempt to use the individualist and rational choice of self-interest to explain social institutions and public policy formulations, for example[29].

In the political field of study, Realism is one of the most dominant perspectives in the study of international relations, and its source can be traced back to ancient Greek with Thucydides' work to Niccolò Machiavelli in the Italian Renaissance period and Thomas Hobbes in the English seventh century political time. These three scholars marked the called Classical Realism[30]. From there, several other realist approaches emerged in which some similarities in concepts and world view between them can be observed. These concepts and assumptions, such as power, anarchy, and national security, will be an important source to understand the dynamics in IPE.

The agreed framework by Realists points out that the states are the main actors in the international system and are pursuing power to take a dominant position. This called "state of war" is a consequence of an anarchic international system, where there is no supreme authority – contrary to domestic politics, where a hierarchical structure and clear governance exists

[29] Robert Gilpin, "Global Political Economy," *Princeton University Press*, January 1, 2001. P. 25-27.
[30] Robert H Jackson and Georg Sørensen, *Introduction to International Relations : Theories and Approaches* (Oxford: Oxford University Press, 2013). P.67.

within the state[31]. The very definition of the State is intrinsic to the notion of power and international politics. Connected with the realist thinking, Machiavelli was the first to describe the State in Western literature as all governments and states that had or have authority over men. These are or were republics or principalities that can be hereditary, passed between families, or acquired, due to conflicts and power disputes. This broad definition, however, was refined after Westphalia (1648), where the conception of a sovereign State over its territory emerged and was structured in internal dynamics of national formation.

Aligned with the conception of the post-Westphalia order, the sociologist Max Weber defines the State as the holder of the legitimate monopoly on the use of violence. In the conception of the Weberian State, power is concentrated and monopolized regarding the formulation and application of public policies aimed at social control and political order - fundamental to maintaining the unity of the national State. Its rationality is based on the authority and the bureaucratic apparatus[32]. However, the definition of state and government are distinct from one another. While the state is the supreme controlling force within society and territory, the government or governance refers to the rules, style, scope, purpose, and degree of control. That is, refers to the rulers, which can be a group of people who are in charge of the state at a particular time[33].

There are two contrasting viewpoints on the role of government in society. One group of thinkers views it as essential for maintaining social order and resolving conflicts, while the other sees it as guiding humanity towards higher forms of civilization. Government is not merely a tool of those in power but a means of upholding moral principles and promoting progress. These perspectives are often referred to the called organic and mechanistic theories of government, respectively. Although they are more commonly known as theories of the State[34].

In particular, the Mechanistic Theory is aligned with the liberal approach based on the social contract defined by John Locke, where individuals transfer consensually part of their freedom to a higher authority in order to guarantee safety, life, and property. If there is no authority legitimacy, the society has the right to resist since the pact is based on trust. In contrast with the realist approach, Locke assumes that human nature is good, social, and rational. In the

[31] Ibid. P. 66-70.
[32] Thales Castro, *Teoria Das Relações Internacionais* (Brasília: Fundação Alexandre De Gusmão, 2012). P. 102.
[33] Frank Bealey and Allan G Johnson, *The Blackwell Dictionary of Political Science : A User's Guide to Its Terms* (Oxford, Uk ; Malden, Mass.: Blackwell Publishers, 1999). P. 147.
[34] Ibid.

case in which it is not possible to guarantee the natural rights of each (life, freedom, property, and goods), it is possible to reverberate a state of war by means of force[35].

On the other hand, analyzing the case of the European Union, there are some distinct particularities as it does not refer to a State, but it possesses some of the same characteristics based on institutions and governance within the bloc. In fact, the EU case is the first to create supranational communities, such as The European Coal and Steel Community, which was established to achieve peace and prosperity in the post-Second World War time. It refers to a voluntary transfer of sovereignty to a supranational body.

The process of integration continued to the creation of the European Economic Community and the European Atomic Energy Community. From there to today's days, several important agreements have been signed to extend the integration level in the EU. Integration was expanded to important areas such as creating a common market, common trade policy, transport, agriculture, military, etc. Today, the EU has twenty-eight member states, and its institutional architecture consists of the European Parliament, the European Council, the Council of the European Union, the European Commission, the Court of Justice of the European Union, the European Central Bank, and the European Court of Auditors[36].

Ernst Haas defines regional integration as a transformative process in which political actors across different settings are convinced to redirect their loyalties, expectations, and political engagements towards a new central entity. This entity's institutions possess or require authority over existing nation-states, leading to the emergence of a new political community[37]. The emergence of regional economic integration in Europe was driven by the conviction that promoting trade and economic cooperation among neighboring states would decrease the probability of conflict. Member states could jointly prioritize peace and prosperity by fostering a shared interest in each other's economic well-being. The European Union serves as a prime illustration of this concept, as economic integration has led to closer political and economic collaboration in a region plagued by longstanding national disputes. Consequently, eliminating trade barriers and promoting free trade lies at the core of contemporary Interdependency Theory.

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[35] Robert H Jackson and Georg Sørensen, *Introduction to International Relations : Theories and Approaches* (Oxford: Oxford University Press, 2013). P. 100-103.

[36] European Union, "Types of Institutions and Bodies," european-union.europa.eu, 2022.

[37] Ernst B. Haas, "The Study of Regional Integration: Reflections on the Joy and Anguish of Pretheorizing," *International Organization* 24, no. 4 (1970). P. 610-613.

In this sense, institutions are seen as the rules of the game or the humanly devised constraints that shape human interactions[38]. Therefore, as described before, the EU framework can be related to the governance of its state members for the areas in that there is shared jurisprudence, which is the case for trade policy and sustainable measures.

Nevertheless, the argument here sets that both realism and liberalism can be used to understand IPE. Even if both perspectives broadly differ in their assumption of human nature and the world's view. Each focuses on different aspects that can be highlighted in a specific condition. For example, it can be argued that in a case of war, conflict, and lack of trust, the realist approach can be helpful to recover and highlight the reality of an international anarchy system and power dynamics. On the other hand, liberalism brings the other aspects included in the IPE field of study, such as social, cultural, and economic aspects.

Therefore, for clarity reasons, this paper will combine both definitions of power from the realist and liberal approaches. While the base definition is similar where according to Realism, power is defined as the ability of an actor to get others to do something they otherwise would not do, being a form of control over outcomes, the Liberal approach defines the capacity of an individual, group, state, or some other agent to have effects on outcomes. The main difference relies on how to get power. Hence, this paper will focus on the Liberalism view to understand the nature of the international system based on rules and self-interest to gain power.

For the realist approach, in order to pursue power, states need to gain and maintain capabilities that refer to the state's ability to act and defend its interests. Capabilities can be achieved through wealth, natural resources, and military power. These capabilities are not distributed equally among states; therefore, the state fears possible gains that may favor others more than itself, which hinders cooperation[39]. On the other side, it includes liberal principles that focus on the existence of law, norms, and fairness. Therefore, a set of rules exists that legitimate the use of power, which values, economy, military, and other sources can influence[40]. In this view, cooperation is facilitated to achieve human progress. These definitions are not exclusive to one that can complete according to the focus of analysis and context.

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[38] J. Jupille and J. A. Caporaso, "INSTITUTIONALISM and the EUROPEAN UNION: Beyond International Relations and Comparative Politics," *Annual Review of Political Science* 2, no. 1 (June 1999): 429–44. P. 431.

[39] Kenneth N. Waltz, *Theory of International Politics* (Boston: Addison-Wesley Publishing Company, 1979). P 106.

[40] Robert Gilpin, "Global Political Economy," *Princeton University Press*, January 1, 2001. P. 17.

3.3 Interdependence Theory

Interdependence as a theoretical view emerged amidst a scenario where neither Modernists nor Traditionalists in International Relations could fully understand global politics. Having in mind the state of anarchy in the international order, that is, the concept based on the idea that the world lacks any supreme government or sovereignty[41], Keohane and Nye (2001) introduced a framework to acknowledge both arguments: (i) from the modernist side with the assumption that advances in technologies and increases in social and economic transaction leads to a new world in which states and their control of force will not be longer necessary; and, (ii) from the traditionalist side with the assumption that states and military forces continue to be the driver in the world politics[42]. Therefore, the authors argue that world politics is marked by continuity and change, where multiple factors and variables affect world politics and the international economy. The proposed framework of interdependence provides the analytical tools to understand the effect of changes.

On the other hand, interdependence can also be based on a rhetorical view, just as before, during the Cold War, national security was a slogan to American political leaders to justify and boost support for their policies[43]. Not only from a domestic perspective but also as rhetoric at the international level as it was used for endorsing cooperation, creating alliances, and military involvements. This logic can be widely observed during the Covid-19 pandemic in mid-2020 when rhetoric was used to increase cooperation to mitigate the effects and find a world solution with international investments in vaccines, for example. At the same time, interdependence was felt asymmetrically, as there were countries that were more affected than others.

In the same way that national security was used as rhetoric in international relations, interdependence is also a concept used to justify political action. Keohane and Nye state that interdependence affects world politics and the behavior of states, while governmental actions also influence patterns of interdependence[44]. It is a two-way street, as there are external factors and internal reactions from governments. For example, trade sanctions from one state to another. These actions and arrangements are called international regimes, and they can be seen as creating or accepting procedures, rules or institutions, regulations, and transnational control.

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[41] Kenneth N Waltz, *Theory of International Politics* (New York: Mcgraw-Hill, 1979). P. 89.
[42] Robert Owen Keohane and Joseph S Nye, *Power and Interdependence* (Longman Publishing Group, 2001). P. 3-4.
[43] Ibid. P. 5.
[44] Ibid.

They are intermediate factors between the power structure of an international system and the political and economic bargaining surrounding it[45].

Domestic, transnational, and governmental interests are simultaneously involved in international regimes. That can be affirmed considering when the domestic and foreign policies became closely linked. However, it does not mean that interdependence leads to no conflict. On the contrary, the authors suggest that conflict will take new forms and might even increase[46]. By new forms, it means that the traditional concept of national interest based on the idea that states are pursuing to maximize their power is no longer applicable in most cases. But also, absolute cooperation and the absence of no conflict are not the reality either. One example of a new form of conflict is increased competitiveness in international markets.

For the purpose of clarification of concepts, dependence means a state of being determined or significantly affected by external forces. Independence means mutual dependence[47]. In world politics, interdependence refers to situations where reciprocal effects among countries or actors can be observed. However, these effects are often felt asymmetrically, with different strengths and extensions. They often result from international transactions that can be through flows of money, goods, people, messages, regulations, etc. Therefore, interdependence is related to the costs of such transactions without necessarily measuring whether the benefits of the relationship will exceed the costs or the contrary situation. If there are no costs, it is mainly an interconnectivity relationship[48].

3.3.1 Asymmetrical Interdependence as a Source of Power: Connectivity, Sensitivity, and Vulnerability

Keohane and Nye (2001) point out the concept of power described by the realist Hans Morgenthau. Power in International Relations is the ability of an actor to get others to do something they otherwise would not do, being a form of control over outcomes.

However, measuring power is not easy. Applying this broad concept to interdependence first is important to make the distinction between connectivity, sensitivity, and vulnerability. The last two scenarios can be observed in asymmetrical interdependence relationships. Connectivity is not considered a source of power as it is not a form of interdependence since it does not involve costs and constraints.

[45] Ibid. P. 18.
[46] Ibid. P. 7.
[47] Ibid. P. 8.
[48] Ibid. P. 8-10.

For instance, asymmetrical interdependence can be a source of power when thinking in the context of control of resources or the potential to affect outcomes[49]. In a relationship where one actor is less dependent, they have a significant political resource because external changes are less harmful to them than to their partner. However, this advantage does not guarantee control over outcomes, but it has the potential to achieve it. While asymmetrical interdependence is a valuable foundation for political analysis and political bargaining, it does not help alone explain negotiation outcomes.

Sensitivity and vulnerability interdependence are essential aspects of globalism, with vulnerability interdependence being significant from a political perspective since it involves human action. It is worth highlighting that the term "globalism" refers to the current state of the world, which involves networks of interdependence across multiple continents. This interdependence is facilitated by flows of capital, goods, information, ideas, people, force, and environmentally or biologically relevant substances. The concept of globalism implies an increase or decrease in these networks of interdependence, which have become more complex and integrated in recent years[50]. Nevertheless, sensitivity encompasses different degrees of responsiveness within a policy framework, assuming that the framework remains unchanged. Therefore, the question arises: how quickly do changes in one country bring costly changes in another, and how great are the costly effects?[51]

The authors give the example of how increased oil prices in 1971, 1973-1974, and 1975 affected the United States, Japan, and Western Europe. In this case, the core rationale for analyzing the sensitivity is based on the absence of new policies and how these countries were affected in terms of greater foreign oil prices and the proportion of petroleum they imported. For example, the US was less sensitive since its petroleum import demand was inferior due to the fact that they have substantial domestic production.

Vulnerability, on the other hand, arises when an actor reacts to specific flows, and the costs of adjusting are high in comparison with the other actor. In this case, there is a change of policies and, therefore, subsequent consequences, such as an impact on world dynamics, rules, alliances, conflicts, etc. This can be measured by the costliness of adjusting to a changed environment over time and by how fast it can be done[52]. This dynamic can be observed in the

[49] Ibid. P. 10.
[50] Robert Owen Keohane, Joseph S Nye, and Fareed Zakaria, Power and Interdependence, 3rd ed. (Longman, 2008), 225.
[51] Robert Owen Keohane and Joseph S Nye, *Power and Interdependence* (Longman Publishing Group, 2001). P. 10.
[52] Ibid. P. 11-12.

case of this research, where the EU faces a new challenge of adapting to meet its carbon neutrality goal amid the Russian gas shortage after the Russia-Ukraine war outbreak. Hence, vulnerability can be a valuable analytical tool for comprehending changes in international regimes, which are governing arrangements that affect the relationship of interdependence[53].

However, this framework is limiting to predicting outcomes as it is expected that interest at high stake becomes more important and the actors will tend to raise their costs, whether political, economic, or even military power resources will be used. Besides, it varies from case to case depending on the commitment in acting and responding, given the nature of the relationship[54]. For example, if the asymmetrical interdependence is between more cooperating partners, it is not highly probable that strong economic sanctions and military force will be used. Yet, analyzing asymmetrical interdependence can help understand the power source in international dynamics. Sensitivity interdependence can provide political influence when there is no change in rules and structure, and vulnerability interdependence can put the actor in a disadvantageous position to bear the costs of changing the rules[55].

3.4 National Competitiveness Theory

Michael E. Porter (1990) asserts that a country's competitiveness depends on its industry's ability to innovate and improve. With globalism being an inherent aspect of today's world, the significance of states' roles becomes even more pronounced in ensuring their competitive advantage, as it is an ongoing process. To assess whether a country's specific industry is competitive, Porter created a framework to investigate why nations gain competitive advantage and what the implications are for companies' strategies and national economies. National values, culture, economic structure, institutions, and histories are all variables that affect this process[56]. By defining a nation's industry competitive as internationally successful, Porter used the criteria of possessing a competitive advantage relative to the best international competitors.

Nevertheless, companies achieve competitiveness through innovation in the broad sense, such as improving technologies, ideas, processes, marketing, etc. The advantage of it comes when competitors are slow to react. Therefore, once a company achieves advantage competitiveness, it can only sustain it through more innovations. Thus, with this assumption,

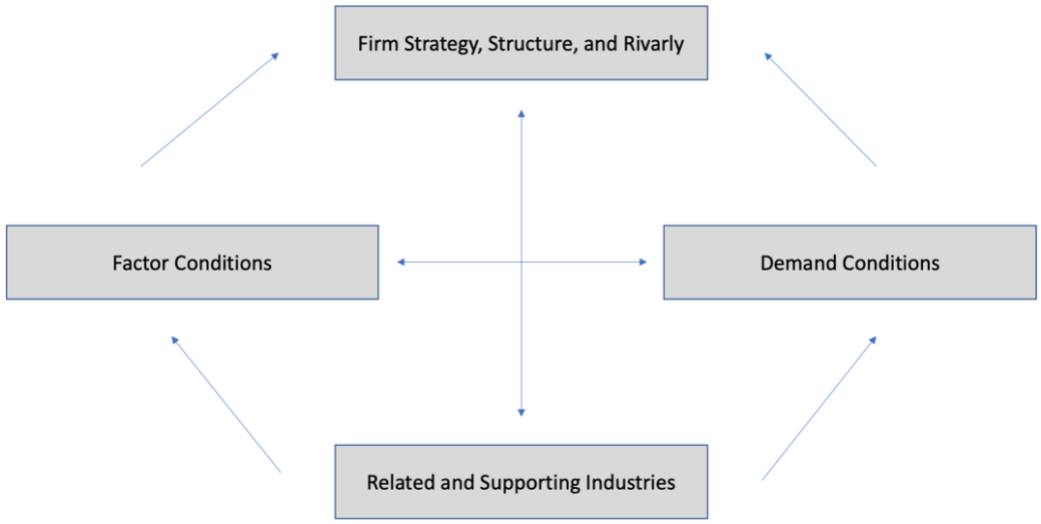
[53] Ibid. P. 17.
[54] Ibid. P. 15- 17.
[55] Ibid. P. 16.
[56] Michael E. Porter, *The Competitive Advantage of Nations* (London: Macmillan, 1990).P. 73-74.

successful companies are constantly pursuing upgrades[57]. The question relies on why those successful companies are able to overcome challenges and how to achieve them. Porter (1990) identified four key factors:

1. Factor Conditions: The nation's position in factors of production such as skilled labor and infrastructure.
2. Demand Conditions: Demand from a target market sustains the industry's production or service.
3. Related and Supporting Industries: The presence or absence in the nation of suppliers and other industries that can be as much as internationally competitive.
4. Firm Strategy, Structure, and Rivalry: The conditions in the nation governing how companies are created, organized, and managed, as well as domestic rivalry.

Together, these factors form a diamond structure that all impact another aspect, working as a system.

Figure 2.



[58]

The primary aspect to consider is the condition of factors. According to classical economic theories by Adam Smith and David Ricardo, factors of production such as labor, land, natural resources, capital, and infrastructure determine the flow of trade. However, this is not the sole determinant of trade flow in today's complex and globalized world. Institutions play a crucial role in creating specialized factors and improving conditions for them. Even if a country faces

[57] Ibid. P. 75-78.
[58] Ibid. P. 78.

a disadvantage in one of these factors, states and companies can serve as a for innovation and transformation, ultimately turning a weakness into a competitive advantage[59].

Secondly, it is important to assess the demand conditions. When it comes to home-demand conditions, there is an impact on how companies perceive, interpret, and respond to buyer needs. Therefore, understanding the domestic demand compared to other countries and regions is a factor. Besides, the demand itself is also important to assess the sophistication of consumers in terms of pressure for quality changes. For example, local buyers can help a nation to export the values of a given industry, such as pressure for more sustainable production. This can create an advantage to anticipate or even create global trends[60].

Thirdly, having a competitive supplier network and supporting industries can help to create a solid base for a given industry to thrive. This factor can have different impacts as they can deliver more cost-effective inputs and raw materials together with the efficiency of lowering logistics costs. Another aspect is the market access to components and machinery that can increase the likelihood that both industries will innovate according to specific needs, having better communication and trust[61].

Lastly, firm strategy, structure, and rivalry wrap up Porter's diamond. Competitiveness arises from the convergence of management practices and organizational frameworks. In addition to the companies' side, the circumstances and context of a country create strong support for how these companies are created and organized and how they function[62]. This can be argued following numerous aspects such as how is the process to start companies, incentivize, invest, tax, international market access, and others. Aligned with that, education also plays a key role in offering skilled labor and support for research and innovation.

On the other hand, rivalry creates a drive to innovate and upgrade to maintain a competitive edge. Firms push each other to lower costs, improve quality and service, and innovate in other areas because the mere advantage of being in a country with the other aspects of the diamond is not sufficient. They must differentiate themselves in some way. If there is a concentration of firms in a particular geographic area, the conditions of rivalry can intensify[63].

With those factors in mind, it is noteworthy to mention that they work as a system where each one affects another, and they often depend on the condition of the others. According to Porter (1990), domestic rivalry and geographic concentration significantly impact by

[59] Ibid. P. 79.
[60] Ibid. P. 82.
[61] Ibid. P. 82-83.
[62] Ibid. P. 83.
[63] Ibid. P. 84-87.

transforming a diamond into competitive conditions. They promote improvement in all the other factors and reinforce the circularity of the system. This systemic nature fosters clusters of competitiveness where industries are interconnected[64].

3.4.1 The Role of the State: National Competitiveness

Porter (1990) argues that both classical economic approaches are flawed. Neoliberalism views the state's role as a mere supporter and helper of industries, while the Classical approach advocates for a free market with minimal state intervention. Porter argues that both approaches would lead to a permanent erosion of competitiveness[65].

The state, as a supporter, can create illusory conditions for a given industry to thrive, and instead of promoting the proper structure based on the diamond, it can create dependency for more help. On the other hand, the assumption of a free market ignores the role of the state in shaping the context and institutional framework necessary to stimulate competitive advantage. The state's actions and policies can significantly impact an industry's competitiveness, and the government should work toward creating an environment that fosters innovation, encourages investments, and supports the growth of industries[66]. However, States often fail to create these right conditions. Porter (1990) highlights that this failure is related to the fact that the process of creating a competitive industry takes time and even decades. For the policy timeframe, most governments chose policies with faster impact to show short-term benefits through subsidies and protection, for example[67]. It can bring short-term advantages, but they usually hinder innovation as it puts industries in a state of comfort, undermining competition and dynamism in the long term.

In contrast, there are specific approaches and policies that a State should follow to ensure its action is in the right direction. Governments possess fundamental responsibilities like education systems, national infrastructure, research, health care, etc. These are factors of creation. Yet, they are not enough to produce competitiveness by themselves. The State should invest the effort to specialize in these factors and tie them up to specific industry groups[68]. For that, the creation of target apprenticeship programs, investments in research for prominent

[64] Ibid. P. 86-87.
[65] Ibid. P. 86.
[66] Ibid.
[67] Ibid. P. 87.
[68] Ibid. P. 88.

industries, trade association activities, and other initiatives that support the basis of these factors.

In addition, strict product, safety, and environmental standards are key to promoting domestic demand based on standards in these areas. Therefore, it can pressure companies to innovate and upgrade in quality and to respond to consumer and social demands. This also has an impact when it comes to exporting values and indirectly force industries in other countries to also follow some of the standards[69]. One example of that is the strict environmental rules in the EU that force other countries to adapt in order to guarantee market access.

Legal framework and limited cooperation among industries rivals also function as a State role. Global policies are applied to protect technology and Research and Development (R&D) initiatives, especially in sensitive industries. Considering that innovation and technologies are the base to create and maintain competitiveness, the State must ensure the legal framework to protect R&D and promote cooperation in other cases. Antitrust laws also follow this rationale to prevent diminishing rivalry. In alignment, the investment framework must also be ensured since investment and innovation are directly related. This can be done in several ways, funds, tax, regulating markets, etc[70].

At last, Porter (1990) defend an open market access. That means that any quantitative restraints agreement is dangerous, ineffective, and often costly to consumers[71]. However, this is in the case of an attempt to deal with the fallout of national competitiveness. He does not mention the adoption of sanctions and protective measures when other contexts are involved.

3.5 Summary

This chapter discussed the International Political Economy (IPE) field of study and its relationship with International Relations and dynamics of power. It was argued there is no separation between politics and economics at the international level, as the interaction from both fields impacts the decision-making process. This interaction is built on relations of power that dictate the rules of the game and limits when it comes to the availability of resources, productivity, and other economic factors. In this sense, there is a relation of power when firms and organizations seek to exert control over one another, while states pursue maximizing their wealth and power as a means to pursue their broader objectives.

[69] Ibid.
[70] Ibid. P. 88-89.
[71] Ibid. P. 88.

Power can be understood as the ability of an actor to get others to do something they otherwise would not, being a form of control over outcomes and effects. This definition is supported both by the Realism and Liberalism theories. However, they differ in how to perceive the gain of power.

While the realist approach focuses on the nature of the international system as being anarchic, which creates a condition of a "state of war" where the states will pursue power to defend their position, the notion of power itself is strongly correlated with military power and a selfish human nature. On the other side, Liberalism perceives a more positive view of the international system. The state is still the main actor; however, the development and maturation of institutions and international regimes implicate a more cooperative system.

To pursue power, therefore, can be through the gain and maintenance of capabilities such as wealth, natural resources, military power, diffusion of values and rules, depending on the focus of analysis. International Political Economy is a complex field of study as it comprehends different aspects of politics and economics. In the case of the European Union, there is a strong aspect of shared interests and institutions as it is a supranational community. Hence, both world views are important sources to perceive power and its relations to apply to the chosen theoretical framework: Interdependence Theory and National Competitiveness.

Interdependence theory brings together the assumption of anarchy in the international system and that technological advance and increases in social and economic transactions lead to a more cooperative world, but not necessarily without conflict. It is argued that world politics is marked by continuity and change that are affected by aspects of the International Political Economy. From the more realist view of having national security in focus to pursuing wealth and economic power.

Keohane and Nye (2001) highlight that interdependence refers to situations where reciprocal effects among countries or actors can be observed, meaning mutual dependence. However, these effects are, in most cases, felt asymmetrically. Because of that, it can be a source of power in states' relationships. Vulnerability interdependence is the most important for IPE analysis as it directly impacts world dynamics because implicate policy changes.

The case study being analyzed illustrates a dynamic in which the European Union is confronting the challenge of achieving its goal of carbon neutrality in energy while also dealing with a gas shortage caused by the outbreak of the Russia-Ukraine conflict. Meaning it is an external factor that directly impacts the energy market in the EU. This situation highlights the importance of vulnerability as an analytical tool for understanding changes in international regimes, which are governing arrangements that impact interdependent relationships.

In sequence, the National Competitiveness theory introduces the element of competition to assess a particular market. It assumes that globalism is an inherent aspect of today's world and asserts that the states' role becomes more prominent in ensuring their competitive advantage internationally. Porter (1990) framed four main factors for states to achieve competitiveness: (i) Factor conditions; (ii) Demand conditions; (iii) Related and supporting industries; and (iv) Firm strategy, structure, and rivalry. This framework is called the diamond model, where the state should create the right conditions for industries to thrive. These conditions include specialized education, guaranteeing safety, quality, and environmental regulations, limiting cooperation with rival industries, encouraging investment, deregulating competition, ensuring antitrust policies, and promoting a free market. Therefore, in the context of the biofuel industry in the EU, this theory will be applied to explore the EU role to promote competitiveness within this market.

Chapter 4. Literature Review

This chapter introduces previous academic research on EU energy dependency and the EU-Russia relationship in the energy sector. The focus is to present how the Russia-Ukraine energy case is relevant to the European Union. Building on the academic background understanding of these topics, this review serves as a foundation for the empirical analysis in this study. The analysis aims to contribute by examining the specific impacts of the Russia-Ukraine conflict on the EU's green energy transformation. Therefore, this MA thesis provides an additional analysis that extends the existing research in this field by considering the changing conditions resulting from the Russian invasion in Ukraine territory.

4.1 The EU-Russia relationship in energy

The history of energy between the European Union and Russia started to gain weight during the Cold War. Back in the Soviet times, Russia began to export fossil fuels to the EU on a large scale, and their cooperative relationship in energy gained traction, especially after the Cold War period. This dynamic was built on based in a strong interdependence network, where the EU depends on the energy supply and Russia on the technology and revenue from the EU[72]. Up until mid-2020, this relationship was marked as being positive for both sides in terms of trade.

[72] Marco Siddi, "EU-Russia Energy Relations," *Handbook of Energy Governance in Europe*, 2022. P. 238.

Still, the tides started to change with more controversial political choices by Russia involving Ukraine in 2006 and in 2009 after the gas transit crises. In 2014, the crisis in Crimea revealed a path of deterioration in the EU-Russia relations[73].

Some of the approaches between EU member states diverged. For example, Poland and Lithuania have framed energy trade with Russia as a security issue. However, despite instabilities, the energy trade between the regions had a considerable rise since 2016, and the energy field was one of the few sectors where a substantial level of cooperation remained after the Crimea annexation[74].

Gas has been the most sensitive commodity primarily because of the high vulnerability of some East-Central European states. These countries are dependent on Russian gas pipeline infrastructure and more dependent on energy imports, such as Bulgaria and Lithuania[75]. Therefore, some EU countries would be more affected by supply disruptions than others. However, such risks started to decrease as new interconnections within the EU were being built.

Another factor to keep in mind is that the EU values are endorsed in many of the energy packages, for example, with the promotion of competitiveness and liberalization of the energy market. The EU was already aware of the dependency risks, and this position reflected in its adoption of policies for the sector, but in a slow pace of diversification. This is because the process of diversification is resource-demanding as gas transportation is technically more complex, and diversifying suppliers requires significant, long-term investments into pipelines or liquefied natural gas (LNG) terminals[76]. On the other hand, on the Russian side and with a completely different approach, the state holds control of energy production and supply. However, conflict of interest also plays a part as commercial actors have their impact, especially from the big companies[77].

Nevertheless, the literature on EU-Russia energy relations is vast and cross-disciplinary. Marco Siddi (2022) draws prominent scholars and debates on the topic during this turbulent relationship where recent studies have adopted an International Political Economy (IPE) approach as it is a field that permeates different areas of knowledge. Security studies, Securitization Theory, Realism, and Constructivist Theory are also scholars' choices to discuss the topic. Beyond the International Relations area, economists and political scientists also

[73] Ibid.
[74] Ibid.
[75] Ibid. P. 239.
[76] Ibid. P. 242.
[77] Ibid. P. 239.

contributed academically[78]. As an overview, the most repeated consensus points out that the European Union has approached the Russian relationship primarily as a liberal actor, using regulatory and market power rather than hard economic or geopolitical power[79]. This view is based on the argument that it would be more controversial and of dubious benefit to the EU to adopt hard measures towards Russia as the interdependent relationship is stronger. However, it is clear that the situation changed with the Russian invasion of Ukraine. Yet, it is important to trace the retroactive framework to understand where the EU stands now when it comes to green energy transformation.

In this line, authors like Goldthau, Sitter, and Boersma addressed a more liberal view based on trade to assess the EU-Russia energy interdependence. However, they noted the growing securitization permeating this relationship. On the other hand, other authors argued adopted a neorealist view to criticize that the EU should take a more strategic approach[80]. Andrej Krickvic (2015) argued that interdependence in the energy field intensifies the tension between both regions as there is the fear of creating an asymmetrical interdependence, creating a vicious cycle of action and reaction to balance asymmetries. When one actor moves to reduce dependency, in return, the other will lose trust and act accordantly[81]. At the same time, numerous studies point out that Russia uses energy as an aggressive instrument of foreign policy and suggests that new pipeline projects are an attempt to divide the EU[82]. As an example of the discussion on such an "energy weapon," the hypothesis of the EU adopting an energy boycott on Russia is discussed in more detail in the following section.

Regarding renewable energies, the European Union and Russia have plans to increase domestic production and consumption of non-hydrocarbon energy sources, meaning mainly fossil fuels. The EU's targets for 2030 include a 55% reduction of fossil fuel emissions compared to 1990 levels and becoming climate neutral by 2050. For that, adaption in the energy sector should be the main driver to reach the targets as it represents more than 75% of the EU's total greenhouse gas emissions (GHG)[83]. On the other hand, the targets set in Russia's Energy Strategy up to 2030 are much more modest. The Russian strategy only limits carbon dioxide emissions to not exceed the level of 1990 by 2030[84].

[78] Ibid.
[79] Ibid.
[80] Ibid. P. 239-240.
[81] Ibid. P. 240.
[82] Ibid.
[83] European Commission, "Renewable Energy Targets," energy.ec.europa.eu, 2022.
[84] Marco Siddi, "EU-Russia Energy Relations," *Handbook of Energy Governance in Europe*, 2022. P. 255.

In this context, EU-Russia cooperation in the field of renewable energy sources is still limited and not convergent. Yet, the biofuels sector is the market that shows the most attractiveness between the countries. Considering the territory proximity and availability of raw materials for this type of production, this market can be developed[85]. In terms of other resources, Russia has the potential to become an important actor in renewable energy production and consumption when it comes to solar, wind, hydro, geothermal, and bioenergy. Even if the traditional form of EU-Russia energy cooperation was developed based on fossil fuels over history, there is space for the development of renewables[86].

4.2 The Russia-Ukraine Energy Case and the Correlation with the European Union

Tsakiris (2015) explains Ukraine's dependency on Russian energy and the impacts of this relationship on the European market. In line with the EU-Russia dependency, the Ukrainian territory lies between the EU and Russia, having, therefore, a strategic geopolitical location. In special, the author assesses the possible scenario of the EU boycotting Russian oil or/and gas, providing valuable insights into the analysis of this paper, particularly in light of Russia's invasion of Ukrainian territory.

To understand the energy dependency between Ukraine and Russia, it is important to note that Ukraine imports approximately 67% of its gas needs from Russia, which is estimated to be around 32bcm/year. Given that gas accounts for 40% of the country's total energy consumption, Gazprom, the Russian state company of natural gas, effectively controls 26.8% of Ukraine's total energy demand, according to the US Energy Information Administration in 2014[87]. In 2013, Ukraine signed two major shale gas agreements with Shell and Chevron aimed at developing potential reserves. However, most of these reserves are located in eastern Ukraine near the Donbas region and are unlikely to produce any gas before the early 2020s if they follow the expected timeline[88]. Important to note that this region is now one of the areas that were illegally annexed by Russia, compromising the Donetsk, Luhansk, and Zaporizhzhia territories. The European Union does not recognize this annexation[89].

In addition to Ukraine's limited production, the country cannot get Liquefied Natural Gas (LNG), which is an alternative to natural gas as it is a liquid form after the liquefaction

[85] Ibid. P. 256.
[86] Ibid.
[87] Theodoros Tsakiris, "The Energy Parameters of the Russian–Ukrainian–EU Impasse: Dependencies, Sanctions and the Rise of 'Turkish Stream,'" *Southeast European and Black Sea Studies* 15, no. 2 (April 3, 2015). P. 205.
[88] Ibid.
[89] European Council, "EU Response to Russia's Invasion of Ukraine," www.consilium.europa.eu, 2022.

process. This option would be ensured through the LNG supply via the Turkish Straits, but Ukraine does not have a re-gasification facility nor the money to build one in the short term. Besides, there is no dedicated pipeline connecting it to Europe apart from the reserve-flow capacity lines with Slovakia and Hungary[90].

In this sense, although there is no dedicated pipeline for exporting EU gas to western Ukraine, the European Commission (EC), in collaboration with Poland, Hungary, and Slovakia, has successfully reserved the flow of the Soviet-era pipeline network that delivers Russian gas to Central Europe. This allows for the immediate re-sale of the gas to Ukraine once it crosses into the EU territory[91]. With this pipeline opened from the EU side to Ukraine, The EC financed the re-commissioning of an old 400m pipeline segment at Vozhany in Russia, which increased the technical export capacity of the pipeline to 10bcm/year.

Since the end of 2014, Ukraine can get around 50% of its net import requirements via the EU if there is no danger to the transit of Russian gas to Europe[92]. Therefore, Tsakiris (2015) argues that Ukraine's energy demand is met through increased Russian gas exports to the EU, which are then sold to Ukraine via the EU grid. Regardless of whether Ukraine integrates into the EU gas market or not or whether Gazprom has only one or multiple clients in Ukraine, Kyiv will remain dependent on Russian gas for almost all of its import needs for several decades rather than just a few years. The same applies to the oil context, where Ukraine depend on 74,8% of its demand on imports, and 100% of this total is from Russia. Oil accounts for almost 10% of the energy share consumption in Ukraine[93].

In this context, the author draws the following scenarios: EU boycott on Russian gas and/or oil. It is argued that for a boycott to succeed, alternative sources need to balance out the volume of oil or gas lost due to the disruption. Otherwise, this movement would become a self-inflicted supply shortage[94]. As an example, the author mentions the successful US boycott again Iranian oil. For that, the US needed assurance from Saudi Arabia, meaning they would mobilize and balance the oil loss from Iran. As the US-led sanctions tightened, Iran lost around 1.5 mb/d in exports throughout 2012 and 2013. Still, there was no oil crisis and no price hike since Iranian exports were substituted by increased Saudi and other Arab Gulf exports[95]. On

[90] Theodoros Tsakiris, "The Energy Parameters of the Russian–Ukrainian–EU Impasse: Dependencies, Sanctions and the Rise of 'Turkish Stream,'" *Southeast European and Black Sea Studies* 15, no. 2 (April 3, 2015). P. 205-206.
[91] Ibid.
[92] Ibid.
[93] Ibid. P. 207.
[94] Ibid. P. 210.
[95] Ibid.

the other hand, even if Saudi Arabia agrees to boycott Russia together with the West, its surplus production would not be sufficient to balance the Russian production to avoid a crisis and price hike[96]. Therefore, it is concluded that if a boycott takes place, it would most likely backfire.

Regarding the gas market, the same logic applies. Although there may be enough LNG supply available in spot markets to secure EU supplies for 6-8 weeks, a potential boycott against Russia would be self-defeating for European member states, even those who are not dependent on the transit of Russian gas via Ukraine. Germany and France are unlikely to advocate for a boycott against EU gas imports from Russia for political reasons and because their own gas imports are fully secured through Nord Stream, a major pipeline system. If Ukraine were to collapse or Russia invaded, the EU would lose around 50% of its total gas imports. According to the author, this amount would be almost impossible to substitute on a long-term basis and entirely impossible to replace on a short-term basis[97].

Nevertheless, this assessment that the EU would not likely apply a boycott to Russian oil and/or gas due to the high risk of backfire was made, considering that the EU's diversification ability would not be possible before the mid-2020s. Combined with the trade data of dependency, it can be affirmed that the EU did not reach sufficient diversification. On the contrary, its dependence kept increasing with the exemption of the Covid-19 pandemic time due to lower economic activity. Even if most of the dependent countries have developed alternative routes, such as Lithuania, which opened an LNG terminal in late 2014, Latvia expanded its gas storage capacity, and Slovakia, Hungary, and Poland have built interconnecting pipelines, the dependency is still strong[98]. However, the current gas disruption due to the conflict imposed higher complexity on the scenario.

Chapter 5. Empirical Case

This study examines the relationship between the European Union and Russia in the context of the energy sector, with a focus on the asymmetrical interdependence between the two regions and its impact towards the renewable energy transition. Additionally, it assesses the European Union role to promote competitiveness within the biofuels sector. Against the backdrop of

[96] Ibid.
[97] Ibid. P. 213.
[98] Marco Siddi, "EU-Russia Energy Relations," *Handbook of Energy Governance in Europe*, 2022. P. 244.

ongoing conflict, the EU is confronted with new challenges as it seeks to achieve its ambitious targets of increasing the share of renewables.

To provide a comprehensive understanding of this topic, this chapter will begin by presenting the scope of the EU dependency on energy followed by the set of sanctions imposed by the EU in response to the Russian invasion of Ukraine territory. Additionally, empirical data pertaining to the biofuel sector in the EU will be analyzed. This data will frame the current status and progress of the EU's transition towards renewable energy sources, including the use of biofuels. The chapter will explore key statistics, trends, and targets related to the EU's green energy agenda.

Together with the empirical analysis, the chapter will also discuss a theoretical analysis framed within the field of International Political Economy (IPE) and apply Interdependency and National Competitiveness theories.

5.1 EU Energy Dependency

The EU's energy policy has received attention recently due to its new sustainable targets and the ongoing Russia-Ukraine conflict, although it had been overlooked in the past. It wasn't until the early 1990s that the EU's energy framework began to take shape as it exists today. The initial focus was on environmental protection rather than energy dependence. Today, both aspects of dependency and sustainability are intertwined and frame the current strategy.

In 1995 the "White Paper: An Energy Policy For the European Union" was introduced. Back then, the European Commission already stated the need to create a coherent energy policy at the European Union level, making acknowledging the existence of forces that will have important consequences on the future of the Community's energy sector as the members move to greater integration and into a more competitive energy market[99].

The importance was given considering that energy is strategically relevant as a raw material for industry, particularly energy-intensive industries, for the quality of life and the creation of jobs. This is because energy prices have a high impact on costs of production, consumer prices overall, and economic convergence within the EU[100]. In line with this, the EU began adopting directives aimed at liberalizing the energy market. The First Energy Package, which was introduced for electricity in 1996 and for gas in 1998, was incorporated into the legal systems of member states in 1998 and 2000, respectively[101].

[99] European Commission, *An Energy Policy for the European Union* (European Commission, 1996). P. 5.
[100] European Commission, *An Energy Policy for the European Union* (European Commission, 1996). P. 5.
[101] "Internal Energy Market | Fact Sheets on the European Union | European Parliament," Europa.eu, 2009.

Therefore, an energy policy framework with common objectives would enable the Community to respond effectively to potential destabilization in prices, with higher attention to complex problems involving energy and environmental protection[102]. For that, there is a commitment by industries, governments, international organizations, and the general public to ensure that measures in the energy sector will not jeopardize sustainable development, which the Community endorsed in its Fifth Environmental Action Programme – Towards Sustainability[103].

In sequence, the called "Green Paper: Towards a European Strategy for the Security of Energy Supply" was in discussion. The Commission opened a debate in 1993 between all interested parties, which was followed by its introduction in November 2000. This document pointed to the necessary reorganization and diversification of the energy sources imports with supply flexibility and, at the same time, warned against the increasing fuel import dependency[104]. In addition, there was a focus on research and technological development and environmental and energy policies to be considered in an integrated manner. It is interesting to note that the Commission refers to a matter of security of supply. Further developments in the European energy policy were directed towards greater diversification of resource management, energy demand, improved supervision of external energy supplies, and the establishment of the internal market[105].

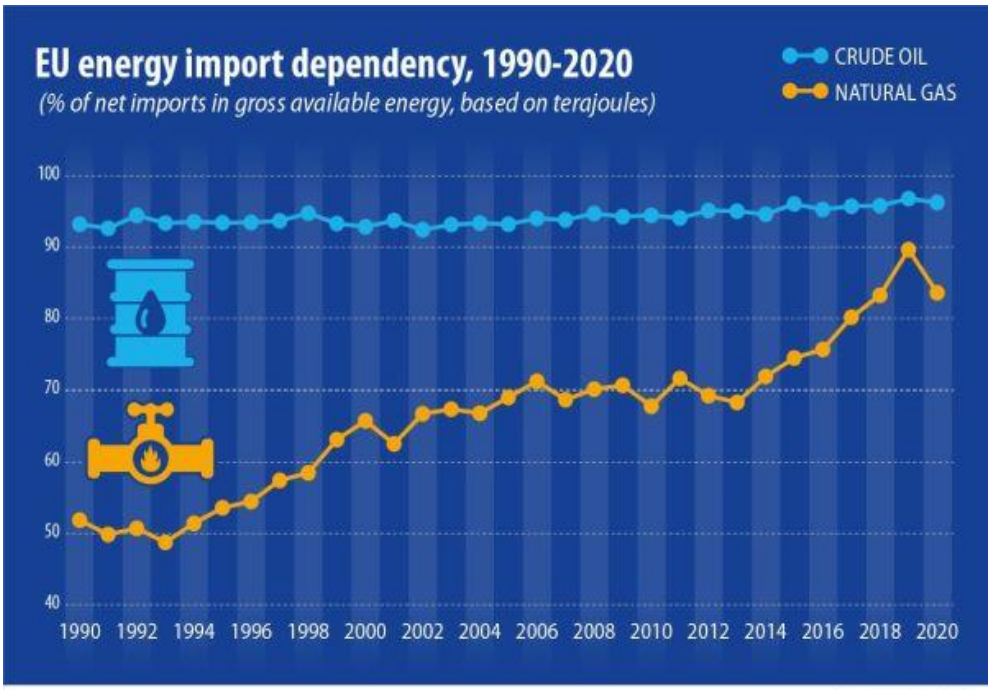
In the same line, later in 2006, the Green Paper "A European Strategy for Sustainable, Competitive and Secure Energy" was introduced. This paper contained the major declaration of the EU to foster energy sources diversification amid the context after the first Russian-Ukrainian crises with the pro-democracy leader Viktor Yushchenko's election and the gas transit crisis between both countries[106]. While in 2006, when the EU depended on 50% of energy imports, there was the expectation that this share would rise to 70% in the next 20 to 30 years from that period[107]. It was already highlighted that the source of energy comes from regions threatened by insecurities. The dependence on gas would increase to 80% over the next 25 years, where mainly three countries imported the consumption: Russia, Norway, and

[102] European Commission, *An Energy Policy for the European Union* (European Commission, 1996). P. 5.
[103] European Commission, *An Energy Policy for the European Union* (European Commission, 1996). P. 5.
[104] European Commission, *An Energy Policy for the European Union* (European Commission, 1996). P. 6.
[105] Milan Vosta and Svitlana V. Musiyenko, "Energy Security and Energy Policy of the EU in the context of ressource import dependency," *Aktual'Ni Problemy Ekonomiky = Actual Problems in Economics* no. 174 (2015): 39–48. P. 45.
[106] Ibid.
[107] European Commission, *An European Strategy for Sustainable, Competitive and Secure Energy* (European Commission, 2006). P. 3.

Algeria. Besides energy consumption being in a rising trend, so it was Greenhouse gas emissions (GHG), which was expected to increase by around 60% by 2030[108].

According to data from Eurostat, it is possible to observe this trend already pointed out by these previous documents released by the European Commission. In the period from 1990 to 2020, the EU's dependence on energy imports increased steadily. In gas, it went from around 50% in 1990 to around 85% in 2020, having its highest point of 90% of dependency in 2018. In oil, the dependency share maintained fairly stable as we can observe:

Figure 3.



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These high numbers come from the fact that the European Union is not a significant producer of energy compared to its demand, where the most important primary energy source is oil and petroleum products, accounting for 35% of the market share between all types of energy consumed[110]. In mid-2005-2015, oil production in the EU decreased from 3185 barrels per day to 1437 barrels per day, and it keeps following a decreasing trend[111]. It is noteworthy that this period was before Brexit. The UK was the biggest producer, accounting for 60% of the total EU oil production. In addition, despite not being an EU member state, Norway is the

[108] Ibid. P. 3-4.
[109] "EU Energy Mix and Import Dependency," ec.europa.eu, accessed April 11, 2023.
[110] "Energy Statistics - an Overview," ec.europa.eu, accessed May 2023.
[111] Milan Vosta and Svitlana V. Musiyenko, "Energy Security and Energy Policy of the EU in the context of resource import dependency," *Aktual'Ni Problemy Ekonomiky = Actual Problems in Economics* no. 174 (2015): 39–48.P. 42. Apud BP, 2014).

largest oil producer in Europe, surpassing the total oil production of all EU countries combined[112]. In 2021, the biggest producers in the EU were Italy, Denmark, and Romania, respectively. Yet, their production is far from being sufficient to cover the demand. In 2020, the EU relied on oil imports accounting for 96,96% of its total consumption[113].

Natural gas is the second most important source of primary energy in the EU. The total EU consumption accounted for almost 22%[114]. The largest supplier is Russia, which uses its dominant position as political leverage and adapts its pricing policy according to political needs[115]. The overall gas production is approximately only 30% of the total EU consumption, and the largest consumers in the EU are listed in order by Germany, Italy, France, the Netherlands, and Spain[116]. Again, the main natural gas suppliers to the EU are Russia, Norway, and Algeria. In 2020, the sum of the import volume from those countries and together with smaller-scale sourcing countries accounted for 83.6% of the total gas imports to the EU, and Russia alone represented 41,1%[117].

Moving to the next milestone in the EU energy framework, the European Commission released an import document to the European Council and the European Parliament. Entitled "An Energy Policy for Europe," the paper set the ground for the later "Action Plan for the years 2007-2009", which created the internal market for electricity under Common EU Energy Policy[118]. Despite being an action specific to electricity security, it contributed to strengthening the EU framework on energy policies and strategies in general as it set rules and recommendations for the generation, transmission, distribution, and supply of electricity, intending to improve and integrate energy markets across the EU. This movement was aligned with the Second Energy package that was adopted in 2003 and internalized by 2007. From that point, industrial and domestic consumers were free to choose their own gas and electricity suppliers[119].

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[112] Ibid.
[113] "EU Energy Mix and Import Dependency," ec.europa.eu, accessed April 11, 2023.
[114] "Energy Statistics - an Overview," ec.europa.eu, accessed May 2023.
[115] Milan Vosta and Svitlana V. Musiyenko, "Energy Security and Energy Policy of the EU in the context of ressource import dependency," *Aktual'Ni Problemy Ekonomiky = Actual Problems in Economics* no. 174 (2015): 39–48.P. 42. Apud BP, 2014).
[116] "EU Natural Gas Consumption by Country," Statista, accessed May 9, 2023.
[117] "EU Energy Mix and Import Dependency," ec.europa.eu, accessed April 11, 2023.
[118] Milan Vosta and Svitlana V. Musiyenko, "Energy Security and Energy Policy of the EU in the context of ressource import dependency," *Aktual'Ni Problemy Ekonomiky = Actual Problems in Economics* no. 174 (2015): 39–48.P. 45. Apud BP, 2014).
[119] "Internal Energy Market | Fact Sheets on the European Union | European Parliament," Europa.eu, 2009.

In 2009, the scope was broadened to introduce the international market for oil and gas. The Third Energy Package achieved liberalization of gas and electricity markets, ensuring a functioning market with fair market access and a high level of consumer protection, as well as adequate levels of interconnection and generation capacity. Nevertheless, with a gap of ten years, in 2019, the Forth Package added more complexity and resilience mechanism to the EU energy policy framework. It consisted of one directive (Electricity Directive 2019/944/EU) and three regulations (Electricity Regulation 2019/943/EU, Risk-Preparedness Regulation 2019/941/EU, and EU Agency for the Cooperation of Energy Regulators (ACER) Regulation 2019/942/EU).

Here, there was a focus on renewable energies together with dependency risks. The Fourth Energy Package implemented new regulations for the electricity market to facilitate the integration of renewable energies and attract investments. It mandated that Member States must develop contingency plans to address potential electricity crises and expand the competencies of ACER (Agency for the Cooperation of Energy Regulators) for cross-border regulatory cooperation in cases where there is a risk of national or regional fragmentation[120].

At last, the Fifth Energy Package, also known as the "Fit for 55," came to introduce the current energy targets on sustainability within the EU. It was published in July 2021, and its main purpose is to align the energy targets with the new European climate ambitions for 2030 and 2050. In special, after Russia's invasion of Ukraine in February 2022 and after having the Russian gas supply cut after a political move, the EU decided to phase out all Russian fossil fuel imports rapidly. Other energy-saving measures, diversification, and a plan to accelerate the adoption of renewables were also endorsed.

5.2 EU sanctions towards Russia

As we can observe, previous EU strategies on energy and sustainability shows that energy security was gaining traction among policymakers in the EU, and that position was already reflecting upon the energy packages and action plans. This particularly can be traced back to the 2014 European Energy Strategy and the 2015 Energy Union framework, which included, among other goals, the diversification of energy suppliers and strengthening resilience against price and supply chocks[121].

[120] "Internal Energy Market | Fact Sheets on the European Union | European Parliament," Europa.eu, 2009.
[121] Ibid.

Within the EU-Russia trade relationship, oil was perceived as a lucrative component, while gas was seen as more sensitive due to the challenges associated with diversifying gas suppliers. It is important to note that the vulnerability to gas supply disruptions varied among European member states, leading to different policy positions among them[122].

Aligned to this same period, the tensions arised with the annexation of Crimea by Russia and the non-implementation of the Minsk agreements, which represented a series of international agreements which sought to end the Donbas conflict between separatist groups and the Armed Forces of Ukraine[123]. In retaliation, the EU started gradually to impose sanctions on Russia in 2014.

EU leaders decided to tie the existing economic sanctions as Russia kept non-fulfilling the Minsk agreements in March 2015. As a result, the EU has extended the sanctions multiple times. These measures include restrictions on specific companies and individuals with close relations to the Russian government, as well as sector-wide actions that limit trade in goods that are related to the defense and energy sectors. In response, Russia has imposed counter-sanctions on imports of food products from the US, EU, and other countries that joined the original sanctioning measures against Russia[124].

However, the measures did not affect the overall trade energy volume between the EU and Russia not until 24 February 2022, when Russia invaded Ukraine. Sanctions include targeted restrictive measures in the form of individual sanctions, economic sanctions, and visa measures. The economic sanctions aim to harm Russian economy for its actions and to effectively weaken Russian abilities to continue the aggression[125].

Summing up all individual sanctions, the EU has sanctioned 1473 individuals and 207 entities. The EU has also imposed sanctions on Belarus for its involvement in Russia's invasion of Ukraine and on Iran due to the supply of drones to Russia, which is considered to be a military aid. As part of the economic side, the EU has imposed a number of import and export restrictions on Russia[126]. According to the European Commission, since February 2022, the over €43.9 billion in exported goods to Russia and €91.2 billion in imported goods were lost[127].

[122] Marco Siddi, "EU-Russia Energy Relations," *Handbook of Energy Governance in Europe*, 2022. P. 243.
[123] European Council, "EU Sanctions against Russia Explained," Council of the European Union, 2022.
[124] "EU Sanctions against Russia over Ukraine," www.consilium.europa.eu, n.d.
[125] Ibid.
[126] Ibid.
[127] Ibid.

One of the most affected sectors was energy, where Russian goods are banned from exporting to the EU. The complete list of sanctioned products includes the following [128]:

- crude oil (from December 2022) and refined petroleum products (from February 2023), with limited exceptions
- coal and other solid fossil fuels
- steel, steel products, and iron
- gold, including jewelry
- cement, asphalt, wood, paper, synthetic rubber, and plastics
- seafood and liquor (e.g., caviar, vodka)
- cigarettes and cosmetics

In June 2022, the Council adopted a sixth package of sanctions that, among others, sanctions the purchase, import, or transfer of seaborne crude oil, that is, the oil supplied by sea transport and other certain petroleum products from Russia to the EU. One of the measures implemented is a price cap aimed at reducing the price of Russian oil. These sanctions came into effect on December 5, 2022, for crude oil, and on February 5, 2023, for other refined petroleum products[129]. As most of the Russian oil delivered to the EU is seaborne, these restrictions covered nearly 90% of Russian oil imports to Europe in 2022. However, there is a foreseen exception for imports of crude oil supplied by pipeline to member states that suffers from a higher dependence and have no alternative sources.

This movement targets to reduce Russia's trade profits and harm the country's ability to finance the war. However, the scenario also greatly impacted the EU as the group became sensitive to energy prices and supply. Therefore, it brings new challenges to substitute the energy gap made by Russia and to achieve the sustainable goals set on the Package Fit for 55.

On the other hand, Russia responded by cutting the gas export to the EU as the region is more vulnerable in this market. Gazprom announced a reduction of gas supply from the main pipeline Nord Stream 1 from June 2022[130]. Initially, the discourse was due to technical reparation, but it was rapidly followed by declarations from high Russian authorities relating to a response to the EU sanctions. This shortage had a significant impact on prices.

The Dutch TTF spot, the pricing scheme hub for gas, reached 320€/MWh on 26 August, while regular prices surrounded between 20-30€/MWh before the conflict[131]. The current

[128] European Council, "EU Sanctions against Russia Explained," Council of the European Union, 2022.
[129] Ibid.
[130] "Quarterly Report on European Gas Markets Market Observatory for Energy DG Energy Volume 15 (Issue 3, Covering Third Quarter of 2022) Energy," accessed February 21, 2023.
[131] Ibid.

tightness of the gas market and the sharp increase in both spot and future prices can have been impacted due to multiple factors, including reduced availability of Nord Stream, the complete supply shutdown that fully started in early September 2021, and uncertainties in the market regarding how to ensure alternatives in the short and medium term. These developments occurred during a period of high gas demand due to the need for storage refilling and multiple heat waves during the summer[132].

To fill this gap, the EU had to rely on the import of LNG, where the region saw an import increase of 89% from September 2021. In most of 2022, gas hub prices in Europe developed a premium price compared to the Asian markets, giving solid incentives to send LNG cargoes to Europe. The abundance of LNG in southwestern and northwestern Europe resulted in a permanent discount in LNG import prices to the TTF and other international systems[133].

This movement was a strategy to guarantee sufficient gas to supply the EU over the 2021-2022 winter and to ensure a higher stock load for the upcoming winter. This flow shift was validated because the higher price made the EU attractive. However, the high prices impacted the EU economy, households, and industries, especially for the high-intensive industries. In contrast, the EU succeeded in reducing consumption by 8% compared to 2021[134]. This was due to awareness policies for the population to use less gas, together with a high price that in itself discouraged consumption.

Analyzing the sanctions, there is also a transition period where a cap is imposed to harm Russian oil in the international market, but at the same time, the EU continues to import from Russia as there is no immediate supply alternative. But it is clear that the EU is aiming to detach its energy sector not to have a dependent relationship. Also, it means that even with all these restrictions, Russia remains to export oil to the EU as there's no immediate shift considering infrastructure and geographical conditions. However, for the gas scenario, the context differs because the EU is more vulnerable to Russia than oil. While in the oil context, more players can supply the EU and more resilience in stocks[135]; the gas market is more susceptible to disruptions due to the lack of supply and infrastructure alternatives that need time and high investments to adapt to new trade flows.

[132] Ibid.
[133] Ibid.
[134] Ibid.
[135] European Commission, "EU Oil Stocks," energy.ec.europa.eu, accessed May 2023.

5.3 The Green Energy Transformation in the EU

In this context of uncertainties in energy supply, the green energy transformation plays an important role for both reasonings within the European Union: to meet the sustainable goals and to achieve energy diversification. The European Green Deal is one of the current most important sustainable policies where it sets the framework for the EU to achieve carbon neutrality by 2050.

In November 2019, the European Parliament declared a climate emergency by asking the European Commission to adapt all its proposals in line with a 1.5 °C target for limiting global warming and ensuring that greenhouse gas (GHG) emissions are significantly reduced[136]. Therefore, the Parliament adopted the EU Climate Law on 24 June 2021, which makes legally binding a target of reducing emissions by 55% by 2030 compared to 1990 and climate neutrality by 2050[137]. While the European Green Deal (EGD) represents the general action plan to mitigate climate change, the Fit for 55 Package sets the measures to achieve the targets of the EGD.

On the energy side, the EU already counted with the Renewable Energy Directive (2009/28/EC), called RED I, which is the legal framework for developing renewable energy across all sectors of the EU economy, supporting clean energy cooperation among the member states[138]. Given the need to speed up the EU clean energy transition, the Directive was revised into the called RED II and entered into force in 2018. Yet, its biding application started since June 2021[139].

With the changes, the RED II sets the overarching European renewable energy target of 32% and includes rules to ensure the uptake of renewables in the transport sector and in heating and cooling, as well as common principles and rules for renewables support schemes, the rights to produce and consume renewable energy and to establish renewable energy communities, and sustainability criteria for biomass[140]. It also establishes rules to remove barriers, stimulate investments and drive cost reductions in renewable energy technologies, and empowers citizens, consumers, and businesses to participate in the clean energy transformation[141].

In July 2021, the European Commission proposed a third revision of the directive to increase the target to 40%, up from the previous 32%. This proposal aims to implement the

[136] European Parliament , “Green Deal: Key to a Climate-Neutral and Sustainable EU,” June 2022.
[137] European Parliament , “Green Deal: Key to a Climate-Neutral and Sustainable EU,” June 2022.
[138] European Commission, “Renewable Energy Directive,” energy.ec.europa.eu, 2022.
[139] Ibid.
[140] Ibid.
[141] Ibid.

RED III as part of the Fit for 55 package, which seeks to implement the European Green Deal. However, due to the recent Russian invasion of Ukraine and the need for greater energy independence from fossil fuels, the Commission proposed another increase in the target to 45% by 2030. On 30 March 2023, a provisional agreement was reached for a binding target of at least 42.5%, with the aim of reaching 45%. Once the legislative process is complete, the new legislation will be officially adopted and put into effect[142].

Although the EU has made progress in increasing the share of renewables in the overall energy market, this progress has not been entirely consistent, even after adopting the Renewable Energy Directive. While the percentage of renewables increased from 9.6% to 21.8% between 2004 and 2021, this progress occurred over a period of 17 years. With a target of 45% by 2030, significant progress still needs to be made in less than a decade.

Figure 4.

Share of energy from renewable sources, 2004-2021
(% of gross final energy consumption)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
EU	9.6	10.2	10.8	11.7	12.6	13.9	14.4	14.5	16.0	16.7	17.4	17.8	18.0	18.4	19.1	19.9	22.0	21.8
Belgium	1.9	2.3	2.7	3.1	3.6	4.7	6.0	6.3	7.1	7.7	8.0	8.1	8.7	9.1	9.5	9.9	13.0	13.0
Bulgaria	9.2	9.2	9.4	9.1	10.3	12.0	13.9	14.2	15.8	18.9	18.0	18.3	18.8	18.7	20.6	21.5	23.3	17.0
Czechia	6.8	7.1	7.4	7.9	8.7	10.0	10.5	10.9	12.8	13.9	15.1	15.1	14.9	14.8	15.1	16.2	17.3	17.7
Denmark	14.8	16.0	16.3	17.7	18.5	19.9	21.9	23.4	25.5	27.2	29.3	30.5	31.7	34.4	35.2	37.0	31.7	34.7
Germany	6.2	7.2	8.5	10.0	10.1	10.9	11.7	12.5	13.5	13.8	14.4	14.9	14.9	15.5	16.7	17.3	19.1	19.2
Estonia	18.4	17.5	16.0	17.1	18.8	23.0	24.6	25.5	25.6	25.4	26.1	29.0	29.2	29.5	30.0	31.7	30.1	37.6
Ireland	2.4	2.8	3.1	3.5	4.0	5.2	5.8	6.6	7.0	7.5	8.5	9.1	9.2	10.5	10.9	12.0	16.2	12.5
Greece	7.2	7.3	7.5	8.2	8.2	8.7	10.1	11.2	13.7	15.3	15.7	15.7	15.4	17.3	18.0	19.6	21.7	21.9
Spain	8.3	8.4	9.2	9.7	10.7	13.0	13.8	13.2	14.2	15.1	15.9	16.2	17.0	17.1	17.0	17.9	21.2	20.7
France	9.3	9.3	8.9	9.4	11.2	12.2	12.7	10.8	13.2	13.9	14.4	14.8	15.5	15.8	16.4	17.2	19.1	19.3
Croatia	23.4	23.7	22.7	22.2	22.0	23.6	25.1	25.4	26.8	28.0	27.8	29.0	28.3	27.3	28.0	28.5	31.0	31.3
Italy	6.3	7.5	8.3	9.8	11.5	12.8	13.0	12.9	15.4	16.7	17.1	17.5	17.4	18.3	17.8	18.2	20.4	19.0
Cyprus	3.1	3.1	3.3	4.0	5.1	5.9	6.2	6.2	7.1	8.4	9.1	9.9	9.8	10.5	13.9	13.8	16.9	18.4
Latvia	32.8	32.3	31.1	29.6	29.8	34.3	30.4	33.5	35.7	37.0	38.6	37.5	37.1	39.0	40.0	40.9	42.1	42.1
Lithuania	17.2	16.8	16.9	16.5	17.8	19.8	19.6	19.9	21.4	22.7	23.6	25.7	25.6	26.0	24.7	25.5	26.8	28.2
Luxembourg	0.9	1.4	1.5	2.7	2.8	2.9	2.9	2.9	3.1	3.5	4.5	5.0	5.4	6.2	8.9	7.0	11.7	11.7
Hungary	4.4	6.9	7.4	8.6	8.6	11.7	12.7	14.0	15.5	16.2	14.6	14.5	14.4	13.6	12.5	12.6	13.9	14.1
Malta	0.1	0.1	0.1	0.2	0.2	0.2	1.0	1.8	2.9	3.8	4.7	5.1	6.2	7.2	7.9	8.2	10.7	12.2
Netherlands	2.0	2.5	2.8	3.3	3.6	4.3	3.9	4.5	4.7	4.7	5.4	5.7	5.8	6.5	7.4	8.9	14.0	12.3
Austria	22.6	24.4	26.3	28.1	28.8	31.0	31.2	31.6	32.7	32.7	33.6	33.5	33.4	33.1	33.8	33.8	36.5	36.4
Poland	6.9	6.9	6.9	6.9	7.7	8.7	9.3	10.3	11.0	11.5	11.6	11.9	11.4	11.1	14.9	15.4	16.1	15.6
Portugal	19.2	19.5	20.8	21.9	22.9	24.4	24.1	24.6	24.6	25.7	29.5	30.5	30.9	30.6	30.2	30.6	34.0	34.0
Romania	16.8	17.6	17.1	18.2	20.2	22.2	22.8	21.7	22.8	23.9	24.8	24.8	25.0	24.5	23.9	24.3	24.5	23.6
Slovenia	18.4	19.8	18.4	19.7	18.6	20.8	21.1	20.9	21.6	23.2	22.5	22.9	22.0	21.7	21.4	22.0	25.0	25.0
Slovakia	6.4	6.4	6.6	7.8	7.7	9.4	9.1	10.3	10.5	10.1	11.7	12.9	12.0	11.5	11.9	16.9	17.3	17.4
Finland	29.2	28.8	30.0	29.6	31.1	31.0	32.2	32.5	34.2	36.6	38.6	39.2	38.9	40.9	41.2	42.8	43.9	43.1
Sweden	38.4	40.0	41.7	43.2	43.9	47.0	46.1	47.6	49.4	50.2	51.2	52.2	52.6	53.4	53.9	55.8	60.1	62.6
Iceland	58.9	60.3	60.9	71.9	68.0	70.2	70.9	72.3	73.7	73.8	73.0	71.9	75.3	74.1	77.2	78.6	83.7	85.8
Norway	58.4	60.1	60.5	60.4	62.0	65.1	61.9	64.6	64.9	66.5	68.4	68.5	69.2	70.0	71.6	74.4	77.4	74.1
Montenegro	:	35.7	34.8	32.9	32.3	39.4	40.6	40.6	41.5	43.7	44.1	43.1	41.5	39.7	38.8	37.7	43.8	39.9
Moldova	7.4	6.4	7.0	6.4	7.0	7.9	21.4	22.1	24.3	24.4	26.2	26.2	26.9	27.8	27.5	23.8	25.1	22.3
North Macedonia	15.7	16.5	16.5	15.0	15.6	17.2	16.5	16.4	18.1	18.5	19.6	19.5	18.0	19.6	18.2	17.5	19.2	17.3
Albania	29.6	31.4	32.1	32.7	32.4	31.4	31.9	31.2	35.2	33.2	31.9	34.9	37.0	35.8	36.6	38.0	45.0	41.4
Serbia	12.7	14.3	14.5	14.3	15.9	21.0	19.8	19.1	20.8	21.1	22.9	22.0	21.1	20.3	20.3	21.4	26.3	25.3
Kosovo*	20.5	19.8	19.5	18.8	18.4	18.2	18.2	17.6	18.6	18.8	19.5	18.5	24.5	23.1	24.6	24.2	24.4	22.4
Georgia	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	19.0

Results until 2020 are based on the methodology included in Directive 2009/28/EC, while results for 2021 are based on Directive (EU) 2018/2001
** This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence.*
Source: Eurostat (online data code: nrg_ind_ren)

eurostat

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Nevertheless, given the new measures, it is possible to observe that the EU accelerated the transition to renewables due to instabilities with Russia and Ukraine. Within the International Political Economy (IPE) field of study, human behavior is at the center of the decision-making process under conditions of scarcity and constraints, which is the case of this analysis. The EU

142 Ibid.
143 Eurostat. "Renewable Energy Statistics," ec.europa.eu, n.d.

is in a position of energy scarcity and needs to adapt, and this movement impacts the region's decision-making process. Therefore, IPE directly impacts the functioning of the international system and political and economic power relations as they are intrinsically related to behavior, whether at the individual or state level. The factors that can impact this dynamic vary from different perspectives. Susan Strange (1994) frames production and trade, money and finance, knowledge and technology, and security as the main factors[144]. In this case, we can observe all of these factors as trade, money and finance are directed related to the energy trade aspect and knowledge, technology and security also plays a role regarding the development of renewables and the security of energy supply.

Moreover, the EU-Russian relationship in energy dates back to the Cold War period and started to gain traction since then. They were mainly marked by commercial interests and a positive trade flow of hydrocarbons, oil, and gas[145]. The EU benefits from the import of energy at a competitive price, while Russia benefits from the revenue, knowledge, and technology for further developments in the sector. At the same time, as pointed out in the literature review, the EU and Russia slowly diverged in how to approach their energy strategies. Therefore, Strange's factors have played a role in the adopted behavior of both sides.

Marked by an interdependent relationship, the EU was early aware of the risks of higher levels of dependence in the energy sector. As we can observe, the first papers, strategies, and regulations surrounding energy within EU member states already included dependency concerns together with sustainable issues. As the energy-related sectors are responsible for 75% of total greenhouse gas emissions (GHG) in the EU, this market is a sensitive topic for the region considering the ambitious goals for climate change. On the other hand, Russia does not share the same concerns, or at least not at the same level[146]. Considering that the EU was framing a transition with biding goals to increase the renewable share, consequently, this movement would have an impact on the production and trade area with Russia as the relationship was mainly built upon the fossil fuels market.

However, the pointed data in *Figure 1* indicates that despite the adoption of new energy directives and sustainable goals, the energy trade between the EU and Russia did not have a negative impact. On the contrary, it kept increasing, supported by demand. In this scenario, most previous literature assessed that a boycott or hard economic measures towards oil or gas

[144] Susan Strange, *States and Markets* (Bloomsbury Publishing, 2015). P. 29-32.
[145] Marco Siddi, "EU-Russia Energy Relations," *Handbook of Energy Governance in Europe*, 2022. P. 238.
[146] Ibid. P. 239.

from Russia could potentially backfire, as the negative impact may not outweigh the potential benefits.

At the same time, it can be argued that the EU-Russian interdependence in the energy field intensified the tensions between the regions as supported actions and reactions to get a better position in the asymmetrical relationship. For instance, with the EU promoting diversification from Russia. This strategy clearly promotes less dependency on energy and is transparent in affirming that the dependence on Russia is seen as a risk due to political instabilities.

The EU's concerns regarding energy security were further validated as political tensions between Russia and Ukraine escalated. Russia demonstrated its willingness to use its energy market as a political tool to pursue its own interests, as evidenced by the gas cuts imposed on Ukraine in early 2006 as a means to pressure more favorable price agreements. However, the intensification of disagreements, coupled with Russian actions that contravened EU values, particularly the annexation of Crimea, marked a turning point. This was further exacerbated by the invasion in February 2022.

In response to these developments, the European Council issued a joint statement condemning Russia's illegal annexation of Ukraine's Donetsk, Luhansk, Zaporizhzhia, and Kherson regions, in addition to the adoption of sanctions described above. Such Russian actions were seen as attempts to undermine the rules-based international order and as a violation of Ukraine's fundamental rights to independence, sovereignty, and territorial integrity, principles enshrined in international law and upheld by the United Nations[147].

5.3.1 REPower EU and its impacts

From the EU's internal perspective, the REPowerEU Plan was introduced in May 2022 as a strategic response to address the energy supply shortage. Aiming to save energy by producing clean energy and diversifying energy suppliers, the Plan is supported by financial and legal measures to build and adapt infrastructures and energy systems. In other words, the plan is to make Europe independent from Russia's fossil fuel before 2030. Among the short-term and medium-term initiatives, it is included[148]:

[147] European Council, "Statement by the Members of the European Council," September 2022.
[148] European Commission, "REPowerEU: Affordable, Secure and Sustainable Energy for Europe," commission.europa.eu, 2022.

Figure 5.

REPower EU

Short-term initiatives	Medium-term initatives
Common purchases of gas, LNG and hydrogen via the EU Energy Platform for all Member States who want to participate as well as Ukraine, Moldova, Georgia and the Western Balkans.	New national REPowerEU Plans under the modified Recovery and Resilience Fund – to support investment and reforms worth €300 billion.
New energy partnerships with reliable suppliers, including future cooperation on renewables and low carbon gases.	Boosting industrial decarbonisation with €3 billion of frontloaded projects under the Innovation Fund.
Rapid roll out of solar and wind energy projects combined with renewable hydrogen deployment to save around 50 bcm of gas imports.	New legislation and recommendations for faster permitting of renewables especially in dedicated 'go–to areas' with low environmental risk.
Increase the production of biomethane to save 17 bcm of gas imports.	Investments in an integrated and adapted gas and electricity infrastructure network.
Approval of first EU-wide hydrogen projects by the summer.	Increased ambition on energy savings by raising the EU-wide target on efficiency for 2030 from 9% to 13%.
An EU Save Energy Communication with recommendations for how citizens and businesses can save around 13 bcm of gas imports.	Increase the European renewables target for 2030 from 40% to 45%.
Fill gas storage to 80% of capacity by 1 November 2022.	New EU proposals to ensure industry has access to critical raw materials.
EU-coordination demand reduction plans in case of gas supply disruption.	Regulatory measures to increase energy efficiency in the transport sector.

Looking into the short-term measures, it is already possible to observe some impacts. Considering the Russian gas shutdown from September 2022, the EU successfully guaranteed enough gas to go through the winter and start the new year with record storage, making it easier to fill it again for the winter of 2023-2024. This is because LNG imports rose by 89%, mostly coming from the USA, followed by Qatar and Russia, respectively[149]. However, even in an extreme context, the supply shortage did not impact higher internal production within the EU. In the third quarter of 2022, natural gas production fell by 9% compared to the same period a year ago.

While some countries observed an increase, such as Denmark (+14%), Ireland (+11%), Hungary (+8%), and Italy (+3%), the main producers observed a significant decrease in the Netherlands (-13%), Germany (-9%) and Romania (-2%). The European Commission pointed

[149] "Quarterly Report on European Gas Markets Market Observatory for Energy DG Energy Volume 15 (Issue 3, Covering Third Quarter of 2022) Energy," accessed February 21, 2023.

out that this trend is an effect of technical and societal/environmental obstacles, such as resistance from society to further gas exploitation and depleted gas fields[150].

On the other hand, biogas and biomethane production are on an upward trend. According to the European Biogas Association, the sector already provides 18,4 billion cubic meters (bcm) of renewable gas to Europe. By 2050, it is expected to scale up to 167 bcm, covering 35-62% of 2050's gas demand[151]. The International Energy Agency (IEA) also indicates a similar expectation. There are sufficient sustainable feedstocks to support 95 bcm of biomethane output and a potential to achieve 130 bcm by 2050[152]. Hence, the REPower EU set the target to the biomethane production achieve a supply of 35 bcm per year by 2030.

For that, The European Commission introduced in May 2022 a Staff Working Document that includes possible actions to unlock the potential of biogas and biomethane across the EU. It promotes biomethane production from waste and residues, contributing to energy production, saving decomposition emissions, and creating a better destination to waste and residues that would otherwise lead to land use change issues. By 2024, for example, the EU member states must collect separate organic waste that could boost biomethane production[153].

Subsequently, the EU launched the Biomethane Industrial Partnership (BIP) in September 2022 to support the achievement of the 35 bcm target. The Biomethane Implementation Plan (BIP) aims to foster collaboration and engagement between various stakeholders, including the European Commission, EU member states, industry players, feedstock producers, academia, and NGOs. The plan seeks to facilitate the stakeholders' dialogue regarding biomethane production and utilization. Additionally, the EC will work closely with member states to assist them in developing national strategies for biomethane production and encourage cooperation on biomethane between member states, including Ukraine[154].

However, it is important to note that a significant journey is still ahead. One key aspect to consider is the distinction between biogas and biomethane. Biogas refers to a mixture of various gases, which includes biomethane, carbon dioxide, and others. To convert biogas into biomethane, a purification process is necessary to remove undesirable gases. Currently, the

[150] Ibid.
[151] EBA. Statistical Report 2022-Open Interactive. 2022.
[152] International Energy Agency (IEA), "Scaling up Biomethane in the European Union: Scaling up Biomethane in the European Union: Background Paper," 2022.
[153] "Biomethane," energy.ec.europa.eu, accessed May 2023.
[154] Ibid.

European Union produces only 3 bcm of biomethane. In order to achieve the target of scaling up production to 35 bcm by 2030, significant mobilization within the sector is required[155].

This entails implementing measures and initiatives to increase production capacity and improve the purification process to meet the ambitious goals[156]. While biogas can be used to power electricity and heating, biomethane is a direct substitute for natural gas[157]. The European Biogas Association assesses that 5.000 new biomethane plants must be constructed by building entirely new facilities and upgrading existing biogas plants to produce biomethane[158].

On the consumer side, the European Commission proposed a new legislative tool in July 2022 to reduce gas use in Europe by 15% until next spring. The new regulation set a target for all Member States to reduce the gas demand by 15% between 1st August 2022 and 31st March 2023. To help Member States deliver the necessary demand reductions, the Commission has also adopted a European Gas Demand Reduction Plan which sets out measures, principles, and criteria for coordinated demand reduction[159].

According to Eurostat, the EU achieved the target, having natural gas consumption dropped by 17.7%[160]. Following this short-term reduction, the EU also released the Communication (COM/2022/24) to promote voluntary energy saving based on the energy security argument due to supply disruption and aiming to lower GHG emissions[161].

The EU strategically constructed a rhetoric that framed energy as a security issue, driven by its heavy reliance on Russian oil and gas for its energy consumption. While both oil and gas imports were of concern, the vulnerability was particularly pronounced in the gas market. The limited availability of alternative gas supplies and the challenges associated with building new alliances created a high level of dependence on Russian gas. Developing new infrastructure for gas supply requires significant investments and time, making it a complex task. As an alternative, liquefied natural gas (LNG) can be shipped by sea from other regions, but this option comes with higher prices due to logistical considerations and competition overseas. Consequently, the impact of this situation is felt by both consumers and industries, particularly

[155] International Energy Agency (IEA), "An Introduction to Biogas and Biomethane – Outlook for Biogas and Biomethane: Prospects for Organic Growth – Analysis," IEA, 2020.
[156] Ibid.
[157] Ibid.
[158] Dekker Harmen and Peters Daan, "Commission Announces Groundbreaking Biomethane Target: 'REPowerEU to Cut Dependence on Russian Gas' | European Biogas Association," www.europeanbiogas.eu, March 2022.
[159] Ibid.
[160] Eurostat. "EU Gas Consumption Decreased by 17.7% - Products Eurostat News - Eurostat," ec.europa.eu, accessed May 12, 2023.
[161] "EUR-Lex - 52022DC0240 - EN - EUR-Lex," Europa.eu, 2022.

those in energy-intensive sectors, as it directly affects the cost of production and the competitiveness of EU products on the international stage.

The rhetoric of security was deliberately employed to shape the new strategies aimed at reducing the EU's dependency on Russia. This approach involved setting binding targets for EU member states to accelerate the adoption of renewable energy sources within a shorter timeframe. By implementing action plans for industries and consumers, the EU sought to address energy supply shortages.

On the consumer side, higher energy prices were used as a means to discourage excessive consumption while simultaneously attracting LNG to the European market as an alternative energy source. These measures were designed to enhance energy security and promote a shift towards more sustainable and diversified energy systems within the EU.

For example, the REPower EU increases the scope compared to the Fit for 55 package to decrease natural gas consumption in all industrial sectors by 2030. Implementing REPowerEU would, in addition to higher fuel prices, lead to a switch in the industrial sector from natural gas to hydrogen and coal and, to a lesser extent, oil[162]. This is a way of saying that the EU might face higher prices in the short period, but the adoption of this strategy will lead to better energy security by achieving renewable alternatives. Therefore, the rhetoric of energy security is being used to justify political action in face of an asymmetrical relationship with Russia.

The security-focused rhetoric not only aimed to accelerate the transition to renewables and reduce energy consumption but also to establish and enhance partnerships with alternative energy suppliers. During the critical period when there were concerns about filling the EU's reservoirs for winter, the United States and Norway played significant roles in supplying energy. Their contributions helped mitigate the risk of a severe shortage crisis. Moreover, these partnerships extended beyond short-term supply arrangements, as the EU sought to foster medium and long-term energy agreements that prioritize investments in renewables and sustainable practices to reduce greenhouse gas emissions, such as the project of carbon capture. Notably, the United States emerged as a key supplier of LNG, further diversifying the EU's energy sources.

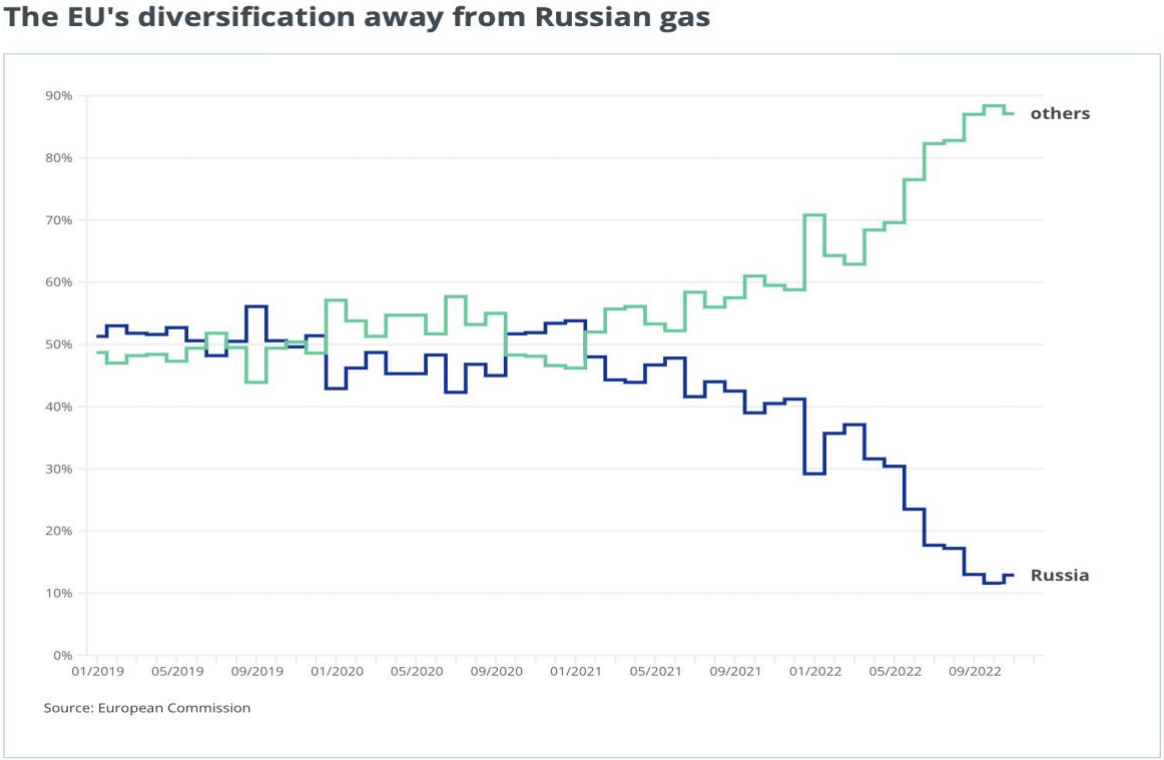
Rather than resorting to military force or direct involvement in the conflict, the European Union initially opted for a response rooted in realism by imposing stiff economic

[162] European Commission, “Implementing the REPower EU Plan: Investment Needs, Hydrogen Accelerator and Achieving the Bio-Methane Targets. SWD (2022) 230 Final.,” Europa.eu, May 2022.

sanctions on Russia. These measures changed the before liberal lead relationship based on cooperation in energy to a conflicted one. The sanctions scope extends beyond the energy sector and has had a broad impact that affects trade to finance and political domains. This has led to a significant detachment in the overall relations between the EU-Russia and can be seen as a power movement attempt to change Russian behavior towards Ukraine. However, it is important to note that certain exemptions are granted based on the higher dependency of certain member states, particularly those in the Balkan region. Yet, Russia's share in the EU imports decreased by 22,9% for gas and 5,7% for oil[163].

In order to diversify the gas import from Russia, the EU built and strengthened partnerships to ensure energy supply. Starting in July 2021, there was a gradual move to reduce imports from Russia and increase imports from other partners. However, after the invasion in early 2022, there was a sharp continuation of this trend.

Figure 6.



[164]

In contrast, Norway is now the main natural gas supplier to the EU, holding 24,93%, followed by Algeria with 11,62% and others with 13,09%. For the LNG imports, the United

[163] Eurostat, "EU Imports of Energy Products - Latest Developments," ec.europa.eu, March 2023.
[164] European Council, "Where Does the EU's Gas Come From?," www.consilium.europa.eu, February 7, 2023.

States, together with Qatar and Nigeria, summed 25,72% in the market share[165]. In particular, the EU and Norway signed the Green Alliance, being the most comprehensive bilateral agreement established under the European Green Deal. Signed on April 2023, the initiative will deepen cooperation, especially in clean energy and industrial transition[166].

Of its kind, the EU also firmed a similar agreement with Japan in May 2021. In both agreements, there is a focus on energy transition and research and technical development[167]. As an example, the EU and Norway are developing multiple projects of carbon capture and storage. This mechanism is a set of technologies aimed at capturing, transporting, and permanently storing CO2 that would otherwise be emitted into the atmosphere[168].

As for the LNG from the United States of America, in July 2018, the former president of the European Commission, Jean-Claude Juncker, and the former American president, Donald Trump, agreed to enhance EU-U.S. strategic cooperation in the energy sector. Since then, there has been a significant increase in the EU imports of liquefied natural gas (LNG) from the U.S., rising by 181%. In a press release from the EC, it was stated that the EU is open to increasing imports of LNG from the US as long as market conditions and prices are favorable[169].

In addition, The EU has co-financed or committed to co-finance LNG infrastructure projects worth over €656 million. Recent developments show that the LNG infrastructure has been implemented. The gas interconnector between Greece and Bulgaria, the Polish-Slovak gas interconnector, the Baltic pipeline, delivering gas from Norway, and a new floating LNG terminal in Eemshaven in the Netherlands have been inaugurated and became operational in Q4 2022[170].

Together with investments and partnerships to guarantee the current demand for fossil fuels, one way of decreasing dependency is by increasing energy production. However, the European Union (EU) faces challenges in this regard, as it is not a significant producer of fossil fuels. Both oil and gas production fall short of meeting the demand within the EU, primarily due to technical barriers and societal resistance towards expanding fossil fuel production.

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[165] Ibid.
[166] "Norway," energy.ec.europa.eu, n.d.
[167] "Press Corner," European Commission - European Commission, accessed May 12, 2023.
[168] "Carbon Capture, Storage and Utilisation," energy.ec.europa.eu, n.d.
[169] "EU-U.S. Joint Statement: Liquefied Natural Gas (LNG) Imports from the U.S. Continue to Rise, up by 181%," European Commission - European Commission, n.d.
[170] "Quarterly Report on European Gas Markets Market Observatory for Energy DG Energy Volume 15 (Issue 3, Covering Third Quarter of 2022) Energy," accessed February 21, 2023.

In terms of energy production in 2020, renewables held the largest market share among various energy sources in the EU, accounting for 40.8%. Nuclear energy followed closely at 30.5%, while solid fossil fuels contributed 14.6%, natural gas accounted for 7.2%, crude oil comprised 3.3%, and other sources constituted 3.7% of the energy mix. Renewable energy sources encompass bioenergy (biomass and waste), hydropower, wind, solar, ambient heat, and geothermal energy[171]. These numbers show that renewables, in addition to having the current largest market share, are also the market with the greatest potential for growth in domestic production, considering that we have seen that fossil fuels have social, resource, and technological resistance.

Despite the significant progress in renewable energy production, the EU still heavily relies on imports, which comprise 57.5% of its energy consumption[172]. This highlights that the current level of EU production is insufficient to ensure complete energy security. Alongside investments and partnerships to secure the necessary supply of fossil fuels, the EU needs to enhance further its domestic energy production capabilities to decrease dependency and strengthen energy security.

5.4 Biofuels framework

Regarding fuels, the European Union recognizes the significant impact of the transport sector on greenhouse gas emissions and has implemented specific measures to address this issue. In 2017, the transport sector accounted for 27% of the total greenhouse gas (GHG) emissions in all EU-28 member states. Among the various modes of transport, road transport contributed the largest share, followed by aviation and maritime activities[173].

In the EU's policy framework for the transport sector, the White Paper "Roadmap to a Single European Transport Area" adopted in 2011 sets out key objectives and targets to be achieved by 2050. The main focus is on reducing greenhouse gas emissions and decreasing dependency on oil. A big part of the strategy is to invest in technology and innovation. They are marked as essential for the EU to achieve climate neutrality in the sector[174]. According to the White Paper, the transport sector in the EU aims to achieve a 60% reduction in greenhouse gas emissions by 2050 compared to 1990 levels. In addition, the EU's policy framework has

[171] Eurostat, "Energy Production and Imports," ec.europa.eu, January 2022.
[172] Ibid.
[173] European Environment Agency, "Greenhouse Gas Emissions from Transport in Europe," European Environment Agency, 2019.
[174] European Commission, "White Paper: Roadmap to a Single European Transport Area – towards a Competitive and Resource Efficient Transport System. COM(2011) 144 Final," March 2011.

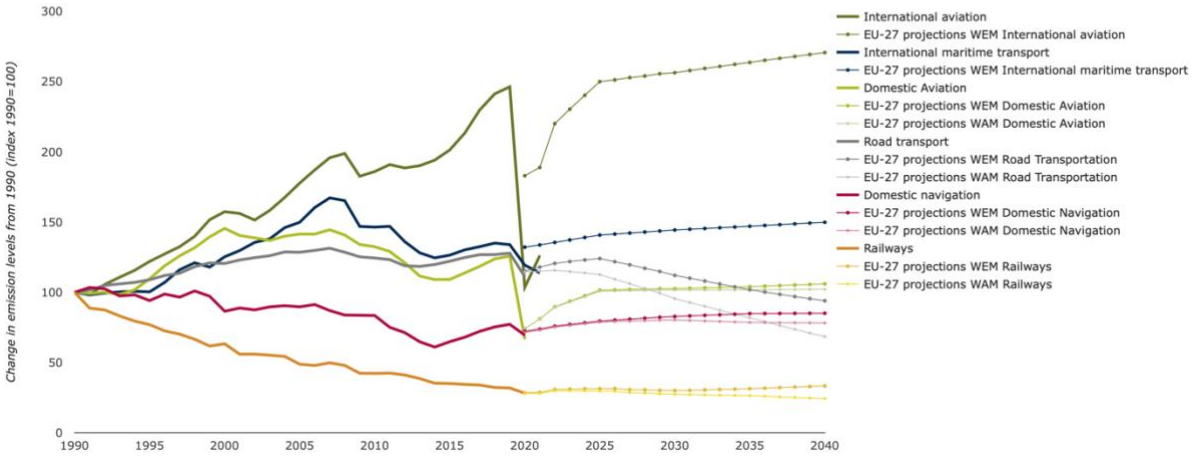
been further strengthened with the adoption of the EU Green Deal, which sets out a comprehensive plan to make the European Union climate-neutral by 2050[175].

Nevertheless, since 1990 the European Union has experienced an overall increase in GHG emissions from the transport sector, although there have been variations among different subsectors. For instance, emissions from railways and domestic navigation, as well as domestic aviation, have shown a decreasing trend over time. However, emissions from international aviation and road transport have continued to rise[176].

Notably, the trend in emissions was disrupted in 2019 and 2020 due to the COVID-19 pandemic, which led to a significant reduction in transport activity. As a result, greenhouse gas emissions from the transport sector temporarily decreased during this period[177].

Figure 7.

Figure 2. Greenhouse gas emissions from transport in the EU, by transport mode and scenario



[178]

In this context, the EU share of renewables in the transport sector reached 9.1% in 2021, which is below the target set by the EU to reach 14% by 2030, as outlined in the Fit for 55 package[179]. To achieve this goal, the EU has adopted a strategy focused on decarbonization through vehicle electrification, establishing appropriate infrastructure, providing incentives, and promoting alternative fuels such as advanced biofuels, hydrogen, and liquified methane[180].

[175] Statistical Office Of The European Communities, *Energy, Transport and Environment Statistics : 2020 Edition* (Luxembourg: Publications Office Of The European Union, 2020). P. 50.
[176] Ibid.
[177] Ibid.
[178] European Environment Agency, "Greenhouse Gas Emissions from Transport in Europe," European Environment Agency, 2019.
[179] Eurostat, "Share of Renewables in Transport Decreased in 2021 - Products Eurostat News - Eurostat," ec.europa.eu, January 2023.
[180] European Council, "Fit for 55: Towards More Sustainable Transport," www.consilium.europa.eu, April 2023.

The EU aims to facilitate the transition to electric vehicles by enhancing charging infrastructure networks and offering financial incentives to encourage their adoption[181].

On the other hand, in the current share of renewables in the transport sector, the main alternative considered is biofuels, as per the criteria outlined in the Renewable Energy Directive II (2009/28/EC). This is because although the recent boost to promote electrification in the transport sector, the current impact is still minimum. The same case applies to hydrogen and liquefied methane as a fuel source, as there are still technical and economic barriers to escalating and making it profitable for the producers[182].

Aligned with this, Michael E. Porter (1990) asserts that a country's competitiveness depends on its industry's ability to innovate and improve. Despite the fact that the European Union is not categorized in the Weberian form of unity of the national state, the EU shares some of the same characteristics based on institutions and governance within its member states. In this case, the EU acts as the "state" as it possesses the legitimacy to create and adopt policies. Therefore, in Porter's view, it can be argued that the EU must act to provide the right conditions for the biofuels sector to achieve competitiveness, considering that the sector is strategic to secure energy diversification in transport.

However, there are some specificities within the biofuels sector as it is a highly regulated market. Biofuel producers must follow a range of quality specifications and, above all, sustainable criteria that frame most of the market. This creates a close relationship between policy formulators and the industry, as projections of demand and supply are directly related to what is set in policies. For instance, by 2030, a minimum share of 3,5% of advanced biofuels is mandatory among other renewable energy sources in transport[183]. On the other hand, future electrification in road transport will probably have an impact on the demand side for biofuels as it changes the market options. Although besides road transportation, biofuels have an important role in the decarbonization of the aviation and maritime sectors, being one more alternative energy source.

[181] Ibid.
[182] General Secretariat of the Council, "COM(2021) 559 Final: Proposal for a REGULATION of the EUROPEAN PARLIAMENT and of the COUNCIL on the Deployment of Alternative Fuels Infrastructure, and Repealing Directive 2014/94/EU of the European Parliament and of the Council" (2022).
[183] European Commission, "Biofuels," energy.ec.europa.eu, accessed May 2023.

5.4.1 Renewable Energy Directive towards the transport sector

The revised Renewable Energy Directive (EU) 2018/2001 (RED II) established an overarching policy for promoting and using energy from renewable sources in the EU. According to Article 25 of the directive, each member state is required to calculate the minimum share of renewables for the transport sector, taking into account two key criteria[184].

Firstly, they must consider renewable liquid and gaseous transport fuels of non-biological origin. This includes fuels such as advanced biofuels, hydrogen, renewable diesel (HVO), and synthetic fuels produced from renewable sources[185]. Secondly, recycled carbon fuels are also included, which encompasses fuels that are produced from recycled non-renewable sources such as fossil waste from plastic, rubber, etc[186].

The directive also provides for the specific feedstocks that the first type of fuels can be produced from in Annex IX, including biomass fractions of wastes and residues from forest-based industries, animal manure, and sewage sludges, used cooking oil, animal fats as categories 1 and 2 in accordance with Regulation (EC) No 1069/2009, for instance[187]. However, even counting these measures and the policy framework set in the Fit for 55 package to escalate decarbonization in the European transport sector, National projections compiled by the European Environment Agency (EEA) suggest that domestic transport emissions will only drop below their 1990 level in 2029[188].

It is important to mention that only road transport emissions are projected to decrease until 2030 as most of the measures are directed to this subsector, also because it is the one with the highest share in emissions and, therefore, the strategic focus. In 2020 it emitted 77% of all EU transport GHGs, including domestic transport and international bunkers. The largest increases up to 2030 are projected in the aviation sector, followed by international maritime transport, as national policies do not prioritize them[189]. Still, the Fit for 55 package also encompasses measures to foster advanced biofuels for aviation and maritime.

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[184] European Commission, "Biofuels," energy.ec.europa.eu, accessed May 2023.
[185] European Parliament , "DIRECTIVES DIRECTIVE (EU) 2018/2001 of the EUROPEAN PARLIAMENT and of the COUNCIL of 11 December 2018 on the Promotion of the Use of Energy from Renewable Sources (Recast) (Text with EEA Relevance)," 2018.
[186] Ibid.
[187] Ibid.
[188] European Environment Agency, "Greenhouse Gas Emissions from Transport in Europe," European Environment Agency, 2019.
[189] European Parliament , "DIRECTIVES DIRECTIVE (EU) 2018/2001 of the EUROPEAN PARLIAMENT and of the COUNCIL of 11 December 2018 on the Promotion of the Use of Energy from Renewable Sources (Recast) (Text with EEA Relevance)," 2018.

Called RefuelEU aviation initiative, the proposal aims to increase both demand for and supply of sustainable aviation fuels (SAF) while ensuring a level playing field across the EU air transport market[190]. This is facilitated considering that biofuels in general, including road, aviation, and marine, can be made of agricultural waste, used cooking oil, and hydrogen, for example. This means that the current production of biofuels can be directed to all these subsectors according to their specificities. The difference relies on technical parameters to adapt to current engines in these subsectors[191].

For the maritime sector, the initiative called FuelEU Maritime aims to reduce the greenhouse gas intensity of the energy used onboard by ships by up to 75% by 2050 by promoting the use of greener fuels by ships[192]. Despite progress in recent years with the limited use of alternative fuels, the maritime sector still operates almost entirely on fossil fuels. It constitutes a significant source of greenhouse gases and other harmful pollutant emissions due to the low availability of biofuels that match the current ship engines[193].

5.4.2 Biofuel production

The United States was the world-leading biofuel producer in 2021, with production amounting to 1,436 petajoules. Brazil and Indonesia ranked second and third, with production accounting for around 840 and 312 petajoules, respectively. In contrast, Germany's biofuel production reached around 121 petajoules that year, which puts the country among the top five countries in biofuel production and the leading producer in Europe[194]. Therefore, the production of biofuels is part of the European strategy to diversify its energy matrix as the region counts with an elaborated infrastructure and availability of supply and demand.

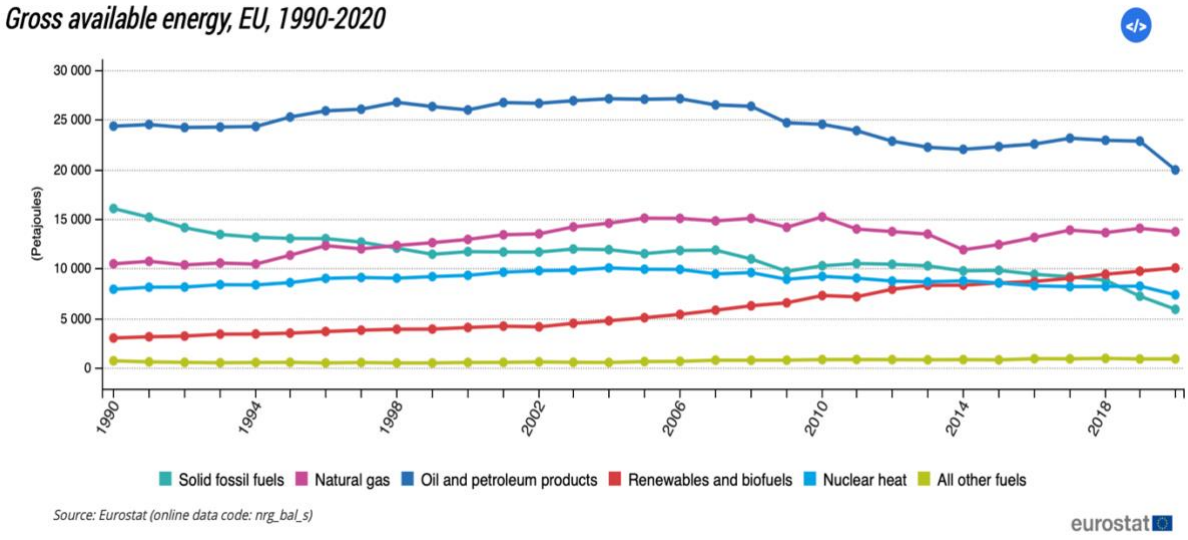
By 2030, the EU aims to increase the share of renewable energy in transport to at least 14%, including a minimum share of 3.5% of advanced biofuels. At the same time, EU countries must define the obligation of fuel suppliers, aiming to ensure this target's achievement[195].

In addition, the RED II reinforced the sustainability criteria for biofuels. That is because most biofuel production worldwide currently uses the so-called conventional feedstocks, such

[190] European Council, "Fit for 55," www.consilium.europa.eu, 2022.
[191] Chia-wen Carmen Hsieh and Claus Felby, *Biofuels for the Marine Shipping Sector: An Overview and Analysis of Sector Infrastructure, Fuel Technologies and Regulations* (IEA Bioenergy, 2017).
[192] European Council, "Fit for 55," www.consilium.europa.eu, 2022.
[193] Chia-wen Carmen Hsieh and Claus Felby, *Biofuels for the Marine Shipping Sector: An Overview and Analysis of Sector Infrastructure, Fuel Technologies and Regulations* (IEA Bioenergy, 2017).
[194] Statista, "Leading Countries Based on Biofuel Production Worldwide in 2021," Statista, March 2023.
[195]European Commission, "Biofuels," energy.ec.europa.eu, accessed May 2023.

as sugar cane, corn, rapeseed, palm, and soybeans. In the EU case, this is a concern as it can promote land use expansion and increase competition with the food and feed industries[196]. Consequently, the current focus of the EU strategy is to promote advanced biofuels as described above.

In this context, the availability of renewables and biofuels already surpassed solid fossil fuels in 2018 and 2019 and gained further ground in 2020. In comparison, solid fossil fuels decreased by 18.4 % in 2020, sinking to the lowest value since 1990[197]. These data reinforce the role of biofuels in the EU strategy of decarbonization in the transport sector as their share in energy availability follows an increasing trend, as we can observe in the latest Eurostat data: *Figure 8.*



As for the demand side, according to the International Energy Agency (IEA), global demand for biofuels is set to grow by around 41 billion liters, which corresponds to 28% over 2021-2026. Government policies aligned with sustainable goals are the principal driver of the remaining expansion. However, other factors such as overall transport fuel demand, costs, and specific policy design influence the growth and which fuels grow the quickest[198].

Even though the main producer countries are not located in the European Union territory, the region still holds a high demand position, especially for advanced biofuels with the new targets set on RED II. Nevertheless, the European market is still dominated by conventional feedstocks, which led the European Commission to limit the production and

[196] Ibid.
[197] Ibid.
[198] International Energy Agency (IEA), "Biofuels – Renewables 2021 – Analysis," IEA, 2021.

consumption of first-generation biofuels with the Low ILUC (Indirect Land Use Change) directive, establishing a cap on these fuels at 5%. Hence, one of the conditions that other regions surpassed the EU is because of less restrictive regulations on the allowed feedstocks. While other regions are allowed to use, to a larger extent first generation fuels that are related to conventional feedstocks, the EU, on the other hand, is stricter to guarantee the use of advanced biofuels that are sourced from waste[199].

According to the International Energy Agency (IEA), there is a risk of feedstock shortage for the production of advanced biofuels. The demand for vegetable oil, waste, residue oils, and fats is projected to increase by 56% to 79 million tonnes between 2022 and 2027[200]. Fuels derived from wastes and residues are particularly in high demand because they meet the greenhouse gas emissions and feedstock policy stated in European regulations such as the RED II. By 2027, wastes and residues will account for 13% of biofuel production, compared to 9% in 2021[201]. However, a significant fraction of the feedstocks for EU biodiesel production is sourced by imports. For instance, UCO imports accounted for more than 50% of the EU consumption, showing a risk in case of disruption in international markets[202].

The increasing demand for these feedstocks is showing signs of their availability limit. Despite this, markets are dynamic, and high prices serve as a signal to explore new sources[203]. This situation has accelerated the development of government initiatives and industry innovations to address the potential feedstock shortage risk and ensure a sustainable supply of advanced biofuels. Efforts are being made to identify new feedstock sources and improve the efficiency of feedstock utilization to meet the growing demand for biofuels. These efforts can be observed through the EU strategies towards the sector. The measures have a wide range of diversification, meaning to spread out demand and supply from electrification, power-to-x, and hydrogen, among others.

With this context of uncertainties and increasing competition regarding the availability of feedstock and the development of other renewable energy sources, it can be argued that these factors contribute to a competitive scenario. According to Porter (1995), local competition is one of the aspects of the diamond model as it leads companies to invest and innovate, creating

[199] Ibid.
[200] International Energy Agency (IEA), "Is the Biofuel Industry Approaching a Feedstock Crunch?," IEA, December 2022.
[201] Ibid.
[202] Anouk van Grinsven et al., "Used Cooking Oil (UCO) as Biofuel Feedstock in the EU" (CE Delf, December 2020). P. 20.
[203] Ibid.

better solutions to be introduced to the market and consumers. This is because competition pushes each other to lower costs and to pursue better effectiveness in production, strategy, sales, and other aspects. However, the aspect of firm strategies and technologies that are being developed was not included in this research due to a lack of data and time constraints.

Moreover, demand conditions are also present. As we can observe, the IEA pointed out that the demand for biofuels will increase by around 28% by 2026, showing that there is space for further development in the sector, especially in the short and medium term, where there is still a lack of other renewables sources in large scale for the transport sector as it is the case of hydrogen and power-to-x (PtX) for instance. The demand is also driven by the EU regulations considering that there is a binding target for industries to achieve a set percentage of advanced biofuels in their fuel blending.

Regarding related and supporting industries, a parallel can be made throughout the different types of biofuels available. The Annex IX of RED II states which feedstocks can be used to produce advanced biofuels, where there is a range of possibilities with producers opting for one or another, or even multiples. A study led by Salimbeni pointed out that the overall production of biofuels in the European Union accounted for how many facilities are currently in production and for which type. The database reports 310 facilities within liquid fuels and 233 for producing biomethane[204].

It is also worth highlighting that these facilities can cross among different sectors. The use of waste in accordance with Annex IX can be applied not only for biofuels but multiple other industries like oleochemicals, food, and feed industry[205]. Pointing out that besides competing with each other, these facilities also have an aspect of support when the productions are complementary.

Therefore, the EU has an active role in promoting a competitive environment, as described by Porter (1995). Despite the controversial aspect of factor conditions with the risk of lack of availability of feedstocks, the EU, through regulations and initiatives, is setting the tone for the sharp increase and development of renewables in general, including biofuels. This movement is aligned with what Porter described as ideal regarding the role of the state. One example of that is the Horizon 2020 initiative. It is a funding programme for research and investments (R&I) that is designed to facilitate and strengthen the impact of R&I in supporting and implementing EU policies, by promoting industrial competitiveness and protecting

[204] Andrea Salimbeni, *Overview on Biofuels Production Facilities and Technologies in Europe* (Renewable Energy Consortium for Research and Demonstration (RE-CORD): BIKE-biofuels, 2021).
[205] Ibid.

knowledge[206]. Under Horizon 2020, great part of the scope encompasses the energy sector, including clean hydrogen, aviation, and bio-based solutions[207].

Chapter 6. Discussion

According to Keohane and Nye (2001), interdependence does not guarantee a conflict-free relationship, yet conflict can arise in new forms and might even increase.[208] In this case, it can be argued that the asymmetrical interdependence relationship between the EU-Russia does not necessarily lead to the chosen adopted behavior by the EU in hard-sanctioning Russia, but the relationship was already showing signs of a detachment of strategies and values. On the other hand, due to the dependent condition, particular EU member states showed resistance to limiting Russian energy as it would be too harmful to their economies, as in the case of Balkans countries and intensive industries countries, such as Germany. We can observe this as the energy trade between the EU and Russia did not significantly impact until the invasion.

However, world politics and the international economy are marked by continuity and change. The invasion in February 2022 brought to light the EU's susceptibility to disruptions in its energy supply and its asymmetrical dependence on Russia. Recognizing this vulnerability, Russia strategically utilized its control over gas exports as a political tool to exert pressure on the EU and manipulate the unfolding Ukraine-Russia conflict. By either cutting off or threatening to cut off gas supplies, Russia aimed to affect outcomes and coerce the EU into stepping back from supporting Ukraine. This episode highlights the power dynamics inherent in the asymmetrical EU-Russia relationship, where Russia exploits its energy resources for political gain.

In this context, indeed, asymmetrical interdependence can be a source of power when it comes to control of resources and the potential to affect outcomes. The faster assumption would be to consider that the less dependent country would have a significant political resource due to higher resilience to disruptions. However, Keohane and Nye (2001) argue that this advantage does not guarantee control over outcomes; instead, it is just a potential.

As this case refers to the EU as vulnerable, the disruption of the energy supply led to human action in the form of adopting sanctions, policies, and new strategies for the energy

[206] EUR-Lex, "Research and Innovation - EUR-Lex," eur-lex.europa.eu, accessed May 2023.
[207] EUR-Lex, "EUR-Lex - 4567592 - EN - EUR-Lex," eur-lex.europa.eu, accessed May 2023.
[208] Robert Owen Keohane and Joseph S Nye, *Power and Interdependence* (Longman Publishing Group, 2001). P. 7.

sector overall. Therefore, the EU reacted, and it was willing to bear the high costs of adjusting. This impacts world dynamics and international regimes within energy as it changes the flows of energy in the international market and also sets the tone to increase faster the renewables share not only in the EU but at first to its partners and at the international level, given the economic importance of the EU.

For the green energy transformation, it can be concluded from the data analyzed that the conflict deepened the divergencies between the EU and Russia, which led to the EU speeding up the pace to shift its energy matrix to renewables. With higher targets for 2030, the member states must adapt in a considerably short period of time, considering the historical pace. Over the period of 17 years from 2004 to 2021, there was an increase of 12,2%. In less than a decade, the EU must achieve more than 23,2%.

Consequently, the asymmetrical energy relationship between the EU and Russia and the conflict catalyzed a significant shift in the EU's energy regime. Prior to the invasion, although the EU had established frameworks and mechanisms to promote carbon neutrality through recommendations, regulations, and measures, it did not exhibit the same level of urgency and determination to set binding targets and proactive action plans for accelerating the adoption of renewables. However, as the relationship deteriorated and the need for energy independence and sustainability became more pronounced, the EU adopted a more aggressive approach. This is evident in implementing initiatives such as the Fit for 55 package and the REPower EU, which aim to foster the transition to renewables and reinforce the EU's commitment to combat climate change.

Aligned with the EU movement to promote renewables, the biofuel sector is framed as one of the key areas for the EU to diversify from Russian energy and as an intermediate solution to decarbonize the transport sector, considering that other long-term solutions need time to develop and become economically viable. Hence, having in mind the competitiveness of biofuels, according to Porter (1990), companies achieve competitiveness through innovation in the broad sense, such as by improving technologies, ideas, processes, marketing, etc. The advantage of it comes when competitors are slow to react. Once a company achieves advantage competitiveness, it can only sustain it through more innovations. Thus, with this assumption, successful companies constantly pursue upgrades, and the state plays an important role in sustaining the right conditions.

The European Union (EU) biofuel industry is composed of major players such as Neste, Eni, Total, Preem, Repsol, and others. These companies have made significant investments in alternative fuels, particularly in producing advanced biofuels. One notable advantage of these

investments is the utilization of existing refining portfolios, leveraging the infrastructure for storage, processing, and logistics of liquid fuels[209].

Focusing on advanced biofuels enables these companies to diversify their product offerings and contribute to the EU's renewable energy goals. Advanced biofuels are derived from sustainable feedstocks and provide a more environmentally friendly alternative to conventional fossil fuels in the short term. By investing in advanced biofuels, these companies align themselves with the EU's sustainability objectives and support the transition to a low-carbon economy[210].

Furthermore, there is growing interest in emerging technologies such as hydrogen and power-to-x (PtX) within the biofuel industry. These are described in the REPower EU Plan and are directed promoted by the EU as alternatives for the future. While these areas are still in the early stages of development, many of the firms mentioned above have made initial investments in these sectors[211]. Hydrogen and PtX technologies have the potential to play a significant role in the future of the energy industry, offering additional opportunities for diversification and renewable energy production.

Therefore, it is possible to argue that the EU is promoting the right environment to foster innovations by encouraging investments and setting the tone from the regulatory and sustainable point of view. There are multiple funding schemes and research initiatives to boost this market within the EU. The REPowerEU plan is speeding up the green transition and promoting massive investment in renewable energy. With an aggressive investment fund, the Plan is mobilizing close to €300 billion, where approximately €72 billion will be in grants and approximately €225 billion in loans[212].

However, it is also important to note several uncertainties surrounding the biofuels markets. This market is expected to face more competition as other renewables are being developed. For instance, fully electric transport vehicles accounted for 12,1% in market share in 2021[213], while the European Environment Agency expects an increase to 80% in market share by 2050[214]. Additionally, power-to-x fuels using renewable electricity is estimated to

[209] Alfredo López et al., "What Future Role for Conventional Refineries in Hydrogen/E-Fuels Production?" (Ricardo, July 2022). P. 1-3.
[210] Ibid.
[211] Ibid.
[212] European Commission, "REPowerEU: Affordable, Secure and Sustainable Energy for Europe," commission.europa.eu, 2022.
[213] ACEA, "Fuel Types of New Cars: Battery Electric 12.1%, Hybrid 22.6% and Petrol 36.4% Market Share Full-Year 2022," ACEA - European Automobile Manufacturers' Association, February 1, 2023.
[214] EEA, "Electric Vehicles and the Energy Sector - Impacts on Europe's Future Emissions — European Environment Agency," www.eea.europa.eu, 2016.

overgrow in the following years, together with broader infrastructure to support these new technologies[215]. Moreover, there are additional uncertainties regarding the projected volume of batteries that will be produced for electric vehicles and, consequently, the consumption of critical raw materials involved in their construction.

These overall uncertainties highlight sustainable biofuels' potential role in achieving the EU's sustainability targets for the transport sector by 2030 and 2050[216]. Not only for road transport but especially in aviation and maritime that lack further development alternatives, aligned to the EU goal of achieving diversification and not only relying on a few energy sources, including diversification within renewable options.

Chapter 7. Conclusion

This MA thesis explored the complex relationship between the European Union and Russia in the context of the energy sector, with a particular focus on the EU's transition to renewables and later with a focus on the biofuel industry as an alternative for the transport sector. Through an analysis of empirical data and theoretical frameworks such as Interdependence Theory and National Competitiveness, the findings point out to valuable insights into the challenges and opportunities faced by the EU in achieving its green energy goals.

The findings of this study have revealed the significance of EU sanctions towards Russia, particularly concerning the energy sector. This shift of political position was a reaction to a vulnerable interdependence relationship. The EU had to act to change the rules in order to bear the costs of an energy shortage.

The imposition of sanctions and the diversification of energy suppliers have become essential elements of the EU's energy security strategy, confirming that the Russian invasion of Ukraine started a process of faster deployment of renewable energies in the EU. That does not mean that before the invasion the EU did count with an extensive framework to promote renewables, but the analyzed data proved that until the invasion, the pace of this transformation did not have an impact on the EU-Russia trade on fossil energies. Meaning that the EU continued to consume high levels of non-renewables.

As a consequence, The REPowerEU Plan was introduced to save energy and promote clean energy production, highlighting the EU's commitment to becoming independent from

[215] Andrea Salimbeni, *Overview on Biofuels Production Facilities and Technologies in Europe* (Renewable Energy Consortium for Research and Demonstration (RE-CORD): BIKE-biofuels, 2021). P.10.
[216] Ibid.

Russian fossil fuels by 2030. Therefore, this MA can conclude that the invasion accelerated the EU green energy transformation.

Moreover, the study analyzed the biofuels sector in the EU, emphasizing its highly regulated nature and its role in the decarbonization of not only the road transportation sector but also the aviation and maritime sectors. The EU's ambitious targets for the share of advanced biofuels in the transport sector by 2030 reflect the importance placed on sustainable alternatives in the short and medium term, which posits the EU's role in promoting competitiveness within this sector according to Porter's criteria.

However, challenges remain. The International Energy Agency's warning of a potential feedstock shortage for advanced biofuels indicates the need for innovative solutions and the exploration of new supplies. Additionally, the rise of other renewable sources, such as electric vehicles in road transport, may impact the demand for biofuels in the future. Yet, this is not necessarily a negative factor, as Porter (1995) highlights that competition leads to advantage competitiveness and higher efficiency.

Considering all the above, this study contributes to the existing knowledge of the EU energy framework by providing a comprehensive understanding of the EU's energy dependency on Russia, the progress of the green energy transformation, and the specificities of the biofuels sector. It highlights the importance of policy measures, industry investments, and technological advancements in achieving the EU's sustainability goals. Moving forward, continued research and analysis in this area will be crucial to assess the effectiveness of policies, monitor market dynamics, and identify emerging trends and opportunities for a sustainable energy future in the EU.

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