# EU path dependency on fossil fuels: Lessons from the Russian invasion of Ukraine

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## Introduction

Since the creation of the European Coal and Steel Community (ESCS) in 1951, energy has been at the core of the European integration project which has ultimately resulted in the foundation of the European Union (EU) (Rogues, 2020). For decades long now, the reliable supply of fossil fuels has made the EU one of the world's biggest economies in the world, and still fosters growth (Van der Meijden & Smulders, 2017). However, the urge to combat climate change has forced policymakers within the EU to rethink the dominant role of fossil fuels in its energy supply. Throughout the years, the EU has agreed on ambitious climate goals and set targets to reduce greenhouse gas emissions and increase the share of renewable energy sources in its final energy consumption. This would imply phasing out the EU's reliance upon fossil fuels, but this has seemed to be rather difficult due to the so called 'carbon lock-in' (Jin, 2021). The EU has experienced an uphill battle in transitioning its fossil fuel-dominated energy system towards a more sustainable one, due to decades of institutional stickiness associated with the legal and regulatory framework governing energy derived from fossil fuels (Stein, 2017). One key contributor, that has laid the foundation for this study, is the effect of path dependence that manifests itself as resistance to changing the status quo of an energy infrastructure dominated by fossil fuels. One key element within the theories of path dependency is the role of key moments in time, that do change the status quo and can shape the outcome in such a way that future decisions are steered along the newly created pathway. In this study, I will examine whether or not the Russian invasion of Ukraine can be seen as such a critical juncture, and whether or not it can break the resistance the EU experiences in transitioning towards a more sustainable and environmentally friendly energy system. The research question that will thus be central to this study is:

*''What has been the impact of the Russian invasion of Ukraine on the green energy transition of the EU?''*

I will explore on the hand of the hand of path dependency theories the practical and legal efforts to overcome such resistance, and will identify the approaches to energy problems that have perpetuated the fossil fuel energy infrastructure. In addition, it will set forth a new framework that facilitates an expansion in logic helping to create positive feedback mechanisms to accelerate the deployment of renewable energy sources and the corresponding phase out of fossil fuels. This thesis will be structured as follows: I will first lay out my theoretical framework which will serve as a reference point for answering my research question. Within the theoretical framework, I will start by explaining the relevant concepts to this study. After having done so, I will set out the relevant literature concerning the European energy transition, the (energy) relations between the EU and Russia, and the way crises tend to affect the process in converging political, economic, and social counterparts. By doing so, I also try to identify gaps and inconsistencies in the existing literature. I will take on a geopolitical reductionist approach to gain an understanding of the relationship between the EU and Russia in terms of energy and draw on Historical Institutionalism (HI) and its literature on path dependency to explore both the barriers to change as well as means to overcome those barriers within the field of energy. When having concluded my theoretical framework, I will set forth my methodological approach used, and how I will go about answering my research question. When having done so, I will move on to my analysis which will be subdivided into three parts. The first part will explore the EU's dependency on fossil fuels coming from Russia, and how that has been affected since the Russian invasion of Ukraine. The second part tries to shed light on the EU's general dependency on fossil fuels, and whether or not the Russian invasion of Ukraine, which has decreased the EU's dependence upon fossil fuels coming from Russia, has decreased fossil fuel consumption and production within the EU. The last part will serve as a narrative account, exploring how the EU and its Member States have reacted to the Russian invasion in terms of their energy policies fostering a green energy transition. To back this up, I conclude the last part by testing the effectiveness of newly adopted energy policies by examining import levels of solar panels, windmills, and heat pumps before the Russian invasion took place and after. My finding will show that the Russian invasion has created a window of opportunity for change, which has set in motion an accelerated transition towards a greener energy system. However, no significant break in fossil fuel dependency has been made, though the first signs of change are apparent.

# Russian Impact: analytical scheme

## Theoretical Framework

My research question is approached from a mainly economic, and monetary perspective and is dedicated to the history of European path dependencies. The theoretical basis for my research employs concepts such as critical junctures and draws upon theoretical work stemming from historical institutionalism. In the first section, I will outline the relevant concepts after which I summarize the relevant literature for this research and I will conclude by exemplifying what this thesis contributes to this field of research.

## Conceptualization

In the following section, I provide a brief overview of some important concepts that will be addressed in this study. For many European countries, the invasion of Ukraine by Russia could be seen as a turning point for energy policies as they heavily rely on Russian energy supplies. For this study, it is important to gain a good understanding of the interpretation of energy policies. Energy policy could be framed as meeting varied social demands which are captured by the energy trilemma which weighs energy security, environmental sustainability, and energy equity (Kuzemko et al., 2022). Attempts to balance energy policy goals can be significantly impacted by external events. Furthermore, balancing energy policy goals as a systems transition is very difficult, which involves various tensions and trade-offs. In writing about the environment and the need to use energy wisely, we need to get a solid understanding of the importance of energy for the nation-state itself, and the way it affects any political, economic, or social integration process. According to Newborough et al. (1991), energy Is not to be seen as any other commodity, but as the pre-condition of all commodities. The importance of energy is particularly demonstrated when it is linked with technology, as they are to be seen as suitable for each other. A principal reason for a more interdependent world is technology, as well as a source for the integration process of the EU. Hamilton (1973) wrote something interesting concerning the intertwined relationship of energy and technology during the energy crisis of 1973-74, in which he stated that the very lifeblood of technology is the supply of energy, but that without any abundance of fuels, and in particular oil, gas, and coal, having an industrial state would simply not be possible. Furthermore, a nation-state strives to achieve an energy objective, in which a particular level of reliable supplies of energy sold at a reasonable price is assured, in a way that national values and objectives are not being jeopardized (Yergin, 1988). An energy crisis would obviously hurt such values and objectives. Energy is thus very important to the nation-state, and therefore it should also be seen as a very important variable, as well as an obstacle, in converging towards a more sustainable climate and deploying more environmentally friendly sources of energy.

In the past decades, the EU managed to maneuver itself dependent on Russian energy; that is, energy coming from Russia. By 2020, Russia was the largest supplier of fossil fuel and the second largest supplier of nuclear energy (Eurostat, 2022a; ESA 2021). It has long been noted by many political scientists that crises and shocks are important drivers for political processes. If we were to follow the concept of path dependency, this would apply. It asserts that to understand a particular outcome, one needs to pursue a historical analysis that has led to such an outcome (Pierson, 2000). It is therefore important to focus on the macro context in which a certain outcome develops for which one needs to pay special attention to the interplay of different institutions that influence the studied outcome. History, and thus the path on which a certain outcome has developed, is thus conceptualized in two ways: there are periods called critical junctures that, from a range of alternatives, have been chosen and thereby channel future movement over the course of a specific path (Mahoney & Schensul, 2019). Second, increasing return processes indicate that the likelihood to proceed with a certain path increases as the number of steps taken down that path increases as well (Skocpol & Pierson, 2002). Levi (1997) adds that it becomes more difficult to shift to a different path as one takes more steps down a certain path, which is called a lock-in effect. The European dependency on fossil fuel supplies from Russia can be seen as a consequence of actions that have been undertaken in the past. More importantly for this study, the Russian invasion of Ukraine and the coherent energy crisis in Europe could be a critical juncture itself after which a new path is chosen, in this context, with respect to energy policy.

Most definitions of crises lay their focus on the 'expectancy', the extent to which it threatens the goals, and the constraints on time that raise the level of intensity (Brecher, 1977; Hermann, 1982; Young, 1968). I will abandon common definitions of crisis by international relation scholars and use a definition of crisis as provided by Foster (1996): it is to be seen as a situation " situation in which the basic institutional patterns of the political system are challenged and routine response is inadequate." Foster notes that the crises that occur are the very situations in which society changes course (p. 29). They are to be seen as the focal points in which important decisions are made and society is redefined. There is reason to believe that the effectual magnitude of the Russian invasion of Ukraine has led to a window of opportunity for new climate and energy policies in Europe thereby emphasizing the accelerated phase out of fossil fuel energy use and the deployment of renewable energy sources.

## Literature review

This chapter aims at gaining an understanding of the existing research relevant to the European energy transition, the (energy) relations between the EU and Russia, and the way crises tend to affect the process in converging political, economic, and social counterparts. By doing so, I also try to identify gaps and inconsistencies in the existing literature. This study tries to examine whether or not the Russian invasion of Ukraine has accelerated the EU transition towards a greener energy infrastructure. Also, the literature will point out that the EU and Russia have shared a rather independent relationship where the EU has been dependent upon energy imports coming from Russia, and in turn, Russia has been dependent upon the EU as the largest net importer which has favored its federal budget. When Ukraine got invaded by Russia, the energy crisis that followed was, from a European perspective, merely a question of energy securitization. As the whole EU27 has been a net importer of energy, an abrupt cut in energy supplies from Russia meant that the EU needed to seek alternatives. This is where it gets interesting as national governments, in light of domestic interests, might stray away from supranationally set objectives. This is reasonable to assume as countries greatly differ in terms of national energy sources, whether it is a pool of natural gas, an arsenal of nuclear energy reactors, or an intensive coal industry. Furthermore, not every European country is as dependent upon energy imports from Russia, which also makes it plausible to assume that countries diverge in how they cope with the challenges posed by the energy crisis.

In this sense, with the energy crisis at hand, it is highly interesting to see whether or not we converge as a Union towards a greener climate, and how EU member states individually approach the supranationally set objectives with regards to reducing greenhouse gas emissions and the deployment of renewable energy sources. For this research, I will draw upon Historical Institutionalism and will make use of literature on dependence and dependency while taking on a geopolitical reductionist approach to EU-Russian relations. This paper adds to existing literature as it, by building on the theory of Historical Institutionalism, tries to shed light on the implications of the Russian invasion of Ukraine as a potential turning point in the European approach to its energy policy. Not every European country is as dependent on Russian energy and therefore this Russian invasion that marked the beginning of an energy crisis can have very different implications for different European countries. Some countries might steer more towards the agreed European climate goals whereas other countries might in fact stray away from those objectives where decision-making is mainly driven by domestic interests in the face of energy security. No actual research has been conducted in light of these posed questions, which for both the literature on path dependency as well as the political relevance of carbon neutrality, makes it an interesting study. It is not to be considered a gap in the literature per se, but this study is mainly written in order to provide interesting insights about where we are heading as a Union and thereby test the underlying theory of path dependency as a predicting value.

### Geopolitical reductionism

Ever since the end of the Cold War, liberal theories of international relations were employed as the optimal analytical framework in terms of explanatory power for the study of the energy relationship between the EU and Russia, as it put emphasis on the energy independence between the EU and Russia. However, ever since the gas conflict of 2006 between Ukraine and Russia, the academic debate began to increasingly scrutinize the existing dominating liberal theories on the EU-Russian energy relations, and a large part began to approach the EU-Russian relationship as an issue of high politics or security (Casier, 2016). According to Siddi (2017; 2020), the gas crisis of 2009, also between Ukraine and Russia, and the seizure of the Crimea in 2014 by Russia, seem to have exposed the Russian usage of energy as a political tool for which geopolitical and realist arguments gained popularity. When taking on either a geopolitical or realist approach to the energy relationship between the EU and Russia, energy resources are to be seen as a tool of power and political influence. Fossil fuels are scarce and oftentimes unequally distributed. Therefore, energy politics is by many viewed as a zero-sum game in which different actors are competing with each other to gain control over the same pool of energy resources, which in turn, after securitization can be used as leverage over energy source-poor countries (Klaire, 2009; Pascual & Zambetakis, 2010). One can argue that throughout the years, Russia has had a rather aggressive foreign policy, with compulsive shades. In particular, Russia has used its strong bargaining position from an energy standpoint to reward friendly states and punish unfriendly ones. Numerous Russia 'friendly regimes' have received debt pardons and supply of natural gas at highly discounted prices, whereas Russia's 'unfriendly regimes' have enjoyed energy embargos and price increases (Korteweg, 2018; Wolczuk, 2016). This is why it is argued that particularly the EU's dependency on natural gas is seen as a weakness. According to many scholars, the increased reliance of the EU on energy supplies coming from Russia is seen as a threat to its security (Cohen, 2009; Mankoff, 2012; Smith, 2010). The logic that follows from this is that the more the EU's reliance intensifies, the less likely will it be to politically confront Russia over its foreign policy. Moreover, as I just mentioned, the EU's reliance on Russian energy is also seen as a security issue as it exposes the EU more to Russian pressure.

Casier (2016) notes that most scholars who try to shed light on the relationship between the EU and Russia take as a vocal point solely the share of Russia's natural gas in the EU's natural gas imports. However, what is interesting in the study of European integration in light of a more convergent response to the energy crisis in terms of a possible increase in renewable energy deployment, is that individual member states that comprise the EU differ significantly in terms of their dependence on Russian energy. There are several countries, like Denmark, Ireland, Portugal, Spain, and Sweden, that are not dependent on Russian natural gas at all, whereas others, like Finland, the Netherlands, and Italy, are highly dependent upon Russian natural gas. Furthermore, it is also pointed out that the share that Russian energy makes up in the total energy imports coming from Russia is fully consumed, because some countries, like the Netherlands, produce their one natural gas. This will become apparent later on in this study as well, as there are some countries with import levels that surpass the 100% mark. According to Casier (2016), the vulnerability of natural gas supply to the EU heavily depends on whether it is measured in terms of the Russian share in the natural gas imports by the European Union, the Russian share in total natural gas consumption by the EU, or even the Russian share in primary energy consumption. An important conclusion can be drawn from this, which is that the EU's supply vulnerability has been relatively stable and that dependence upon Russian natural gas has been exaggerated. Natural gas dependence mainly arises due to issues related to methods of transportation. However, the focus on energy as a geostrategic and security-related issue has led to a tendency to magnify power-related motivations. This is a rather one-dimensional explanation, as it stands in sharp contrast with reality. Matters of energy are namely characterized by complexity and high degrees of differentiation.

Even though the factors described above have had a rather large impact on how we view the relationship between the EU and Russia, there might be another more fundamental reason that I have not mentioned yet. It would help us understand the dissimilarity between the actual change in what is regarded as material energy dependence, and the rise in the social understanding of energy dependence (Mavromati, 2021). It relates to the construction of a new pipeline carried out by the Clinton administration, back in the 1990s, which links the Mediterranean with the Caspian basin. The ultimate goal of the construction of this pipeline was to bypass Russia from gaining control over energy resources in the Caspian, by transferring oil to the West through this pipeline. This logic had of course not been new, especially not regarding the time it took place. Furthermore, energy security and its affordability were no issues to worry about. In this sense, the geopolitical framing of energy dependence cannot be explained by material factors. But what can? Perhaps the still prevalent images of Russia being a threat to the West, and the concurrent behavior towards Russia. The omitting of the US-Russia relationship from this study might therefore be problematic in understanding the European responses, especially when considering a potential shift in path dependency. Moreover, it seems that the existing literature on EU policies regarding energy security has to a great extent under-investigated the effect of the United States as a factor on the relationship between the EU and Russia, and the therefrom developed European energy policy relating to its energy security, especially with regard to natural gas.

## Historical Institutionalism

The development of deploying more environmentally friendly energy sources has faced an uphill battle. Multiple barriers to this development have been scrutinized by scholars and policymakers. According to Tomain (2011), it has been considered difficult to capture the externalities of energy sources. Furthermore, Madrigal and Stoft (2011) argue that a transmission expansion is needed for scaling up the usage of renewable energy sources. More barriers in vastly making use of renewable energy are set out by Shapiro and Tomain (2005) which are: uncertainty in carbon pricing, a narrow investment framework that places limitations on the allocation of capital to renewable energy sources, high transaction costs due to a relatively 'new' market for energy, and last the still ongoing subsidies for fossil fuels. The latter however is in decline, as subsidies for more environmentally friendly sources of energy have seen a steep rise in the past decade. Beyond all the previously described barriers, the desire to rely more upon renewable energy sources is combatted by decades of institutional stickiness. This stickiness is associated with the legal and regulatory framework that governs energy being derived from fossil fuels (Stein, 2017). One ends up in a situation of institutional stickiness when all the actors involved fail to break from a preexisting path, even so, when shifting towards a different path might be more desirable, leading to a better overall outcome. Within the context of this study, this implies that there is a consistent choice for energy generated by fossil fuels in the face of a more desirable alternative, namely renewable energy. According to Unruh (2002), a carbon lock-in exists which inhibits political action despite known climate risks and the presence of cost-neutral if not cost-effective technological alternatives. Whether or not investing in renewable energy sources leads to an overall better outcome, I will leave it open to debate. However, what cannot be denied is that renewable energy results in lower carbon dioxide emissions and lower criteria pollutant emissions. Furthermore, renewable energy sources result in less dependency on unsustainable sources of energy. Moreover, and relevant to this study, is that relying upon renewable energy sources does not come at a cost of finiteness and foreign reliance. Although the low prices of oil and natural gas are seen as great contributors to European reliance on fossil fuels, path dependency theories also help us explain this reliance.

The literature on path dependence finds its origin in the work of Artur (1989, 1994), and afterward the article by Krugman (1991). Scholars have ever since increasingly been appealing to the concept of path dependence, but clear definitions are rare. According to Sewell (1996), path dependence affects future outcomes through a sequence of events that have occurred at an earlier point in time, thereby channeling future movement down that 'path', which makes it increasingly difficult to stray away from that particular path. The logic behind this is that the longer we move down a certain path, the higher the costs of reversal will be. Of course, an array of alternatives will be available for choice, but due to institutional arrangements, an easy reversal of the initially chosen path will be obstructed (Levi, 1997). This whole idea of future movement being channeled along a certain path due to a sequence of events that happened at an earlier point in time is captured by the idea of increasing return processes, in which probabilities to move down a certain path increase as the number of steps taken down that path increase as well. Hence, costs for a sudden change in path increase as the probability for a shift in path decreases. Every decision that is being made produces consequences that make the chosen path more attractive for the 'next round'. A self-reinforcing activity is generated as the number of decisions along a path accumulates. According to Arthur (1994), increasing return processes have some intriguing characteristics, which I will quickly address, as some of those might have important political implications. First, outcomes cannot be predicted ahead of time as previous sequences of events that must have led to such an outcome are partly random. Second, and moreover, early sequences of events do not cancel out and can hence not be treated as noise. As random as they might have been, in some way, they have led to a particular outcome. Third, the further we go down a certain path, the harder it becomes to shift away from this path. And finally, a forgone alternative might have generated higher payoffs. These characteristics imply that, instead of focusing on synchronic explanations to gain an understanding of temporal dimensions of social processes, we need to think about causes and effects that are often separated in time (Pierson, 2000).

The theory of path dependence initially arose as a critique of the assumptions of neoclassical economists about efficiency (Apajalahti & Kungl, 2022). The main focus in the economic field has normally been on equilibria, which is attractive as it suggests a world of potential predictability and efficiency. Equilibrium analysis points to a single optimal outcome given existing preferences and factor endowments. Because it is assumed that marginal returns decrease, this goal is achievable, and with decreasing returns, negative feedback, which will lead to a predictable equilibrium, will be engendered by economic actions. David (1985) and Arthur (1989) described early advocates of the theory by presenting cases where, despite being available a set of more efficient alternatives, suboptimal technologies were established. At the very core of the process, self-reinforcing mechanisms that locked the market into an inefficient state were observed. Within the environmental literature and resource economics relating to carbon lock-in, it is shown that path dependence and lock-in could arise due to a sequence of events that happened earlier in time (Acemoglu et al., 2012). In that particular study, it has come forward that firms that have innovated a lot in dirty technologies in the past are more likely to produce a lot of dirty technologies in the future moments in time. Furthermore, and an interesting point for this study, it is found that if dirty technologies were more advanced to start with in the past, the likelihood for a shift in the path, and hence a potential transition to a more clean technology-driven economy is less likely to happen in the future (Acemoglu et al., 2016). Numerous studies show that the initial condition 'history' is insufficient as a selection criterion and that expectations determine the outcome of equilibrium selection. According to Bretschger and Schaefer (2017), the interplay between expectations and history can shift the equilibrium where expectations start to matter for a transition to clean energy. In another study conducted by van der Meijden and Smulders (2017), it was found due to the complementarity between resource scarcity and technical change, expectations about future energy use affect the transition to the use of green energy.

### Aligning theory with energy

During the last decade, the relevance of political and public awareness for all kinds of energy-related issues, whether it be the long-term stability of energy mixes, or the political stability of supplier countries, experienced a resurgence since the oil shock of 1973-74 (Pointvogl, 2009). The field of energy policy might be the most heavily contested and controversially discussed than any other area of policy-making in the European Union. Political processes are oftentimes referred to as being 'path dependent'. The notion of path dependence is generally used in order to support a few important claims. In a nutshell, these claims encompass that specific patterns of timing and sequence matter, a wide range of social outcomes can be achieved when starting from similar conditions, relatively small events can have large consequences, particular courses of action are hard to reverse when being implemented, and consequently, critical junctures punctuate the development within the political arena which shape the basic contours of our social life (Pierson, 2000). According to Pierson (2000), path dependence generally involves three phases. The first phase, as well as the last phase, is defined by critical junctures which are events that trigger movement toward or away from a certain path. The middle phase is characterized by positive feedback mechanisms, also increasing return processes, which follow the idea of future movement being channeled along a certain path due to a sequence of events that happened at an earlier point in time, where probabilities to move down a certain path increase as the number of steps taken down that path increase as well. Hence, costs for a sudden change in path increase as the probability for a shift in path decreases. Every decision that is being made produces consequences that make the chosen path more attractive for the 'next round'. A self-reinforcing activity is generated as the number of decisions along a path accumulates. Europe's first phase and its corresponding investments in a fossil fuel-dominated infrastructure made sense. One could argue that the critical juncture that set up Europe to follow a path that they beforehand did not know to follow for so many decades was simply the discovery of abundant and in particular cheap oil and natural gas (Covert, 2016; Unruh, 2002). The increasing return processes have been in play ever since the beginning of the 20th century, in which all the investments done during this period were considered the 'better overall outcome'. It is therefore not surprising that fossil fuels, which in this study will encompass oil, natural gas, and coal, still make up almost 70% of Europe's total gross available energy (Eurostat, 2023).

According to Hathaway (2001), within the economy, increasing return processes primarily emerge from four characteristics, the one being more prevalent than the other. These four characteristics can be summed up as large fixed costs, learning effects, adaptive expectations, and coordination effects. It is argued that when these four characteristics are present within a process, a step down one path increases the benefits, or decreases the costs of taking another step along that path, thereby creating a positive feedback loop. The energy market and its infrastructure reflect all of the characteristics mentioned above which has thus resulted in path dependence. Over the past decades, vast upfront investments in the fossil fuel infrastructure have been made, which has rendered it more difficult to reverse and switch to a different path, also referred to as carbon lock-in. Within the energy market, sizable front-end investments are very prominent. Huge investments are made before energy generation can begin. At the beginning of the 20th century, the costs of a generation plant were millions of euros, whereas now, these costs are 100 million euros (Shapiro & Tomain, 2005). In other words, the costs of reversal and potentially shifting from path are very high, at least in monetary value. Furthermore, investors in the energy infrastructure are risk averse, and learning effects make investments in more sustainable energy sources such as renewable energy more expensive. On top of this, the great financial institutions that provide the necessary funds to make those investments are also risk averse, as they are investing in relatively unknown technologies. This thus creates a positive feedback loop where the existing, dominating technology, which is fossil fuel energy, is being locked in and hence keeps innovation in renewable energy down, due to re-investment returns in the already dominating technology in place. Energy actors are incentivized by learning effects to affirm the institutions with which they are familiar the most. Many energy actors have for multiple generations been involved in the fossil fuel business and may thus be reluctant when it comes to change. The logic behind this is that they would lose their advantage with regard to institutional knowledge on the infrastructure of fossil fuels which has been built up over the past decades. Also with respect to the infrastructure of energy, adaptive expectations can be noticed. As to elaborate on what these expectations entail; they arise in the energy market when its uncertainty is being reduced due to increased adoption and where both producers as well as consumers are confident about its quality and performance (Unruh, 2002). Energy actors will not lobby for alternatives that could make their current product, which is an energy infrastructure based on fossil fuels, obsolete. Within its infrastructure, coordination effects exist as well. It is argued that the more interconnected our electricity grid becomes, the more valuable it becomes (ISO/RTO Council, 2005). The European Union has the last two decades accelerated the process of integrating EU electricity markets. This has increased the efficiency of the network as it has become more interconnected, where transmission organizations have been encouraged to join together and take advantage of the economies of scale. From this point of view, any action that one transmission organization undertakes bears consequences for all other transmission organizations.

### When will change occur?

The logic of continued dependence on oil, natural gas, and coal becomes more vulnerable as the EU learns more about the characteristics that shape the increasing returns processes and the externalities that are associated with our reliance and dependence on fossil fuels and more sustainable alternatives advance. While theories associated with path dependence and its positive feedback loops have been well explored, literature on how to reverse or shift away from a certain path is more limited (Sun, 2017). According to Pierson (2000), following his three phases, this would imply some force of critical junctures. The academic field has distinguished between endogenous as well as exogenous forces that can change the direction of existing paths. With respect to endogenous forces, Béland (2010) argued that to understand policy change, one should pay close attention to incremental change that occurs between critical junctures. According to Hathaway (2001), historical institutions tend to be sticky, so they tend to resist change up until a point where an external crisis forces it, which is more in the sphere of exogenous forces. Moreover, since insiders are often content with the status quo, exogenous change is more likely in large and stable organizations (Unruh, 2002). Early theorizing did place emphasis on stability, and from this thinking, change was to happen only due to exogenous shocks or crises leading to critical junctures and consequently institutional reconfigurations that would become stable in the newly changed circumstances (Lockwood et al., 2017). This would in the long run create a pattern of 'punctuated equilibirum'. Within the field of energy, examples of such patterns clearly exist. An extreme example would regard Denmark during the oil shock of the 1970s which led to the expansion of energy efficiency, wind power, and district-based heating. Another example is Great Britain's new paradigm in energy due to its thorough privatization of energy from 1986 onwards. However, within HI, more recent insights have put emphasis on more gradual change, which arises from endogenous sources of instability. It focuses on the limits to optimal institutional design. According to various scholars, these limits arise due to actors having limited time horizons and information and institutions have multiple effects (Clemens and Cook, 1999; Pierson, 2004). This in turn would lead to the possibility that institutions have consequences that might be unanticipated or unintended. Spain and Germany make up a good example of their unexpected vulnerability to fossil fuel incumbents via wholesale electricity prices during the late 2000s. According to Cludius et al. (2014), this arises due to renewable energy slowly but steadily replacing energy generated by the use of fossil fuels, and prices in wholesale energy markets reflect short-run marginal costs of generation. This design thus could be seen in Germany and Spain intended to maximize energy efficiency. According to Mitchell (2016), the rise of renewable energy has caused a reduction in peak pricing which had major effects on utility profitability and consequently investments in new fossil fuel power plants, leading in many cases to corporate restructuring. This once again goes to show the reluctance present when it comes to transitioning to a more climate-friendly energy infrastructure.

The logic that has for long been applied to energy systems is the need for change. The first focal point therefrom should be on how to set such a transition in motion. The logic may be shaped by the growing consensus around climate change and the need to do something as a society. According to Boothe (2012), path dependence can be broken when 'windows of opportunity' arise. Once opportunities have opened up the creation of new pathways, the corresponding dynamics of these pathways become of interest. Furthermore, it is concluded that change occurs as a response to the felt need by all the critical actors involved to reconcile the current institutions in place and the existing policies with a new reality (Cogan, 2010). Just as coordination effects, which I mentioned earlier as one of the characteristics of increasing return processes, suggest that the value of a dense and interconnected energy network increases the more it is being used. Following from this logic, the opposite should also hold. The value of our European integrated energy market should decrease as the amount of fossil fuel infrastructure decreases. It is unlikely that the developers of fossil fuels would voluntarily re-evaluate whether their investments in fossil fuels financially continue to make sense in the long term. Positive feedback loops of the fossil fuel infrastructure can be diminished by enhancing its negative feedback loops. Understanding the political dynamics of elements of a sustainable energy transition, is particularly important, as such a transition often comes along with additional financial costs and challenges to vested interests (Lockwood et al., 2017). This perspective therefore assumes that whether and how quickly elements of a sustainable energy transition occur is highly dependent on the balance between positive and negative feedback loops. It is therefore not surprising that researchers have found resource environments to be more conducive to institutional change, read a change in the pathway, when marked by scarcity and crisis (Sine & David, 2003). This is particularly interesting and applicable for this study as the Russian invasion of Ukraine marked the beginning of a worldwide energy crisis, in which European countries, which are to a great extent reliant upon Russian fossil fuels, have been hurt.

## Methodological Approach

The purpose of this section is to explain and justify the methodological approach used in this thesis. The analysis of the study will be segmented into three different parts. The question central in this study is:

*''What has been the impact of the Russian invasion of Ukraine on the green energy transition of the EU?''*

First, I will examine the energy dependence of the EU on Russian energy. Following the theory of Historical Institutionalism, I will assume a strong (interdependent) relationship between the EU and Russia in terms of energy, up until the point where Russia invaded Ukraine which set in motion an energy crisis (critical juncture) and has seen the EU become much less dependent upon Russian energy. The independent variable for this part of the analysis will thus be the time interval of when the Russian invasion of Ukraine took place; read February and March of 2022. The dependent variable of this study is 'EU climate goals', and to measure this accordingly, I will use three different indicators for this first part, namely the European imports of oil, natural gas, and coal out of Russia. As pointed out earlier, oil, natural gas, and coal still make up more than 70% of Europe's total gross available energy and I therefore consider those three combined a good measure of energy dependence. Important here is to understand that those indicators used help me explain the EU's dependence upon Russian energy, not so much a shift in EU climate goals. However, based on my theoretical framework, I expect the Russian invasion of Ukraine to serve as a critical juncture which has seen the EU's energy dependence on Russia decline to a significant extent which might be interpreted as a window of opportunity where the EU has opted to sharpen its stand with respect to its climate goals. For the purpose of this first part, I will make use of one overarching dataset covering oil, natural gas, and coal. The data is collected from Eurostat's COMEXT database, which is the reference database for international trade in goods. Specifically, I will make use of extra-EU trade statistics, as these statistics encompass a sum of trade of each of the 27 EU Member States with countries outside the EU, such as Russia. Note that this implies that the EU is viewed as a single trading entity and trade flows are measured in terms of imports and exports, but not intra-trade between Member States themselves, which will be the locus in later stages of the analysis. The statistics of the international trade values are expressed in millions or billion (109) euros and are compiled into a monthly process, ranging from January 2021 to March 2023. These values correspond to the amount that would be declared in case of either purchase or sale at the reporting country's border. In this study, I will look at import values, which is called a CIF (cost, insurance, freight) value.

After I have gained an understanding of how the European energy dependence on Russia has evolved during the period of investigation, I will examine what influence the Russian invasion of Ukraine has had on EU energy consumption, paying special attention to the consumption of oil, natural gas, and coal. From the first part of the analysis, we may find that the Russian invasion of Ukraine has indeed served as a critical juncture that has made the EU less reliant upon fossil fuels coming from Russia. However, this does not necessarily imply that the EU itself has become less dependent on fossil fuels. Therefore, in this part of the analysis, the focus will be on EU energy production and consumption levels. Within this part of the analysis, the independent variable will still be the time period comprising the Russian invasion of Ukraine, and the dependent variable, which is 'EU climate goals' will still be measured with respect to three indicators; namely oil, natural gas, and coal. In this section, I hope to find significant drops in both fossil fuel production as well as fossil fuel consumption of the EU Member States, which can hint towards a shift in the EU's path dependency. Following the logic of HI, the value of our European integrated energy market should decrease as the amount of fossil fuel infrastructure decreases, which should spur change. The question however remains, whether the input of fossil fuels within Europe's highly integrated energy infrastructure has decreased enough to actually set in motion an accelerated transition to a renewable energy dominant energy system. For this part, I will make use of resources and data from the Energy Institute. Statistics that come forward in this dataset are taken from government sources and published data. The data on oil production includes crude oil, shale oil, oil sands, condensates, and natural gas liquids. Regarding oil consumption, the statistics comprise inland demand plus international aviation, marine bunkers, and refinery fuel and loss. Moreover, oil product consumption is also included. The corresponding values for oil production and consumption are given in thousand barrels. For natural gas production, all marketed production is included, and gas flared or recycled gas is excluded. With respect to natural gas production, the consumption statistics for natural include derivatives of coal as well and also natural gas consumed in gas-to-liquid transformation. Natural gas converted to liquid fuels is however excluded. The production and consumption values for natural gas are given in billion cubic feet per day (bcf/d). Finally, for both the coal production as well as the consumption statistics, only commercial solid fuels are included. However, with regard to the consumption statistics, coal converted to liquid gas is excluded whereas coal consumed in the transformation process is included. All statistical units for coal are given in exajoules. The

data that will be used in this part of the analysis will be provided in yearly numbers and comprise a three-year period starting from 2020 onwards.
A strong assumption that serves as a benchmark for this research is that the EU has for a very long time been dependent upon fossil fuel-generated energy. Following HI, this implies that throughout the years, we have set our energy infrastructure accordingly, which has come at an enormous cost when adding up all the expenses and investments made in favor of this fossil fuel-reliant energy system. Climate change and the developments in alternative energy sources like renewable energy are something from the last decade. Despite ambitious climate goals set by the EU and its Member States, no real acceleration has been made in the phase out of fossil fuels and the deployment of renewable energy sources. Furthermore, and most importantly for this section, is that changing the current energy infrastructure, besides needing enormous up-front investments, would take years. The point I am trying to make, which lays the foundation for this final part of the analysis, is that change does not occur from one day to another. Since this study aims to gather an understanding of the impact of the Russian invasion of Ukraine on the green energy transition of the EU, I cannot make a conclusive argument based solely on quantitative data covering just one elapsed year after impact. Therefore, this section also explores qualitative data such as government publications that contain alterations in climate goals and incentives provided for the deployment of renewable energy sources and the phase out of fossil fuels. However, based on the qualitative data alone, it would be hard to make a solid argument that can dedicate new policies or more ambitious goals with respect to a greener climate to the impact of the Russian invasion of Ukraine alone. The debate around climate change has become a hot topic, especially in the last few years, which has come in hand with greater emphasis on climate policies and correspondingly new policies to ease the greener energy transition. In other words, the trend for better climate policies has been up already, so it is difficult to make a qualitative assessment of whether or not the new policies agreed upon during the crisis period are significant compared to those agreed upon pre-crisis period. Therefore, to test the effectiveness of newly adopted energy policies, I will use EU imports of solar panels and heat pumps as proxies. This section thus contains a qualitative analysis, which will be backed or invalidated by quantitative statistics. The qualitative data will mainly consist of documents provided by the Ministries of Finance of the EU Member States, but will also comprise publications made by National Banks for example. All relevant information made available during the crisis period will be accounted for. For the quantitative data of this part of the analysis, I will make use of the COMEXT database provided by Eurostat, which is the reference database for international trade in

goods. This dataset will help me test the effectiveness of newly adopted energy policies by using statistics on EU imports of solar panels, windmills, and heat pumps. All statistical values are given in million euros and comprise a three-year time period starting from January 2020.

To sum it up, I will provide a clear overview in the table below of how the analysis will be structured. The first part will explore the EU's dependence on fossil fuel-generated energy coming from Russia, and how the Russian invasion of Ukraine has affected this. The second part is about the EU's dependence on fossil fuels in general, and how the EU has come about the energy crisis posed by the Russian invasion; is it perceived as a window of opportunity for change? Both the first and second parts will be explained on the hand of three indicators, namely oil, natural gas, and coal. The final part tries to shed light on the EU climate goals, and whether or not changes are made in current energy policies by its Member States to accelerate their green energy transition. The effectiveness of these changes in turn is tested by comparing data on pre-crisis and crisis period data on imports of solar panels, wind mills, and heat pumps.

| Theory | EXP | IV | DV | Indicators | Sources |
|---|---|---|---|---|---|
| Historical Institutionalism | If the impact of the invasion is big enough, EU path dependency on fossil fuels will break and introduce a new course. | Time | EU energy transition | Part I: EU imports of oil, natural gas and coal | Part I: Eurostat COMEXT database |
| | | | | Part II: EU production and consumption of oil, natural gas and coal | Part II: The Energy Institute |
| | | | | Part III: EU imports of solar panels, wind mills and heat pumps | Part III: Bruegel & Eurostat COMEXT database |

# Analysis

## Russian fossil fuel dependence

For the relationship between Russia and the EU, energy trade is a very important component. This energy-related relationship dates all the way back to the 1950s when pipelines for the transportation of oil and gas to Eastern European members of the Council for Mutual Economic Assistance (CMEA) (Perovic et al., 2009). In the late 1960s, Western European countries sought to become less dependent on oil and increase the share of gas in their energy mix, for which the flow of hydrocarbon for these countries began. The following decade is mainly characterized by the energy crisis of 1973-74 which has served as an important benchmark that allowed the formerly Soviet Union to gain significance as an oil and gas supplier as many European countries wanted to diversify from the Middle East (Perović, 2017). At the end of the Cold War still, energy trade remained essential for the relationship between the EU and Russia. Moreover, 30 years later, the main non-European energy supplier to Europe is Russia, providing 30% of its oil and coal and almost 40% of the Union's natural gas supplies (Eurostat, 2018). According to Aggarwal and Govella (2012), due to increased energy exports from Russia, they were able to recover from the financial crisis they experienced after the dismantling of the Iron Curtain. Russian revenues from exported oil and natural gas rose during this recession from \$27 billion in 1998 to \$217 billion in 2017. Moreover, in 2018, almost half of the federal budget of Russia came from earnings from exported oil and gas. One would expect that with the end of the Cold War, the relationship between Russia and the EU would flourish. However, on the contrary, this relationship deteriorated, for which the gas crisis between Russia and Ukraine in 2006 is said to be the main contributor (Haukkala, 2011; Belyi, 2014). During this gas crisis, gas supplies to Ukraine were cut which hurt many European countries as over 80% of Europe's gas supplies ran through Ukrainian pipelines. Following this crisis, Europe's energy vulnerability in terms of dependence on the Russian energy supply made energy security a top priority of the agenda of the EU (Baran, 2007).

### Oil imports

Russia is globally a major player in the energy markets and ranks in the top three producers of crude oil, competing with the United States and Saudi Arabia (IEA, 2022). Russia relies heavily on revenues coming from the trade in oil and natural gas as in 2021, it made up almost 50% of the federal budget of Russia. In 2021, Russian crude oil and natural gas output topped more than 10 million barrels per day (bpd), thereby making up for almost 15% of the total supply in the world. When only taking crude oil into account, it exported a total volume of 4.7

million bpd to countries all over the world. China is seen to be the largest importer as it imported 1.6 million bpd of crude oil from the 4.7 million bpd exported, thereby accounting for more than 30% of Russia's exported volumes. What is noteworthy is that the EU as a whole imports 50% more than China does, totaling 2.4 million bpd and thereby also making up for almost half of Russia's exports in crude oil. Several different types of crude oil are produced and exported by Russia of which the most important one is 'urals', which is a medium sour crude oil. In recent years, the Russian oil industry has seen a period of stagnation and consolidation. Despite this period, there are two oil giants within the Russian oil industry that remain and these are Rosneft, which is a state enterprise and considered the largest oil producer within Russia, and LUKOIL, which is Russia's largest privately owned oil company. Other major oil production companies are Gazprom Neft, Tatneft, and Russneft. EU imports of oil coming from Russia in trade value more than doubled between the first quarter of 2021 and the first quarter of 2022 which can mostly be explained by increasing prices (See Figure 1a). A very interesting development during the crisis period took place. When Russia invaded Ukraine, we saw an initial decrease in import value, which shortly rebounded between May and July of 2022. This can be explained as prices still rose during this period, namely by 12,48% (See figure 1c), and volumes were stagnant in coming down (see figure 1b). However, ever since July 2022, a significant diversion in trade took place. This downward trend continued into 2023 and has seen EU imports of oil from Russia decrease from highs of 222 million euros at the start of the invasion to lows of 11,6 million euros in March 2023. This drop of over 200 million euros can be explained by the hand of decreasing prices as well as decreasing volumes. At the start of the crisis period when Russia invaded Ukraine, import volumes were 1.8% up with respect to import volumes in January 2021. However, this drastically changed over the course of the crisis period as we have seen a drop of almost 90% in import volumes when comparing the import volume of March 2023 with the import volume of March 2022. During the same period, prices have also decreased significantly, as we have seen a price drop amounting to a little over 50%. From this data, it is fair to say that the largest contributor to the significant decrease in import values as displayed in Figure 1a, is said to be the drop in import volumes. Furthermore, and particularly interesting for this study, is when we take a look at the main partners of the EU for extra imports of oil, which is shown in Table 1. Russia topped the tables during both the first quarter of 2021 and 2022, but during the first quarter of 2023, Russia was not even amongst the top 5 main partners of extra EU imports of oil anymore.

Figure 1a: EU imports of oil from Russia, 2021-2023

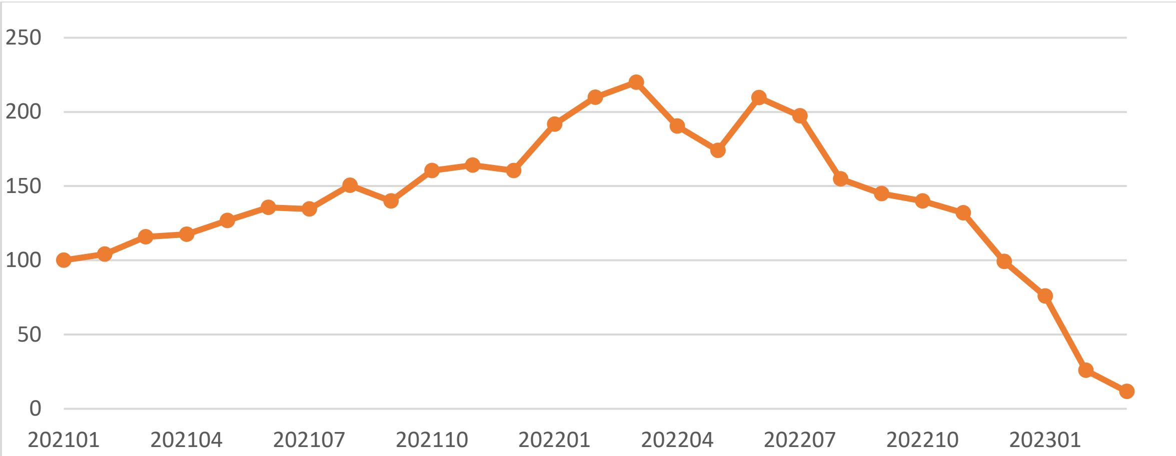



Figure 1b: Import volumes of oil from Russia, 2021-2023

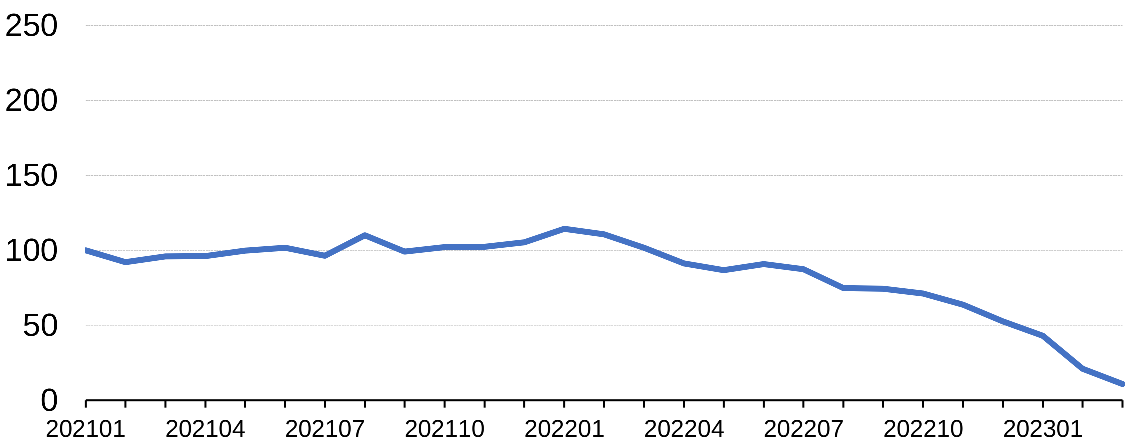
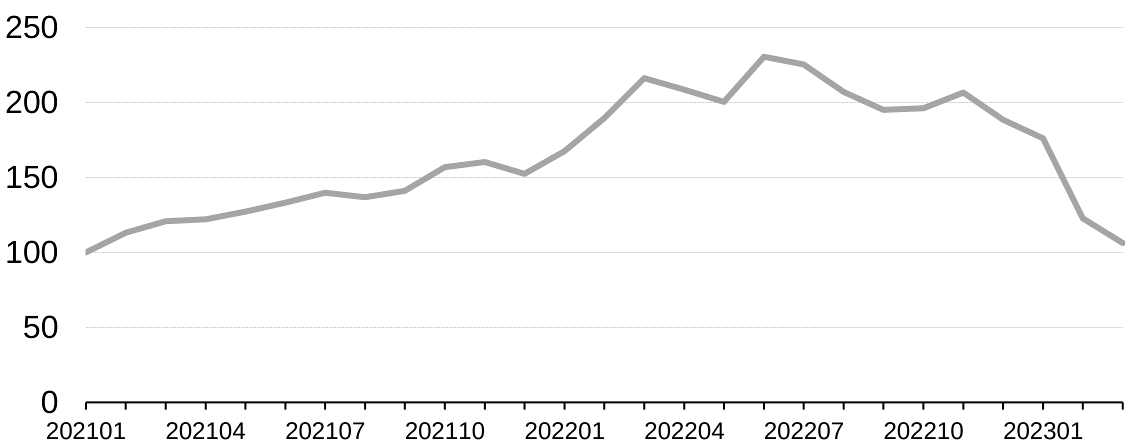



Figure 1c: Import unit values of oil from Russia, 2021-2023




Source: Eurostat (2023a) (Comext data code: DS-045409)

It may well be clear that the EU's dependence on Russian oil has decreased significantly. Before the start of the Russian invasion of Ukraine, Russia's share in extra EU imports of oil still made up almost a third of the EU's total, which has decreased to a meager share of 6% in the first quarter of 2023.

**Table 1: Main partners for extra EU imports of oil**

| First quarter 2021 | First quarter 2022 | First quarter 2023 |
|---|---|---|
| Russia: 28,7 | Russia: 30,4 | United States: 11,4 |
| United States: 7,9 | United States: 9,3 | Norway: 11,2 |
| Norway: 7,9 | Norway: 7,9 | Saudi Arabia: 9,8 |
| Kazakhstan: 7,7 | United Kingdom: 6,9 | Kazakhstan: 8,0 |
| Libya: 6,9 | Kazakhstan: 6,6 | United Kingdom: 7,2 |
| Saudi Arabia: 6,4 | Libya: 5,8 | Russia: 5,9 |
| United Kingdom: 5,8 | Saudi Arabia: 5,5 | Libya: 5,7 |
| Other: 28,7 | Other: 27,5 | Other: 40,9 |

Source: Eurostat (2023a) (Comext data code: DS-045409)

### Natural gas imports

EU imports of natural gas coming from Russia increased sharply between January 2021 and the start of the Russian invasion of Ukraine as prices increased considerably (see Figures 2a & 2c). The supply of natural gas from Russia steadily decreased with a significant drop from April to June 2022 (see figure 1a), due to sanctions and packages imposed by the EU. Thereafter, between June and September 2022, the EU import value of natural gas from Russia increased again with the same amount it decreased in the period prior to that, and this can be attributed to the significant rise in prices during this period as is shown in figure 2c. However, ever since September 2022, the EU import value of natural gas coming from Russia has decreased significantly, amounting to a decrease of almost 70%. Interesting is the fact that that these import values are still well above the level in January 2021, which has been indexed at 100 to serve as a reference point. But once again, if we take a look at figure 2c, the figure which displays the unit value which has also been indexed at 100 for January 2021, this shows that the price is still over 300% up with respect to the price level of January 2021. The EU import value of natural gas coming from Russia was only in March 2023 only up 33,1% which means that import volumes must have fallen significantly. If we take a look at Figure 2b, this is indeed shown, where since the start of the Russian invasion import volumes of natural gas have dropped almost 60%, to an index value of 33,9 in March 2023. It may be clear that the EU has opted for a rather aggressive stand when it comes to its natural gas imports from Russia. This does not necessarily imply a shift in the EU's path dependency on fossil fuels, but it does imply a change in the EU's dependency on natural gas coming from Russia. If we look at Table 2, which shows the main partners to the EU for extra imports of natural gas, Russia's share in EU imports of natural gas was steadily above 30% in both the first quarters of 2021 and 2022. However, this more than halved in the first quarter of 2023, being for the first time not the EU's largest trading partner when it comes to EU natural gas imports. Moreover, the highest share in the first quarter of 2023 was observed for the United States, and shares for Qatar, the United Kingdom, Algeria, and Norway saw increases in their first-quarter numbers when comparing 2023 to 2022.

Figure 2a: EU imports of natural gas from Russia, 2021-2023

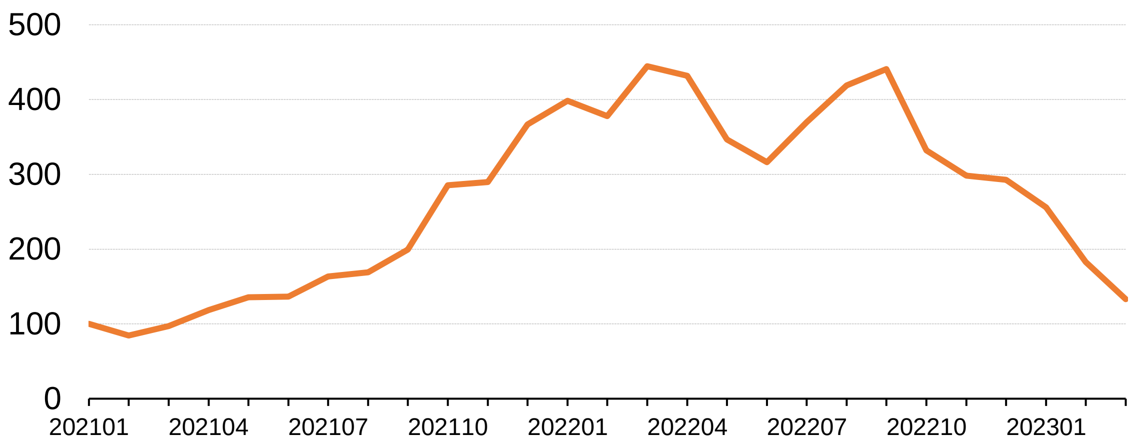



Figure 2b: EU import volume of natural gas from Russia, 2021-2023

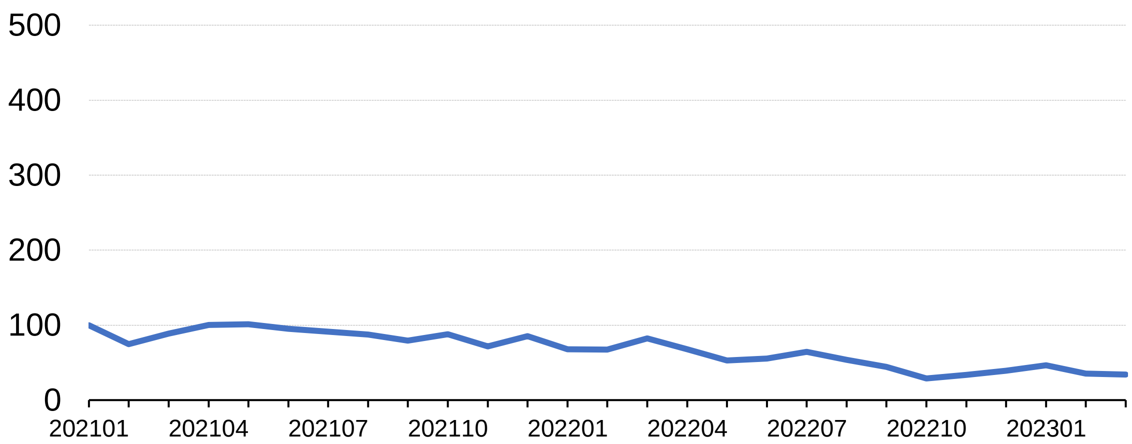
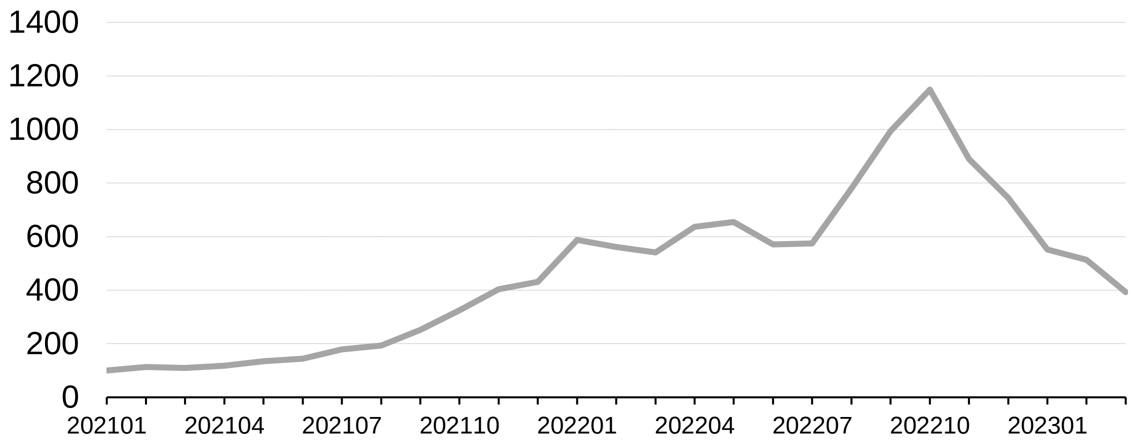


Figure 2c: Unit value of natural gas from Russia, 2021-2023




Source: Eurostat (2023a) (Comext data code: DS-045409)

**Table 2: Main partners for extra EU imports of natural gas**

| First quarter 2021 | First quarter 2022 | First quarter 2023 |
|---|---|---|
| Russia: 39,0 | Russia: 30,6 | United States: 21,1 |
| Algeria: 21,8 | United States: 22,8 | Russia: 15,0 |
| Norway: 10,0 | Norway: 10,7 | Norway: 14,7 |
| United States: 8,2 | Algeria: 8,2 | Algeria: 14,0 |
| Nigeria: 5,7 | United Kingdom: 7,6 | United Kingdom: 11,4 |
| Qatar: 4,2 | Azerbaijan: 6,0 | Qatar: 7,8 |
| Other: 11,0 | Other: 14,0 | Other: 16,0 |

Source: Eurostat (2023a) (Comext data code: DS-045409)

## Coal imports

Between January 2021 and May 2022, the EU imports of coal coming from Russia grew by over 350%, which can as for the cases of natural gas and oil in the previous sections be explained on the hand of a great rise in the price level (see figure 3a & 3c). What is also notable is that ever since the start of the Russian invasion of Ukraine at the end of February 2022, the EU import value of coal from Russia increased by over 50% in just a two/three month time period. However, once again, it becomes clear that this is due to a sharp increase in the unit value of coal during the same period, which amounts to a price increase of 33%. It thus must hold that the EU import volume of coal from Russia for the same time has risen as well, as Figure 3b indeed shows. However, this increase is just in the margins, and ever since the end of May 2022, EU import volumes of coal from Russia have been in a freefall. This decrease got extra pace as in August 2022, the EU introduced its fifth package of EU sanctions which imposed a prohibition on importing coal and other solid fossil fuels into the EU if they find their origins in Russia. As a consequence of this package of sanctions, the EU import volume of coal from Russia has fallen to almost zero in September 2022 and has remained at this level.

Figure 3a: EU imports of coal from Russia, 2021-2023

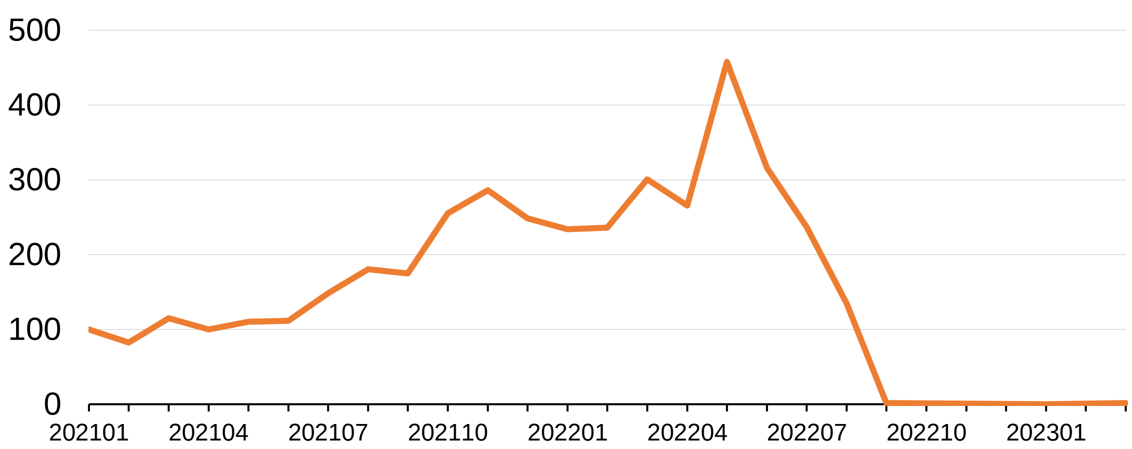



Figure 3b: EU import volume of coal from Russia, 2021-2023

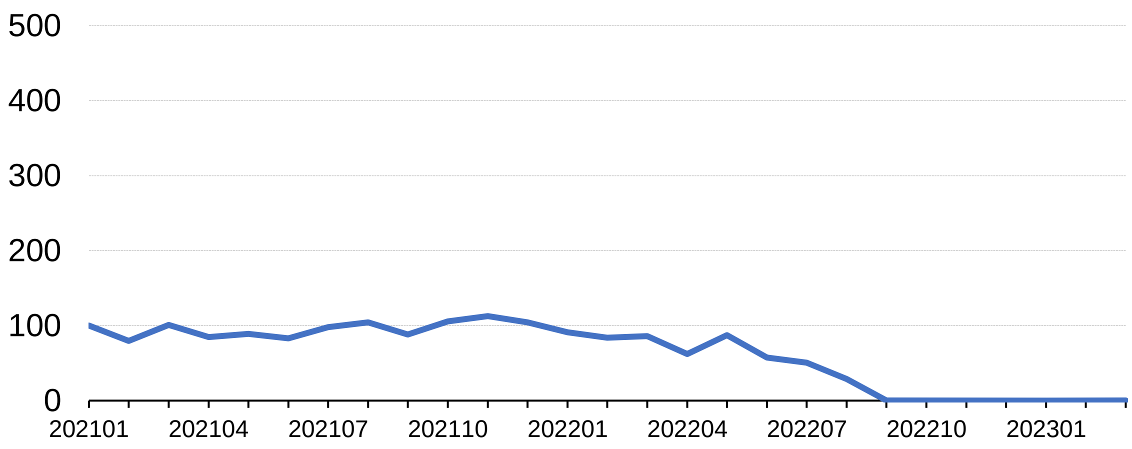
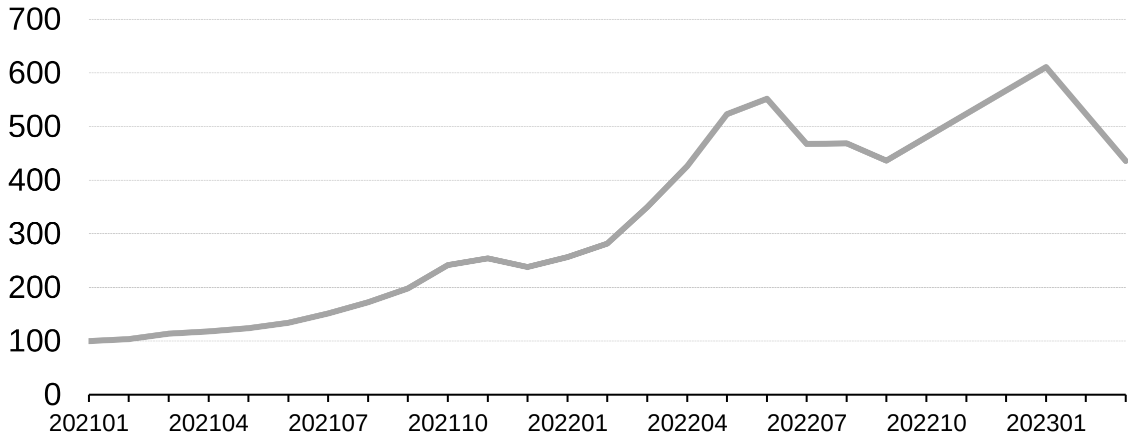


Figure 3c: Unit value of coal from Russia, 2021-2023




Source: Eurostat (2023a) (Comext data code: DS-045409)

**Table 3: Main partners for extra EU imports of coal**

| First quarter 2021 | First quarter 2022 | First quarter 2023 |
|---|---|---|
| Russia: 45,5 | Russia: 45,3 | United States: 25,4 |
| Australia: 19,8 | United States: 15,7 | Australia: 23,8 |
| United States: 18,8 | Australia: 15,1 | Columbia: 17,4 |
| Columbia: 7,5 | Columbia: 12,5 | South Africa: 15,2 |
| Canada: 3,3 | Canada: 3,0 | Kazakhstan: 5,8 |
| United Kingdom: 1,0 | South Africa: 2,7 | Indonesia: 5,0 |
| Other: 4,0 | Other: 5,8 | Other: 7,5 |

Source: Eurostat (2023a) (Comext data code: DS-045409)

Coal is in particular interesting as it most clearly shows a shift away from the EU's dependency on Russian fossil fuels. In the first quarter of 2021 and 2022, the share that Russia made up in the extra EU imports of coal was almost half of the EU's total. For the first quarter of 2023, this has fallen to a share of 0% (see Table 3). In this same period, the shares of Columbia, Australia, South Africa, and the United States have increased significantly. These statistics make it hard to say anything about a change in the path dependency of the EU on a fossil fuel-driven infrastructure, however, the case of coal is clearly evident and speaking for the EU when it comes to their reliance upon fossil fuels coming from Russia. Despite this, it needs to be noted that from all the oil, natural gas, and coal imported from Russia, coal only made up just about 15% of total imports, which makes a ban on coal imports originating from Russia not really telling when it comes down to the EU's reliance on Russian fossil fuels.

Nevertheless, as statistics of oil and natural gas have also shown, the EU is in fact far less reliant upon Russian fossil fuels, which has set the stage for a potential shift in the EU's path-dependent energy infrastructure on fossil fuels.

## A fossil fuel dependent energy infrastructure

The energy crisis that has been sparked by the Russian invasion of Ukraine has been characterized by record-high commodity prices, stagnating economic growth, and high inflation (IEA, 2023). Higher prices for fossil fuels in turn increased the cost of energy generation, which has put pressure on energy consumption. The previous part of the analysis has shown that the energy crisis offset by the Russian invasion has caused a significant decrease in the fossil fuel dependency of the EU on Russia with drops in import volume of almost 90% for oil, 60% for natural gas and to top it off, a little less than 100% for coal. For the purpose of this study, this early evidence is great when exploring whether or not the Russian invasion of Ukraine has spurred the EU away from its path-dependent fossil fuel-dominated energy infrastructure. However, following HI which has laid the foundation for this study, change is very difficult to obtain. The energy infrastructure of the EU which is dominated by fossil fuels is long lived. Once such an infrastructure is created which links its production with its consumption, it becomes an embedded hard infrastructure. See it as a highway grid all around the EU. Once it was configured, locational patterns have grown around the grid which throughout time have rendered it more and more difficult to reroute it. Following this logic, it makes sense to assume that despite a significant drop in fossil fuels coming from Russia, the energy infrastructure would still be highly dependent upon fossil fuels in order to meet the energy demand by the EU Member States. Therefore, in the following subheadings, I will explore both the consumption as well as production levels of oil, natural gas, and coal for the various EU Member States so as to gain an understanding of actual shifts in the EU's fossil fuel reliance and how the EU has managed to absorb the shock caused by the Russian invasion of Ukraine which has seen a steep drop in the EU's fossil fuel imports out of Russia. This section will thus dive into country-specific statistics in order to uncover meaningful trends. It needs to be noted that the data provided in this part of the analysis lacks statistics on Malta. The mix of fuels and their share in a country's energy consumption as well as its production depends on the natural resources a country has access to, but also the structure of a country's economy and the national choices it makes with regard to its energy policy.

## Oil dependence

For decades, oil and petroleum products have had the largest share in energy consumption within the EU. Despite decreasing production over the last past years, oil and its products that are derived from it still play a crucial role within the energy infrastructure of the EU. It goes to show how reliant the EU is on fossil fuels, and thus in particular oil. Table 4 shows the oil consumption in a thousand barrels daily of the countries that make up the EU between 2020 and 2022. For almost all countries, a slight increase in consumption can be noticed between 2020 and 2021 which can be explained due to COVID-19-related restrictions. Because of this, 2020 saw the lowest levels of energy consumption in the EU since 1990. Therefore, when restrictions were slowly relieved during 2021 and economies started to run again, consumption levels in oil also started to rise. However, what is interesting is that oil consumption, despite the Russian invasion of Ukraine, still rose in the year 2022 for the EU as a whole (see Table 4). Moreover, the average growth rate of oil consumption between 2012 and 2022 is valued at a positive value of 0.4%, whereas the growth rate between 2021 and 2022 has been 3.3% for the EU. However, before COVID-19 struck the world, values for the EU were well above 11000 thousand barrels daily which goes to show that the economy was probably still following the trend of COVID-19 recovery. Nevertheless, no severe cuts in oil consumption have been made by the EU despite the Russian invasion of Ukraine and the significant cut in oil imports coming from Russia. When we take a country-specific look, some interesting notes can be made as well. Austria, Belgium, Estonia, and Luxembourg have from all the countries that comprise the EU seen a significant drop in oil consumption levels, which all have seen a sharp drop compared to the previous year, and compared to their growth rates. However, for the gross of the EU countries, a significant rise in oil consumption can be noticed. In 2022, Croatia, Cyprus Greece, Ireland, Italy, Poland, Portugal, Slovenia, and Spain have all seen steep increases in their oil consumption levels both with respect to the previous year as well as with respect to their growth rates, with Greece, Slovenia and Spain topping the table. When analyzing the EU's oil dependency, we could conclude for now that despite serious decreases in oil imports out of Russia, the EU has not yet opted to significantly decrease its actual oil consumption levels.

**Table 4: Oil Consumption**

| Thousand barrels daily | 2020 | 2021 | **2022** | Growth rate per annum<br>2022 | <br>2012-22 |
|---|---|---|---|---|---|
| Austria | 231 | 239 | **232** | -2,7% | 0,5% |
| Belgium | 541 | 600 | **563** | -6,2% | -0,4% |

| | | | | | |
|---|---|---|---|---|---|
| Bulgaria | 95 | 100 | **109** | 9,7% | 2,6% |
| Croatia | 59 | 63 | **69** | 10,8% | 0,7% |
| Cyprus | 44 | 45 | **48** | 6,6% | -0,6% |
| Czech Republic | 181 | 201 | **204** | 1,7% | 0,8% |
| Denmark | 122 | 134 | **138** | 3,1% | -0,4% |
| Estonia | 28 | 27 | **25** | -8,1% | -2,5% |
| Finland | 178 | 168 | **172** | 2,3% | -1,2% |
| France | 1306 | 1428 | **1420** | -0,6% | -1,2% |
| Germany | 2049 | 2042 | **2075** | 1,6% | -0,9% |
| Greece | 246 | 261 | **294** | 12,8% | -0,4% |
| Hungary | 161 | 175 | **172** | -1,8% | 2,9% |
| Ireland | 130 | 141 | **152** | 7,7% | 1,1% |
| Italy | 1039 | 1158 | **1222** | 5,5% | -1,1% |
| Latvia | 33 | 34 | **36** | 4,4% | 0,9% |
| Lithuania | 62 | 63 | **64** | 1,2% | 1,9% |
| Luxembourg | 49 | 53 | **49** | -7,5% | -1,6% |
| Netherlands | 846 | 845 | **885** | 4,7% | -1,0% |
| Poland | 640 | 676 | **724** | 7,1% | 2,7% |
| Portugal | 203 | 209 | **225** | 7,7% | ♦ |
| Romania | 205 | 217 | **220** | 1,4% | 1,7% |
| Slovakia | 83 | 87 | **90** | 3,1% | 2,2% |
| Slovenia | 44 | 47 | **54** | 16,0% | 0,3% |
| Spain | 1056 | 1156 | **1268** | 9,6% | 0,2% |
| Sweden | 255 | 248 | **243** | -2,1% | -1,8% |
| European Union# | 9933 | 10460 | **10802** | 3,3% | 0,4% |

#Excludes Estonia, Latvia and Lithuania prior to 1985 and Croatia and Slovenia prior to 1990.

Source: Energy Institute (2023)

**Table 5: Oil Production**

| Thousand barrels daily | 2020 | 2021 | **2022** | Growth rate per annum 2022 | 2012-22 |
|---|---|---|---|---|---|
| Denmark | 72 | 66 | **65** | -1,6% | -10,8% |
| Italy | 112 | 100 | **92** | -7,9% | -1,9% |
| Romania | 72 | 70 | **65** | -6,2% | -2,4% |
| European Union# | 393 | 369 | **343** | -7,0% | -5,0% |

#Excludes Estonia, Latvia and Lithuania prior to 1985 and Croatia and Slovenia prior to 1990.

Source: Energy Institute (2023)

With regard to EU oil production levels, we can notice something very interesting, and quite contrary to the trend we saw for the oil consumption levels. When we narrow our scope only to the EU, a decreasing trend can be noticed (see Table 5). Oil production within the EU namely decreased in the year 2022 by 7%, which is more than its growth rate of a decrease of 5%. When zooming in for country-specific details, we can notice a decreasing trend for Denmark, Italy, and Romania, for which Italy and Romania have seen a steeper decrease in oil production compared to their growth rate. For Denmark, oil consumption has risen more than its growth rate between 2021 and 2022, whereas oil production has decreased less than its growth rate when comparing the same time span, which goes to show that Denmark may be very reliant upon oil. Italy started to produce far less than it initially did, whereas it has started to consume far more, which might indicate towards consumption of oil reserves the country has in stock. Romania has seen a fall in oil consumption as well as oil production and actually seems to slowly move away from its oil dependency.

### Natural gas dependence

In 2021, the EU imported over 80% of their natural gas. Ever since the energy crisis struck due to the Russian invasion, the EU has asked to ramp up their imports of natural gas to replace the large volumes that have been cut by Russia. Furthermore, countries have rushed to strike deals with other major natural gas exporting countries to secure volumes. Natural gas has been very important for EU Member States, as more than 30% of households within the EU use natural gas to heat their homes (Eurostat, 2022b). Natural gas makes up almost a quarter of the EU's energy mix, and with the significant cut in natural gas imports from Russia, it is interesting to see how the EU has coped with a significant drop in natural gas imports from Russia, and whether or not this has set the stage for an accelerated transition towards the deployment of renewable energy sources. Table 6 shows the natural gas consumption levels of the various EU Member States between the period of 2020 and 2022. For the EU, a promising statistic can be noticed, which is that for the year 2022, natural gas consumption decreased by 13.5% compared to the previous year. Moreover, the average annual trend from 2012 onwards is said to be a decrease of 1.1% in natural gas consumption, which makes the decrease of 13.5% rather significant. What also stands out is the fact that many EU Member States experience an even more significant decrease in natural gas consumption levels. These countries comprise Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, Germany, Hungary, Latvia, Lithuania, Luxembourg, the Netherlands, Poland, Romania and Sweden. From these, especially the Scandinavian countries stand out, as Denmark (-28.3%), Finland (-47.9%), and Sweden (-30.9%) are among the EU Member States with the most significant drops in natural gas consumption levels. This steep reduction in natural gas consumption might have to do with their own availability of resources, but can also be explained on the basis of how these countries are connected to the energy infrastructure. Anyhow, it seems that these countries have opted to accelerate the phase out of natural gas. Of all the EU Member States, Ireland stands out as the only country that has increased its natural gas consumption in 2022 in comparison to the previous year. However, this increase is far from significant as the annual growth rate has been 1%. Despite seeing this promising decreasing trend when it comes to becoming less reliant upon fossil fuels, we still see some countries; Belgium, France, Germany, Italy, the Netherlands, Poland, and Spain, which remain in absolute numbers very reliant upon natural gas, with Germany topping the table (77.3 Bcm). If these heavily reliant countries upon natural gas can take the opportunity that the Russian invasion in some way has presented to accelerate its phase out, the EU as a whole can make some serious steps in the direction of its green energy transition.

**Table 6: Natural gas consumption**

| | | | | Growth rate per annum | |
|---|---|---|---|---|---|
| Billion cubic metres | 2020 | 2021 | **2022** | 2022 | 2012-22 |
| Austria | 8,5 | 9,0 | **7,9** | -12,2% | -0,9% |
| Belgium | 17,0 | 17,0 | **14,6** | -14,2% | -1,4% |
| Bulgaria | 2,9 | 3,3 | **2,7** | -18,1% | -0,5% |
| Croatia | 2,9 | 2,8 | **2,4** | -13,7% | -1,4% |
| Cyprus | - | - | - | - | - |
| Czech Republic | 8,5 | 9,1 | **7,4** | -18,7% | -0,8% |
| Denmark | 2,3 | 2,4 | **1,7** | -28,3% | -8,3% |
| Estonia | 0,4 | 0,5 | **0,4** | -25,5% | -5,5% |
| Finland | 2,1 | 2,1 | **1,1** | -47,9% | -10,3% |
| France | 40,6 | 43,0 | **38,4** | -10,8% | -1,5% |
| Germany | 87,1 | 91,7 | **77,3** | -15,7% | -0,5% |
| Greece | 6,3 | 7,0 | **6,2** | -11,2% | 2,8% |
| Hungary | 10,2 | 10,8 | **9,2** | -15,1% | -0,6% |
| Ireland | 5,3 | 5,1 | **5,2** | 2,0% | 1,0% |
| Italy | 67,6 | 72,4 | **65,3** | -9,8% | -0,9% |
| Latvia | 1,1 | 1,2 | **0,8** | -30,1% | -5,5% |
| Lithuania | 2,4 | 2,2 | **1,6** | -27,9% | -6,3% |
| Luxembourg | 0,7 | 0,8 | **0,6** | -21,4% | -6,7% |
| Netherlands | 36,1 | 34,9 | **27,1** | -22,2% | -3,6% |
| Poland | 21,1 | 22,4 | **17,9** | -19,9% | 0,3% |
| Portugal | 6,0 | 5,8 | **5,6** | -3,5% | 2,1% |
| Romania | 11,3 | 11,6 | **9,8** | -15,6% | -2,5% |

| | | | | | |
|---|---|---|---|---|---|
| Slovakia | 4,8 | 5,3 | **5,1** | -2,8% | 0,1% |
| Slovenia | 0,9 | 0,9 | **0,8** | -11,8% | -0,4% |
| Spain | 32,5 | 34,3 | **33,1** | -3,6% | ♦ |
| Sweden | 1,0 | 1,1 | **0,7** | -30,9% | -3,6% |
| European Union# | 380,0 | 397,0 | **343,4** | -13,5% | -1,1% |

#Excludes Estonia, Latvia and Lithuania prior to 1985 and Croatia and Slovenia prior to 1990.

Source: Energy Institute (2023)

When focusing on the natural gas production levels by the EU, we can notice a decrease of 7.2%. However, this decrease in natural gas production is less than the annual growth rate, which shows a downward sloping trend of 9.7% per year. When zooming in on the country-specific data, what first comes to be noticed is Denmark, which has increased its production despite a downward sloping trend of -13.1% per year and its significant decrease in natural gas consumption of 28.3%. It needs to be noted that Denmark's natural gas production already experienced a significant cut when the COVID-19 crisis hit, which ultimately more than halved Denmark's production levels (3.2 Bcm in 2019 to 1.4 Bcm in 2020). It increased its production levels by just a tiny bit in 2022 compared to 2021 which can indicate that this only compensates for the recovery of its domestic economy. Also noticeable and worth mentioning is Italy. Italy has, despite still experiencing a reduction in natural gas production, reduced far less than its annual trend of -9.1% per year. This can be explained by the fact that Italy has become far more reliant upon the use of natural gas than any other EU member country. Italy is also the country with the highest percentage of gas boilers used as the primary source of heating. Italy has thus seen to be taking measures as a response to the more immediate energy security concerns, which meant no further cut in natural gas production.

**Table 7: Natural gas production**

| | | | | Growth rate per annum | |
|---|---|---|---|---|---|
| Billion cubic metres | 2020 | 2021 | **2022** | 2022 | 2012-22 |
| Denmark | 1,4 | 1,5 | **1,5** | 0,2% | -13,1% |
| Germany | 4,5 | 4,5 | **4,3** | -6,2% | -7,7% |
| Italy | 3,9 | 3,2 | **3,2** | -0,8% | -9,1% |
| Netherlands | 20,1 | 18,0 | **15,1** | -16,5% | -14,0% |
| Poland | 3,9 | 3,9 | **4,0** | 3,0% | -1,3% |
| Romania | 8,6 | 8,6 | **8,8** | 2,3% | -1,3% |
| European Union# | 47,8 | 44,3 | **41,1** | -7,2% | -9,7% |

#Excludes Estonia, Latvia and Lithuania prior to 1985 and Croatia and Slovenia prior to 1990.

Source: Energy Institute (2023)

Considering all the available data presented in Tables 6 and 7, it is fair to conclude that the EU has made some serious efforts when it comes to becoming less reliant upon natural gas as one of the primary energy sources.

### Coal dependence

Coal is both the largest source of electricity generation as well as the largest single source of CO2 emission, thereby creating challenges when transitioning to a greener energy system. By 2021, around half of the over 300 coal-fueled power plants in Europe had either been closed or announced a retirement date before 2030. In the previous part of the analysis, we have among other things explored the EU imports of coal from Russia. By doing so, we have seen that the EU has cut all of its coal imports from Russia as the EU back in August 2022 introduced its fifth package of EU sanctions which imposed a prohibition on importing coal and other solid fossil fuels into the EU if they were to come from Russia. Despite commitments to phase out coal in the light of a more environmentally friendly energy mix, spare capacity in coal power plants remains high and in some countries even exceeds 70%. When the energy crisis struck due to the Russian invasion of Ukraine, expectations arose with regard to high rates of gas-to-oil switching. In other words, it was expected that gas would decrease in the European energy mix, and that of coal would increase, in order to navigate through the energy crisis. Table 8 shows the coal consumption of EU Member States between 2020 and 2022. If we first take a look at the supranational level (i.e. the EU), we can notice a short increase in coal consumption between 2021 and 2022. Moreover, the increase which amounts to 2% is a lot bigger than the annual growth rate of -4.2%. I just mentioned that expectations were that, in order to navigate through the energy crisis which has been posed by the Russian invasion of Ukraine, the EU would see a short-lived increase in coal consumption to compensate for the losses in natural gas supplies. A first insight in this data confirms this expectation, although we cannot yet state with full certainty whether or not the increase will indeed be short-lived. Then, if we go by the statistics on a national level, there seems to be quite a dichotomy between EU Member States further decreasing their coal consumption, and countries that actually increase their coal consumption. Countries like Belgium, Bulgaria, Czech Republic, Estonia, Germany, Italy, Latvia, Lithuania, Luxembourg, Spain, and Sweden have all increased their coal consumption by quite a lot, some of course more than others, while their annual growth rate has been down. Interestingly is that all of the previously mentioned countries were amongst the EU Member States' top losers with regard to natural gas consumption between 2021 and 2022 except for Spain which experienced just a marginal loss of 3.6% (see Table 6). Coal for these countries actually seems to serve as a sort of reception network for the significant drop in natural gas consumption. Other countries like Austria, Cyprus, Hungary, Ireland, Poland, Portugal, Slovakia, and Slovenia have experienced significant decreases in their coal consumption levels; more than their annual growth rate. These countries also decreased their natural gas consumption, but have not been replacing it with coal.

**Table 8: Coal Consumption**

| Exajoules | 2020 | 2021 | **2022** | Growth rate per annum 2022 | Growth rate per annum 2012-22 |
|---|---|---|---|---|---|
| Austria | 0,10 | 0,11 | **0,10** | -5,5% | -2,8% |
| Belgium | 0,10 | 0,11 | **0,12** | 3,4% | -1,8% |
| Bulgaria | 0,17 | 0,22 | **0,26** | 19,4% | -1,0% |
| Croatia | 0,02 | 0,02 | **0,02** | -1,0% | -4,2% |
| Cyprus | ^ | ^ | ^ | -20,7% | 63,5% |
| Czech Republic | 0,52 | 0,54 | **0,59** | 8,5% | -2,3% |
| Denmark | 0,03 | 0,04 | **0,04** | -3,3% | -8,6% |
| Estonia | 0,10 | 0,11 | **0,12** | 7,1% | -2,4% |
| Finland | 0,11 | 0,12 | **0,12** | -0,1% | -4,2% |
| France | 0,19 | 0,23 | **0,21** | -6,1% | -7,4% |
| Germany | 1,85 | 2,24 | **2,33** | 4,1% | -3,6% |
| Greece | 0,08 | 0,07 | **0,07** | 0,5% | -14,4% |
| Hungary | 0,07 | 0,06 | **0,05** | -13,4% | -7,5% |
| Ireland | 0,04 | 0,05 | **0,04** | -14,0% | -7,7% |
| Italy | 0,21 | 0,23 | **0,31** | 30,1% | -7,4% |
| Latvia | ^ | ^ | ^ | 8,6% | -13,9% |
| Lithuania | 0,01 | 0,01 | **0,01** | 3,5% | -1,9% |
| Luxembourg | ^ | ^ | ^ | 5,1% | -1,9% |
| Netherlands | 0,17 | 0,23 | **0,23** | -0,8% | -3,8% |
| Poland | 1,72 | 1,90 | **1,81** | -5,2% | -1,7% |
| Portugal | 0,02 | 0,01 | ^ | -95,4% | -43,9% |
| Romania | 0,15 | 0,17 | **0,17** | -2,7% | -6,3% |
| Slovakia | 0,10 | 0,12 | **0,11** | -10,4% | -3,0% |
| Slovenia | 0,04 | 0,04 | **0,03** | -23,1% | -6,4% |
| Spain | 0,12 | 0,13 | **0,17** | 31,3% | -12,6% |
| Sweden | 0,07 | 0,07 | **0,07** | 6,2% | -1,8% |
| **European Union#** | **6,02** | **6,84** | **6,98** | **2,0%** | **-4,2%** |

#Excludes Estonia, Latvia and Lithuania prior to 1985 and Croatia and Slovenia prior to 1990.

Source: Energy Institute (2023)

**Table 9: Coal Production**

| Exajoules | 2020 | 2021 | 2022 | Growth rate per annum 2022 | Growth rate per annum 2012-22 |
|---|---|---|---|---|---|
| Bulgaria | 0,16 | 0,20 | **0,25** | 24,5% | 0,6% |

| | | | | | |
|---|---|---|---|---|---|
| Czech Republic | 0,43 | 0,44 | **0,48** | 9,3% | -5,5% |
| Germany | 0,98 | 1,15 | **1,21** | 4,9% | -4,9% |
| Greece | 0,07 | 0,06 | **0,07** | 13,3% | -14,7% |
| Hungary | 0,04 | 0,03 | **0,03** | -1,2% | -7,1% |
| Poland | 1,68 | 1,76 | **1,70** | -3,2% | -3,4% |
| Romania | 0,11 | 0,13 | **0,13** | 2,4% | -6,9% |
| Serbia | 0,30 | 0,26 | **0,25** | -3,5% | -1,8% |
| Spain | ^ | ^ | ^ | ♦ | -33,3% |
| European Union# | 3,68 | 3,96 | **4,07** | 2,7% | -4,7% |

#Excludes Estonia, Latvia and Lithuania prior to 1985 and Croatia and Slovenia prior to 1990.

Source: Energy Institute (2023)

When exploring the EU production levels of coal, we also see that the EU has increased its production level compared to both 2021 and its annual growth rate (see Table 9). It is interesting to see that the EU coal production statistics more or less align with its coal consumption statistics. For coal consumption, the level is decreasing by 4.2% per year, whereas for coal production, this is a decrease of 4.7% (see Tables 8 & 9). On the other hand, EU coal consumption increased by 2% in 2022, whereas for coal production, this amounts to 2.7%. From this, we can with some certainty derive that the EU has increased its coal production to only meet the increase in demand in coal consumption. When assessing country-specific statistics, we see that in relative numbers, Bulgaria has increased its coal production a lot, though Germany in absolute numbers matches this increase. Also, the Czech Republic, Greece, and Romania have ramped up their coal production whereas Hungary, Serbia, and Poland have experienced minor decreases.

In 2022, EU oil consumption amounted to 22,13 exajoules, whereas for natural gas, this was 12,36 exajoules, and for coal 6,98 exajoules. Together, this adds up to 41,47 exajoules. When calculating the same numbers for the year 2021, this would add up to 42,51 exajoules. This comes down to an overall decrease of 2.45% in fossil fuel consumption. When doing the same for the fossil fuel production levels, for 2021, this would add up to 7,59 exajoules, whereas for 2022, this amount up to 7,44 exajoules. This comes down to a decrease in fossil fuel production of 1.98%. So both fossil fuel consumption as well as production decreased a little when comparing the pre-crisis period with the period when Russia invaded Ukraine. Despite an overall decreasing trend, only the actual drop in natural gas reliance would be significant.

## Narrative account on the roll out of renewable energy

During times of crisis, for policymakers, it is easier to argue that existing policies need to be re-evaluated and new ones need to be adopted. The current energy crisis posed by the Russian invasion has mostly been a question of energy securitization to meet the energy demands of the various EU Member States. Energy securitization assumes that a political issue is framed as a security issue. During times of crisis, securitization takes place when the stakes are high. A very relevant example that affirms this, and that can serve as a reference point is the energy crisis in the 1970s, but also echoing the energy crises of the late 2000s and 2014, may tell us to expect a greater emphasis on energy security in the energy policies of Alongside attempts to securitize the energy supply, the Russian invasion of Ukraine may have caused a change in perception of energy sources and other components of the fossil fuel infrastructure. the EU (Osicka & Cernoch, 2022; Goldthau & Boersma, 2014). The energy crisis of the late 2000s was characterized mainly by oil scarcity and the gas dispute between Russia in Ukraine mentioned earlier. But unlike this previous crisis, viable long-term solutions to the current crisis will be understood more in terms of an approach towards the decarbonization goals set by the EU. In countries where politicians have traditionally been hesitant and arguably opposing renewable energy source-driven decarbonization like Poland or Czechia, the Russian invasion could strengthen voices in favor of renewable energy sources-driven decarbonization (Szulecki, 2017; Ocelil et al., 2017). Moreover, in countries where pro voices for a renewable energy source-driven decarbonization already dominate the political domain, the Russian invasion will most likely result in a doubling-down of these voices. When the energy securitization framing starts to get more publicly accepted, the more likely it is for the public to become more willing to consider a change in the rules that govern the energy system. This could allow policymakers to implement new energy policies with respect to decarbonization goals more easily and steer towards a new pathway, away from the current fossil fuel-driven energy infrastructure. This part of the analysis brings together the energy policy responses by the EU and its Member States to the energy crisis posed by the Russian invasion of Ukraine. I first analyze policy responses made at the supranational level, after which I will do the same at the national level. I will start from the assumption that the Russian invasion of Ukraine has led to a refocus on energy policies with a range of potential implications for the EU's green energy transition, thereby potentially breaking its path of dependence on fossil fuels. This part of the analysis has thus a qualitative approach to the matter, after which I will test the effectiveness of newly implemented policies by quantifying EU imports of solar panels, windmills, and heat pumps for the pre-crisis and crisis periods. Important to note for the qualitative data with respect to energy policy changes is that the reference point will be the dates of the announcement, as energy actors will anticipate implementation.

## Policies to accelerate the roll out of renewable energy

In the past 15 years, EU legislation on the promotion of renewable energy usage has evolved significantly. Renewable sources of energy comprise wind power, solar power, hydroelectric power, biomass, biofuels, ocean energy, and geothermal energy, which are all said to be alternatives to the unreliable and volatile energy dependence on fossil fuels, in particular oil, natural gas, and coal, which should contribute to the reduction of greenhouse gas emissions and the diversification of the energy supply. In 2018, for renewables in EU final energy consumption, European leaders agreed on a target share of 32% by 2030. However, in March 2023, due to the prevailing energy crisis, and in line with the EU ambition of becoming carbon neutral by 2050, co-legislators agreed to increase the initial target of 32% for renewables up to 42.5%, with the aim of achieving 45%. This section strives to explore the narrative account of the individual member states as well as the overarching institutional bulwark they are part of, namely the European Union, and how those political expressions interact with each other.

Within the European Union, one main package will take shape, which is the REPowerEU, launched in May 2022. It was launched as a response to the challenges being faced by the energy market disruptions due to the Russian invasion of Ukraine. It includes targets for EU-based manufacturing of clean energy technologies and the granting of certain regulatory exemptions to clean energy technology projects. These projects cover solar and wind energy, but also investments in renewable heating such as heat pumps (European Commission, 2022). When Russia invaded Ukraine, it became more clear that the EU needed more alternative ways to ensure its energy supply. It needs to be noted that some countries are much more reliant upon Russian fossil fuels, but it was considered that the possible consequences of great energy disruptions would be jointly suffered by all. The EU needs to securitize its energy for the coming years, and in light of transitioning towards a greener energy system where we become less reliant upon fossil fuels, the REPowerEU has been launched. Following the Russian aggression against Ukraine, the European Commission as part of its REPowerEU plan proposed an amendment to accelerate the transition to a more environmentally stable energy mix, in line with the phase out of Russian fossil fuel dependence. Consequently, it increased the 2030 target of the share that should be made up of renewable energy sources in the European policy mix; the target is now set at 45%. Following this first amendment, the Commission proposed a second amendment in November 2022, for an accelerated deployment of renewable energy source usage. This more or less matches with individual country measures. In the table below, I have summed up the most important measures taken by individual member states as a response to the energy crisis posed by the Russian invasion of Ukraine. What becomes clear is, that despite differing measures, an overall trend seems to have arisen where countries steer in an increasing manner towards the deployment of renewable energy sources within the European energy mix. Consequently, EU member state countries have seemed to steer away from the path of dependency upon Russian energy, and one can expect future decisions to be channeled along the path favoring a clean energy transition. Below I will present a table in which I have outlined all the relevant energy policy measures taken by the various EU Member States to accelerate the rollout of renewable energy sources since the Russian invasion of Ukraine took place. Note that multiple countries have been excluded as they have not yet adopted new energy policies. These countries comprise Austria, Bulgaria, Croatia, Cyprus, Finland, Hungary, Latvia, Luxembourg, Romania, Slovakia, Slovenia and Sweden. The newly adopted energy policies will be interpreted and tested for effectiveness in the following section.

Table 10: Energy policies to accelerate the role out of renewable energy sources.

| Country | Measure | Allocated budget | Date of announcement |
|---|---|---|---|
| Belgium | Accelerate deployment of solar PV and development of offshore wind zone | 1,2 billion euros | March 2022 |
| Czech Republic | Amendment to the Energy Building Act to simplify the permitting procedure for new solar plants. | - | September 2022 |
| Denmark | Signed offshore wind cooperation agreement with Belgium, the Netherlands and Germany. | 135 billion euros | May 2022 |
| Estonia | Accelerate green energy transition by setting renewable energy target for 2030 equal to 100% of total energy consumption. | - | August 2022 |
| France | Accelerate deployment of renewable energy sources by increasing budget. | 1.3 billion euros | September 2022 |

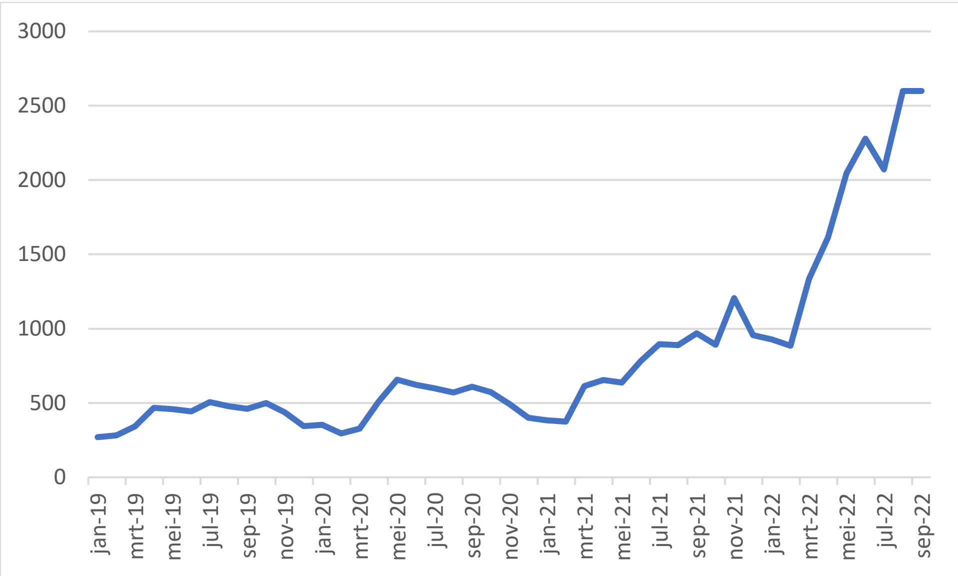
| | | | |
|---|---|---|---|
| Germany | Easter Package to set the 2030 renewable energy target equal to 80% of energy consumption & Wind on land act to increase share of land for wind turbines by 2%. | 4.04 billion euros | April 2022 |
| Greece | Finance 250.000 roofs with solar PV & a first law on offshore wind. | - | September 2022 |
| Italy | Streamline the authorization procedure to install wind parks. and announced the construction of six wind farms. | 85 billion euros | March 2022 |
| Ireland | Revision of the Climate Action Plan to increase renewable energy generation by 20%. | - | May 2022 |
| Lithuania | Strengthening energy independence by promoting solar and wind power. | 1.12 billion euros | April 2022 |
| the Netherlands | Expanding the coalition agreement struck in December 2021 by setting wind energy targets equal to 75% of current energy consumption. | - | September 2022 |
| Poland | Updating the Energy Polish Policy aiming at further development of renewable energy. | - | March 2022 |
| Portugal | Increased targets for offshore wind power. | - | September 2022 |
| Spain | The Energy Saving Decree set out to promote electric mobility. Establish regulatory bases to grant aid to innovative energy storage projects with renewable energy. | 1.4 billion euros<br>150 million euros | March 2022<br><br>November 2022 |

Source: Bruegel (2022) & Bruegel (2023)

## Effectiveness of new energy policies.

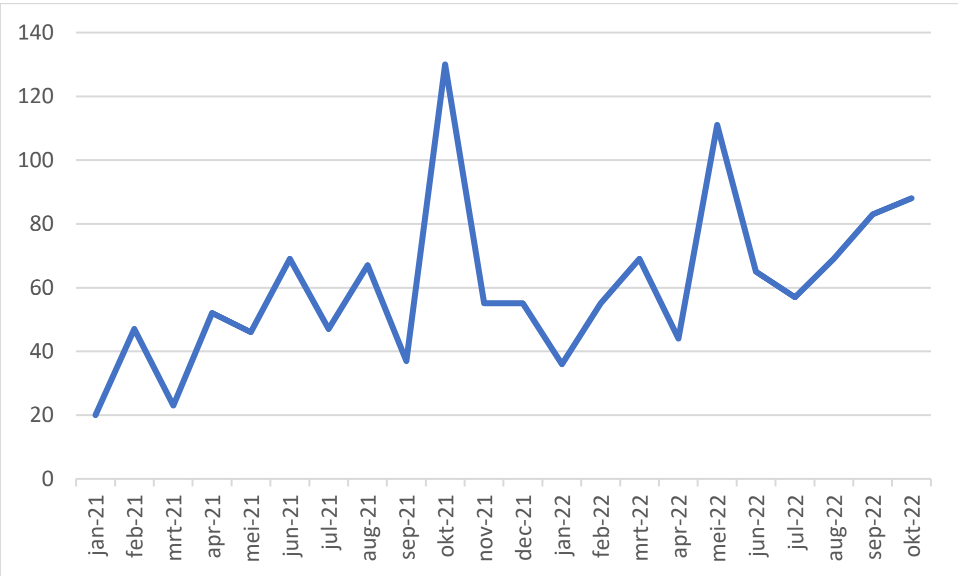
Within REPowerEU, the European Commission set the 2030 target of renewable energy capacity to 1236 GW in order to save up to 21bcm of gas per year. Furthermore, to reduce natural gas imports from Russia, the EU has set a new target on the sustainable production of biomethane of 35bcm by 2030 has been set as a cost-efficient path. On the 22nd of July, in line with the REPowerEU objectives, the European Commission amended the crisis framework (European Commission, 2023) to support the acceleration of renewable energy rollout, as well as the decarbonization of industries. Under this amended framework, EU Member States will be allowed to set up schemes for investments in renewable energy sources, such as solar and wind power, and renewable heat, which includes heat pumps. What has been crucial within this amendment, is the introduction of tender procedures that have simplified this normally long-lasting process of getting for example construction permits. As outlined in the previous section, various EU Member States have since the Russian invasion of Ukraine committed to speed up the green energy transition with great investments in solar and wind energy. Figures 4 and 5 show the EU imports of solar panels (between January 2019 and September 2022) and wind turbines (between January 2021 and October 2022). When looking at Figure 4 first, it is very interesting to see that exactly at the time the Russian invasion of Ukraine took place, the EU significantly imported more solar panels than it did before. From February 2022 to June 2022, the value of EU imports of solar panels increased from 885 million euros up to 2279 million euros. It goes to show that the measures taken by the EU and its Member States with respect to investments in solar energy have had a great effect. It needs to be noted that in 2021, from all the imports related to green energy, solar panels accounted for over 70% of those imports (Eurostat, 2022c). So an increase of 158% in solar panel imports during just a 4-month time spawn is highly significant. Moreover, using the fact that solar accounts for over 70% of EU imports related to green energy, it would imply that these imports in itself also doubled in just over 4 months. When looking at EU imports of wind turbines, we get a rather different view when testing the effectiveness of newly adopted energy policies. Wind turbine imports as displayed in Figure 5 have not seen the clearest trend, though it is upwards. Furthermore, from the time Russia invaded Ukraine, EU imports in wind turbines have actually increased from an import value of 55 million to 88 million in October 2022, which amounts to an increase of 60%. An increase of 60% is in itself of course significant. In the previous section as shown in Table 10, we can notice that in order to accelerate the rollout of renewable energy, especially energy policies are adopted that regard investments in wind energy. Therefore, I would have expected a steeper increase in EU imports of wind turbines. This can however be explained because many of those policies regard offshore windmill parks, for which construction and development takes far more time than that of solar panels. In other words, many of the future windmills have already been invested in, but they are not yet included in the import values provided by Eurostat. All in all, I can conclude that ever since the Russian invasion of Ukraine, EU imports of solar panels and wind turbines have increased significantly by means of newly adopted energy policies.

Figure 4: EU imports of solar panels




Source: Eurostat (2023b) (Comext data code: DS-018995)

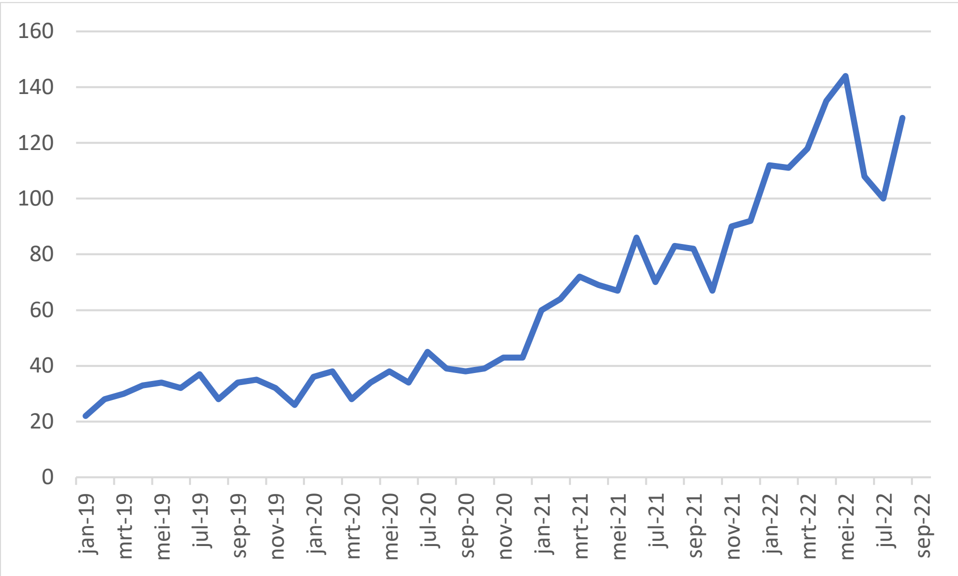
Figure 5: EU imports of wind turbines




Source: Eurostat (2023a) (Comext data code: DS-045409)

According to Eurostat data, around 50% of all the energy that is consumed within the EU is used for heating and cooling, of which 70% still comes from the use of fossil fuels (Eurostat, 2023c). Heat pumps are a technology that is much more energy efficient than the old-fashioned boilers, and allow for greater use of renewable energy sources. Under the temporary crisis framework adopted by the European Commission, schemes have been set up by EU Member States in which investments in renewable heat have been increased.

Figure 6: EU imports of heat pumps




Source: Eurostat (2023a) (Comext data code: DS-045409)

Figure 6 shows us the EU imports of heat pumps between January 2019 and September 2022, and a clear trend can be spotted, which is upward-sloping. Between October 2021 and May 2022, the import value of heat pumps more than doubled from 67 million euros to 144 million euros. Interesting is the fact that REPowerU was launched in May 2022, right at the moment we experience a sudden drop in import values of heat pumps. However, it is already on an increasing trend again, and EU import values in heat pumps amounted to 129 million euros in September 2022, compared to 111 million euros at the moment when the Russian invasion of Ukraine took place. Heat pumps, compared to imports of solar panels and wind turbines, have seen the lowest increase, though an increase. From the data at hand, and adding all three different renewable energy sources together, the EU import value from the three sources combined increased from 1051 million euros at the pre-crisis moment to 2810 million euros in September 2022, which amounts to a stunning increase of 168% in just a half year. I would therefore conclude that the newly adopted energy policies to spur the rollout of renewable energy sources have been very effective.

## Green energy transition of the EU: concluding remarks

This study has examined the impact of the Russian invasion of Ukraine and consequently, the posed energy crisis on the integrational aspect of the European Union, paying special attention to the implications in its transition towards a more environmentally friendly and stable energy mix. The angle this study has been approached from has been one from a geopolitical reductionist approach, drawing upon the literature on dependence and dependency. Critical arguments made here are that, throughout the years, the European Union has become more and more dependent upon fossil fuels, and in particular Russian energy supplies, which has gradually resulted in a carbon lock-in effect. For the EU, it has become increasingly difficult to shift away from its fossil fuel-dependent path, despite numerous efforts. Furthermore, it is stated that in order for the EU to shift away from its path dependence on fossil fuels and hence a break from its fossil fuel dependency on Russia, a critical juncture needs to take place. A certain tipping point will then be reached, which will set in motion a snowball effect and will ultimately result in change; a shift from path dependence. In late February 2022, Russia invaded Ukraine, which, besides creating a worldwide energy crisis as Russia is an energy giant supplying the rest of the world with its oil and natural gas, created a lot of tensions between the EU and Russia. What followed has been a major cut in energy supplies to European countries, and hereby paved the way for a new path; one in which future movement is to be channeled along the lines of the deployment of more environmentally friendly energy sources (i.e. renewable energy sources).

This study first assessed the EU's energy dependence upon Russia, measured in terms of oil, natural gas, and coal imports, as those energy sources make up 70% of the EU’s energy supply. Exploring the EU’s dependence upon Russian energy supplies was not the only scope, as the interdependence between the EU and Russia had already been explored enough by different studies. However, what was not yet conducted was whether or not data would show an actual decrease in energy reliance upon Russian fossil fuels, which could potentially imply an actual shift in the path, thereby straying away from the path dependence upon a fossil fuel-dominated energy infrastructure. Drawing from the obtained results, I conclude that the EU has become significantly less reliant upon Russian energy supplies. Hereinafter, my analysis was to show whether or not the EU’s dependency on its fossil fuel-dominated energy infrastructure would be broken as well. I did so by looking at the EU consumption and production levels for oil, natural gas, and coal. Consumption levels for oil, natural gas, and coal combined decreased by 2.45%, which more or less follows the already decreasing trend.

It needs to be noted that natural gas consumption did significantly decrease, but as oil takes on a high share in the EU's energy consumption, and even increased a little, the average of the three fossil fuels combined is just a minor decrease. I have conducted the same analysis for the EU's production levels, which gave me a result of a decrease in fossil fuel production of 1.98%. So both fossil fuel consumption as well as production decreased a little when comparing the pre-crisis period with the period when Russia invaded Ukraine. Despite an overall decreasing trend, only the actual drop in natural gas reliance would be significant. The last part of this research was merely qualitative, and two-tailed. I first explored the narrative accounts of the EU and its Member States. I set out the newly adopted energy policies since the Russian invasion of Ukraine and explored how these have interacted, paying special attention to investments in renewable energy sources. After having explored the narrative accounts, I tested for effectiveness by looking at EU imports of solar panels, wind turbines, and heat pumps. I found a significant increase of 168% for the three renewable energy sources combined. This is interpreted that the newly adopted energy policies by the various EU and its Member States have been highly effective in accelerating the roll out of renewable energy and shifting away from fossil fuel path dependency.

To conclude, EU member states had for decades been very reliant upon its fossil fuel-dominated energy system, especially on fossil fuels from Russia, which paved the way for future movement and decisions along that path. However, ever since Russia invaded Ukraine, the EU has faced an enormous energy crisis to overcome, which seems to have given the opportunity for the EU to shift away from its interdependent relationship with Russia, and spurring the transition towards a greener climate. My results show some divergence but overall seem to point in one direction, and that is an accelerated transition toward a greener energy system. Different countries have adopted different policy measures in doing so, but most importantly, there seems to prevail a collective trend that channels future movement along a new path, which favors our climate. Despite the efforts of this study, much research can still be done, as data is yet to a very limited extent available. Furthermore, as briefly pointed out in reviewing literature about geopolitical reductionism, the role of the United States in this decade-long process has been under-investigated. One can logically assume that the US has played a pivotal role in shaping an interdependent relationship between the EU and Russia.

For now, I conclude that the EU is showing the first signs of breaking its fossil fuel path dependency, as the transition is accelerated, yet remains slow and steady.

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