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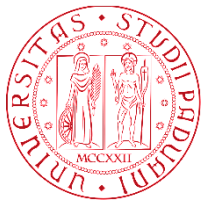

EU green energy transition in the perspective of the war in Ukraine

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Abstract

Focusing on gas and oil supply to the EU, this thesis maps out recent transformations of the energy sector and explores how the roles of different suppliers and resources changed in the wake of the war in Ukraine. The author uses examples from the history of common policy changes that were acting as a response to previous gas disruptions that were part of Russian strategy and uses them as a road map to the present situation. The focus of the thesis is to define and critically evaluate the main aspects of the Energy Union as a crucial document determining the goals of the EU and its energy policy as well as the means to achieve them. The ongoing war in Ukraine is used as a decisive event that can be analysed to discover whether the EU has been acting in accordance with its established principles and goals or has derailed from its path. In the second part, the author explores the immediate reactions of the EU energy policy, which has been searching for alternative sources of energy as the risk of energy insufficiency rises. In this case, the main focus is dedicated to the role of renewable energy, nuclear energy, and LNG, which, in order, represent the cleanest and cheapest sources of energy and therefore appropriate alternatives. Lastly, the author tries to evaluate what would be the optimal strategy to proceed with to achieve the goals outlined in the Energy Union in the light of current political events, partnerships, and capacities available. The thesis thus unfolds the structure of the energy policy of the EU, specific goals, and policy decisions related to them, and seeks to explain its recent developments while trying to discover the weaknesses of the current energy policy.

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1. Introduction

Energy is often nicknamed as the lifeblood of modern society and is closely connected to development of civilizations since their inception. Whether it was the primitive method of harnessing the sun energy that led to igniting the first fires, the utilization of wind power used to set off the of the sailing boats, or the creation of the rudimentary steam engines, humanity has always found a way how to employ technology in collection and utilization of ever larger amounts of energy. This has been especially true since the onset of the Industrial revolution and wide usage of energy sources to help us with virtually every daily activity, spawning to all thinkable industries. With an ever-growing reliance on energy resources and imperfect and insufficient ways of harnessing them to meet the standards and the needs of different nations, it is more than clear that there are and will be disputes regarding its access and usage – especially if we consider its finite category (Rosa et al., 1988).

Indeed, the prominent role of fossil fuels since the development of the first engines has been a constant when it comes to energetics. This is hardly surprising, as fossil fuels have largely contributed to the increase in life expectancy and its quality through an overall rise in GDP per capita. It is widely believed that this was, and still is, possible due to technological advancements that rearranged the production possibilities of societies and have changed the living standards of the mass population for the better advances that would not have been possible without the vital role of fossil fuels (Clemente, 2009). Nowadays, electricity is produced by electromechanical generators. These are fuelled by combustion, nuclear fusion, kinetic, or solar power, and their products accompany us in our everyday lives. Fossil fuels, which formed from the decomposition of buried organisms that died millions of years ago, have been a particularly necessary source for energy supply and electricity generation (Clemente, 2009).

The reasons why hydrocarbon fuels have become popular are manifold, but it is mainly thanks to their high energy density, good trade-off between the energy invested and energy returned, and relatively easy methods for their harnessing. The factor of logistics that exploits the well-established methods for extraction and distribution networks, while being supported by large multinational corporations

interested in the acquisition and exchange of those resources, or policy actors on various levels of government has only helped with their popularity (Clemente, 2009).

Although quoting just a few facts is simplifying the complexity of the issue that contributes to explaining why global efforts of the energy transition to more sustainable resources are so hard to reach, the fact that humanity is, and probably will remain heavily dependent on fossil fuels is hard to deny. Based on recent data, measuring the primary energy use by different sources of energy, fossil fuels accounted for 82% of worldwide production of energy in 2021 (BP, 2022).

This trend is nothing new, as the global share of hydrocarbon fuels in total energy consumption crossed the frontier of 85% several times in the last decade, while in the further past being an almost exclusive source of energy. Looking at the resources separately, in 2021 - coal remained a dominant source of energy for fuel generation, occupying 36% of the overall share, while natural gas slightly decreased its share to 23% and oil occupied the last position (BP, 2022)

However, the heavy reliance on hydrocarbons is accompanied by an ever-increasing necessity for energetic supply, which is partly caused by population growth and paradoxically by rising prosperity, commercial activity, and the convergence of developing countries. This is obvious, taking into consideration, that there are still billions of people lacking the housing and appliances taken as standard for most advanced economies, and hundreds of millions of those who lack even access to energy. Emerging markets such as those in Asia, Africa, or South America account for two-thirds of the total global population and are expected to grow even further in the next 30 years. And although thanks to the increased affordability of green energy sources emerging markets have more possibility to develop sustainable energy infrastructure, this hasn’t been true until recently (International Energy Agency, 2021)

What is more, these infrastructures tend to use advanced technologies and even if built correctly and in a cost-efficient manner, still don’t ensure that some operations that are fundamental for the development of a functional economy can be done. This includes for instance steel or cement production that both need extremely high temperatures and are indispensable for the construction of production capacities, housing, or further development of infrastructure. Developing

economies, but not only them, are therefore left dependent on conventional fossil fuels that have for them numerous advantages comprising affordability, ease, and versatility of use. This process of rapid development and urbanization of developing economies is extremely energy and emission-intensive and can be demonstrated in the case of the growth of China and its industry in the past two decades (International Energy Agency, 2021).

Despite this, developing countries are hardly the only ones reliant on fossil fuels. Some of the richest countries in the world, including the USA, Japan, Germany, and Saudi Arabia, are among the top users of hydrocarbon fuels while also being among the best adepts at switching to cleaner energy. In the case of the USA, for example, fossil fuels took up to 79% of the total energy mix in 2021, and despite the radical changes promised by the Green New Deal, the provisions for the next few years don't seem to lower this share extensively (EIA, 2022). However, due to the increasing importance of developing states, innovations and capacity building in their energy sector will play a prominent role in the future, not only due to the finite nature of fossil fuels (Exxonmobil, 2022).

Another reason why energy has become such a discussed topic is the rising CO2 concentration. This has been closely connected to the consumption of hydrocarbons, a fact that is already well-researched, and efforts are being made to reduce this impact. Nowadays, China is a global leader in new renewable energy installations, and numerous emerging markets are following suit. The Stated Policies Scenario (STEPS)[1] shows us that in both well-established markets of developing economies like India or Brazil and more recent ones in the Middle East or Africa, renewable energy capacities account for almost two-thirds of all newly added facilities (IEA, 2022). Investments in digitalized energy networks, building robust electricity grids, electrifying transportation, or creating reliable operations of wind-rich systems and solar panels are underway in those emerging economies. All these efforts are made to ensure a green energy transition that is both efficient and sustainable, thus minimizing environmental impact while exploiting the benefits of RES. Despite all those efforts, the emerging economies are projected to be responsible for the majority of CO2 emissions growth in the upcoming decades, as

[1] STEPS is a method providing a more conservative benchmark for reaching the energy-related policy objectives, as it doesn't take for granted that the governments will achieve their goals. (IEA, 2022.)

only a fraction of those emissions are covered in their net-zero pledges. Much stronger action is needed internationally to cope with the common cause of climate change through investments and political and societal support (IEA, 2022).

The European Union, on the other hand, is one of the most important international actors in many aspects, representing roughly 15% of the total share of the world's GDP and being the largest trade bloc in the world as well as the biggest exporter of manufactured goods and services (Statista, 2023). In addition, the EU is taking an active role in international diplomacy and development, being a leader in development assistance, working collectively to promote good governance, providing humanitarian aid, and preserving natural resources. It can be claimed that the EU is a beacon with regards to many policy objectives and the means to achieve them. This should include climate and energy strategies as well, as it is evident that they are becoming more and more interlinked. But by taking a closer look at the EU's greenhouse gas emissions, we can observe that energy production accounts for more than three-quarters of its total emissions. This is even more striking when considering that the EU was the third largest producer of CO2 and GHG emissions worldwide in 2015, closely second to the USA (Crippa et al., 2019). This again can be explained through the energy mix of the EU, which was in 2020 mainly composed of a combination of oil and petroleum products, solid fossil fuels, and natural gas, all of which accounted roughly for 68% of the total share of energy creation (Eurostat, 2022).

What is more, the EU is very dependent on the imports of its energy from other countries, acquiring almost 60% of its energy elsewhere and importing it to its member states through well-established distribution networks. A large part of those imports can be traced back to Russia, a country with abundant naturally occurring gas fields and oil reservoirs. Over the past decades, the EU has accepted Russia as a comfortable trading partner for fossil fuels, and in 2020 alone, it covered about 25% of its total by buying Russian hydrocarbons. However, these numbers are just averages, as the EU is not a unitary actor, and the unequal shares of fossil fuels in the energy mixes of member countries create sometimes even higher country-specific dependencies on Russian imports (Eurostat, 2022).

All of the mentioned aspects, namely the role of the EU as an international actor both in mitigating environmental risks and in setting a positive example, as

well as its dependency on energy imports, have been among the key drivers of the Union's new energy policies. Those aim to achieve the goal of decarbonization of the energy sector and to meet zero-net emission objectives while diversifying energy supplies. The instruments that the EU has used for these purposes range from accelerating permits for renewable energy power plants and boosting their offshore versions, to opting for alternative fuels and betting on renewable hydrogen, to ensuring a fair and just energy transition. All those goals are reactions to the socioeconomic dynamics of the region, macrotrends such as urbanisation and globalisation, and the rising importance of tackling climate change (European Parliament, 2023).

And all the defined problems, goals, and tools are to some extent present in the EU's strategic and policy documents, among which the most ambitious and overreaching is the European Green Deal, with the ultimate goal for the EU to become the first climate-neutral continent by 2050. Whether it concerns investing in environmentally friendly technologies, addressing energy poverty, or ensuring cleaner forms of private and public transport, each of those topics is covered by the EGD and is somehow related to energy demand and supply. The Energy Union is then one of the main energy policy instruments that ought to deliver the desired results and transform the whole energy system. However, given the structural outline of the energy sector of the EU, its main goals, and current political events, it is apparent that it is no easy task to achieve an effective energy transition (European Commission, 2021a).

1.1. Structure and goals of the thesis

In recent years the issues of energy security, efficiency and sufficiency have been at the centre of political and public debates. When it comes to the geopolitical situation of Europe, the role of the European Union as an international actor that represents its member states in many areas, must be taken into consideration. After all, the initiatives during the 1950s, such as the Schuman Declaration, that has brought to the creation of the European Coal and Steel Community or the European Atomic Energy Community. As the European Union kept enlarging by including new members and competencies, the idea of unified energy policy and market clearly followed a vision of shared action to get a better bargaining position and to achieve common strategic goals. But the first legally binding commitment in this field arose in 2007 with the Treaty of Lisbon, pointing out some crucial actions and goals that shifted under common competence. However, it was not until 2015 when the Energy Union project established long-term objectives of the EU energy policy. This project has aspired to attain goals of security of supply, sustainability, and competitiveness, and supports them with multiple other dimensions. Although many other policies and initiatives were added to the original package, the original Energy Union provisions were unprecedented. Therefore, to understand the development of EU energy policies over the last decade, one must start with understanding the structure and evolution of the Energy Union as well.

Against this backdrop, this thesis maps out and analyses the EU Energy Union package and the evolution of EU energy policies over the last decade, focusing specifically on how the issue of external energy supply has gained prominence because of the war in Ukraine. The analysis presented in this thesis shows that disruptions in gas supplies to Europe were part of the Russian strategy in the past, and triggered, together with some other factors, the establishment of the energy packages (Lambert et al., 2022) However, the limited ambition of the original package was only overcome during the ongoing war in Ukraine, after the external resources supply dependence has long been underestimated (Lambert et al., 2022).

The first two chapters of the thesis outline the historical development of energy policy in Europe and illustrate the Energy Union's objective, principles, and structure. In the next part, the author explores the reaction of the EU energy policy to the 2022 energy crisis and its search for alternative sources of energy in the situation when the risk of energy insufficiency arose. The focus is posed on the role of key EU institutions in transformation of the energy policy, introducing their main initiatives. Lastly, author tries to illustrate possible scenarios of development of EU energy policy, in the light of current political events, partnerships, and capacities available.

1.2. Limits of the thesis

One of the main challenges of the thesis will be the ability to process the sheer number of resources and material available connected to this problem, released by different journals, governments, agencies, and stakeholders. This could potentially lead to impossibility of justly evaluating all impacts of the advised policy changes. It is mainly due to different individual policies applied by the member states of the EU, their institutional settings, capacities as well as willingness to apply those recommendations.

Closely connected to the previous challenge is the topicality of the issue and its complexity. As the war on Ukraine still hasn't finished and it is impossible to predict its future, it will be difficult to assess the full scope of action that can be taken by the EU and its members. To overcome those challenges the author will prioritize the most relevant and influential sources, by carefully selecting information from reputable journals, research institutes and key government agencies whenever possible. The effort to make the analysis more complex will be enabled by embracing interdisciplinary perspective, by pooling data from the aforementioned types of sources.

The last of the presumed limits would probably be the language barrier of the author. Although most of the texts are available in English, there might be some important information regarding the war on Ukraine, available just in Russian or Ukrainian. As at the time of writing this thesis the war on Ukraine is still ongoing, and both information about it and reactions of the EU to it are updated regularly, the author will also use the information from Ukrainian media that is available in English to support his work. This approach can help to provide a complete picture without omitting important information.

1.3. Research questions

Apart from a brief introduction and putting the whole subject of the thesis into context, the thesis will provide an overview of policy developments that have led to wards the current energy policy settings in the EU and reflect on possible future developments.

The following research questions will be used to structure the analysis and map the main developments in EU energy policies:

- How have EU energy policy priorities changed over time (from the establishment to the first Energy Union)?
- In what way have external factors (in particular in the Eastern direction) shaped policy change ?
- Has the EU learnt a lesson from gas shortages during previous tensions with Russia?
- What are the novelties that the European Green Deal (EGD) has brought about?
- How has the shares of different energy sources changed since the beginning of the war in Ukraine?
- Do the EU's current energy policies reflect the overriding principles of Energy Union ?
- What has been the role and position of the main EU institutions (the Commission, the Parliament, and the Council) in the redesign of EU energy policies as a consequence of the war between Russia and Ukraine
- What are some scenarios for the development of the EU energy sector?

1.4. Methodology

To answer the questions above, the author employs a qualitative research method in order to provide a nuanced description of the evolution of the EU's Energy Union, focusing on its functional and strategic elements. To better understand the motivation and actions of actors, it is important that appropriate research methods are employed. In this thesis, the author adapts a wider scope to analyse the structure and development of energy policy in the EU and the roles of different sources of energy.

In order to elaborate on the considerations, the author aspires to perform a multi-goal policy analysis. This method appears to be appropriate to effectively map the evolution of the energy policy of the EU, which tries to attain multiple policy goals (Mansour, 2018).

This method is labelled in the literature under different names, such as multi attributes (De Felice & Petrillo, 2012), multi-criteria analysis (Dobes & Bennett, 2009) or rationalistic approach (Fischer et al., 1993). All of those come from the rational stream of thought and are used to analyse complex economic, political, social, or foreign policy problems and generally, are based on several logical steps. They include identification of a problem, specification of policy goals and objectives that would help to reach them, specification of policy alternatives and forecast of the possible outcomes. The role of analyst is then to compare all those aspects and choose the best alternative that would lead to achieving the goals and ultimately also the objectives of the energy policy of the EU. The method that the author will use is loosely based on the Bardach & Patashnik (2019) framework, that is a rational model employing practical steps in search of optimal policy for complex bodies. The perk of this model is that it is straightforward and calls for search of smart practices that can be customized to local specificities while being aware of the complexity of public policy (Bardach & Patashnik, 2019).

The reason for choosing this methodology comes naturally as the interdependence between environmental and energy policy making is quite apparent. Both environmental and energy issues are multifaceted, and their solutions affect a wide range of other public policy issues, such as production possibilities, security, health, and even basic human needs. Oftentimes unknown

negative and positive spillover effects are expected behind every policy change. Therefore, normative specification and measurements impacts of every policy alternative, when it comes to a topic as large as the energy policy of the EU, is not possible within the scope of this thesis (Mansour, 2018).

For this reason, the author provides a summary of the external energy relations of the EU and its energy policy development throughout the years as a means to help with understanding the current situation. This will be achieved by gathering an already well-researched pool of literature on the topic that will also be used to find similarities between historical events and recent ones. One of the goals of the thesis is to build up enough information to find incoherencies and structural weaknesses in the efforts used to reach energy and environmental targets that are partly embedded in the Energy Union. The author therefore uses a combination of energy market analyses, expert literature, and official EU documents to try and uncover the weak points of the EU energy policy that led to the building of vulnerability in the energy sector.

Similar documents will be used to make sense of the current development of the green energy transition and its future. As the final part of the thesis will be analytical, the author will try to collect and analyse existing literature on the topic, providing short-term considerations for different commercially available energy technologies. The aim of this approach is once again to critically assess the structure of the EU energy sector and provide information about different technologies, assessing their strengths and weaknesses. Some criteria of those technologies that will be taken into consideration are, for instance, the levelized cost of electricity (LCOE) of different sources, the sustainability of the technology in question, its availability, or the feasibility of the proposed project.

2. Policy context and main issues

In this part of the thesis, the author will present how the energy policy of the EU has changed throughout the years and what the development of energy relationships has been, mainly between the USSR and the Russian Federation and the European Communities and EU members. The timeline will span from the first efforts of European integration to the creation of the Energy Union, putting the changes in the common energy policy into a broader context. The aim of this chapter is to introduce the evolution of energy policy priorities and analyse the extent to which external factors shaped the process of policy change in the EU. More specifically, the author will compare multiple disputes related to gas imports from Russia, which affected the European energy market from 2006 to 2014, and policymaking in the energy sector.

2.1. Early years of energy policy

Following the havoc that World War II had wreaked on Europe and the newly created bipolar system created by the Iron Curtain, the desire for stronger western cooperation was growing. The announcement of financial aid through the Marshall Plan or the creation of the Council of Europe were one of the defining moments of the early history of the EU, yet not the most important ones. It was the Monnet Plan, which was originally an initiative aimed at modernising and re-equipping the French economy in order to speed up the economic recovery after WWII, that inspired Robert Schuman to begin the process of European integration. The previous plan, based on a few key sectors including coal mining, oil extraction, steel production, and expanding electricity or railway capacities, really gave impetus to the Schuman Declaration. In 1950, the proposed establishment of a common market for coal and steel for countries that were willing to participate and delegate the control of key industries to an independent overseeing authority led to the creation of the very first international common energy-related policy in Europe. A year later, six countries decided to join and create a community that would replace conflict with cooperation, formally forming the European Coal and Steel Community (ECSC) with jurisdictional control over the energy resources, paving the way for better economic collaboration (Kanellakis et al., 2013).

During the same period, the core members of the Western European Union (WEU) realised that coal would not be the optimal medium for the energy needs of the future. Nuclear power stood out as an important source to cover the rising demand for low-cost energy and a substitute for depleted coal deposits. However, in the question of nuclear power, there was also a need for greater cooperation among member states, mainly for reasons related to security and competitiveness. The European Coal and Steel Community (EURATOM) was established in 1957, and what was originally meant to be an extension of the ECSC has become a separate body. The main goals of the organisation were to promote the development of nuclear technology for peaceful purposes, provide secure access to nuclear material, and guarantee its safety and control (Jorant, 2013).

The 1960s were a period when the governments of the WEU were favouring the development of new nuclear capacities as a way of increasing independence from imports of oil, gas, or coal, which were in Europe relatively scarce. Although there was increased economic cooperation and, in the case of nuclear material, safety monitoring, a true push for common energy policy didn't come until the oil crises in 1973 and 1974. During the Copenhagen summit, the Member States agreed upon a declaration, which led to a resolution adopted by the Council setting up a new energy policy strategy for the Community. This involved common energy goals for 1985, the adoption of guidelines covering energy supply and demand, diversification of energy resources, preference in the usage of hydrocarbons, solid fuels, and nuclear energy within the community, and stressing the need for better rationality in energy usage (Langsdorf, 2011).

During the following years the connection between energy usage and greenhouse gas emissions started to become more evident, but this hasn't translated yet into the legislature, as environmental policy was definitely not an important issue on the agenda. An exception to this was the integration of environmental protection into the Single European Act (SEA) in 1987, which provided the first legal basis for a common environment policy aiming to preserve the quality of environment, protecting human life and rational use of natural resources. It was, however not until subsequent revisions were made a few years later that the environmental policy has been successfully recognized as a separate

area of interest, as more efforts were deployed to finish the goal of economic integration of the Community (Kanellakis et al., 2013 & Langsdorf, 2011).

The upcoming years are undoubtedly connected to the speeding up of European integration due to several historical milestones, including the ratification of the Maastricht Treaty and the subsequent establishment of the EU single market. These milestones have also had an impact on EU energy policy, although not immediately. While the three mentioned communities were merged into the European Communities, creating a major pillar of the EU connected by economic, social, and environmental policies, significant progress in terms of a common energy policy was not achieved. The reluctance of certain states to create a common energy policy and their preference for focusing on economic objectives led to the failed attempt to include a separate energy chapter in the Treaty of Maastricht. This chapter would have delegated part of the member states' autonomy to the EU itself, but the proposal was refused by members mostly with high reserves of hydrocarbons, while these same members preferred economic cooperation through the completion of the Internal Energy Market. Progress was made gradually, such as through the signature of the European Energy Charter by 53 signatories. This unique treaty provides a multilateral framework for energy cooperation under international law. The treaty addresses the promotion of competitive energy markets, sustainable development, and energy security while establishing the Energy Charter Conference as a platform to discuss issues regarding energy cooperation in the EU (The Energy Charter Treaty, 2014).

As mentioned, the energy market was becoming increasingly liberalised, promoting competition among operators and separating energy production, transportation, and distribution activities. The introduction of market prices, however, did not affect how Member states chose their energy mix or where they purchased energy from, as there was a lack of coherent legislative provisions controlling this sphere. This changed when a directive on common rules for the internal market in electricity was implemented in 1996. The directive established common rules for the organisation and functioning of the electricity sector, access to the market, and criteria for calls for tenders and granting authorisation to Member states (Directive 96/92/EC concerning common rules for the internal market of electricity). A similar move was made for the common market rules for gas through

Directive 98/30/EC, which also integrated the role of LNG in the natural gas sector. These two directives were the cornerstone of the First Energy Package, which has become important legislation constraining member states to transpose the rules into their national legislation. In addition to market regulations, the directives also addressed the issue of environmental protection that member states were obligated to respect, although the protection itself was vaguely defined in the documents (Skjærseth, 2021).

What truly shaped the environmental agenda in the EU and closely connected it to issues of energy generation and resource choice was the first assessment report of the Intergovernmental Panel on Climate Change (IPCC) in 1990. Subsequent reports, followed by the "Earth Summit" in 1992 in Rio and the signing of the Kyoto Protocol in 1997, led to the incorporation of environmental commitments into the goals of the EU itself. Climate change, energy issues, and resource sustainability gained significant prominence on the global agenda, fostering an atmosphere conducive to ambitious changes. The notion that these interconnected topics with common goals needed to be discussed and addressed at a supranational level propelled the EU to take a leading role in combating climate change (Langsdorf, 2011). The protocol's foundation was the recognition of common but differentiated responsibilities, considering various countries' impact on climate deterioration and their capabilities in fighting climate change, closely tied to their economic development. For EU member states, as part of the highly developed world, this entailed committing to significant reductions in potent greenhouse gases, such as carbon dioxide, methane, nitrous oxide, and others, in order to control emissions of the primary human-emitted greenhouse gases (Kyoto Protocol, 2019).

During the same period, the Fifth Environmental Action Programme titled "Towards Sustainability" was adopted. It served as a comprehensive strategy for approaching overall sustainability with a particular emphasis on maintaining access to natural resources and their responsible utilization. The primary objective was to pursue long-term global goals. The programme emphasized two key aspects: integrating the environmental dimension into all major policy areas and promoting shared responsibility among various stakeholders, including governments, industries, and the public, to achieve the set objectives. While the programme

demonstrated a general willingness to integrate and recognize the importance of the environmental agenda across different sectors and establish targets, the progress report on its implementation indicated a slow advancement and a lack of incentives for renewable energy. (The 5th Environmental Action Programme, 1993).

Two White Papers published in 1995 and 1997 reached similar conclusions to the previous report. They emphasized the main objectives of competitiveness, security of supply, and environmental protection while setting an indicative target of a 12% share of renewable energy sources (RES) in total energy generation (Kanellakis et al., 2013).

2.2. The evolution of EU energy dependency and energy policy since 2000s

As the European Union was expanding, both through the addition of new member states and the implementation of new legislation, the area of energy policy remained largely unchanged since the adoption of the First Energy Package. Neither of the two treaties - the Treaty of Amsterdam (1999) and the Treaty of Nice - brought significant advancements for common energy policy and its regulation. Instead of implementing a comprehensive policy-changing program, a piecemeal approach was adopted, as seen in the example of the 2001 Directive on electricity production from renewable energy sources (RES), which set a target to be achieved by 2010 for the EU-15 at that time. Similarly, the Renewable Energy Directive of 2003 established national indicative targets to increase the share of biofuels in the transport sector, as fossil fuels continue to dominate energy generation in this area. Both legislations had to be adopted by the newly acceded countries during the EU's largest expansion in 2004, and similar indicative targets were also adopted for those countries (Kanellakis et al., 2013). The final piece of legislation in the first half of the new decade was the introduction of an emissions trading system in 2005, which was implemented to fulfil the EU's targets pledged in the Kyoto agreement. This initial phase, which served as a pilot program, initially covered CO2 emissions from power generators and energy-intensive industries, with most allowances being provided to businesses free of charge. Although far from perfect, the first phase of the project established a carbon price, the necessary infrastructure to monitor and report emissions, and a system for trading emission allowances within the EU (Development of the EU ETS, 2005-2020).

When discussing the evolution of the common EU energy policy, it is essential to consider the significance of the Action Plan for Energy Efficiency adopted in 2007. Several factors contribute to its importance. Firstly, it unified goals and established linkages between different policies. Previously, policies addressing energy security, supply and regulation, climate change, economic growth, and innovation were developed separately and followed distinct paths. The directives introduced to promote renewable energy, energy efficiency in electricity, buildings, and transportation were often lacking ambition and legal enforceability (Skjærseth, 2021). Although there were some exceptions, such as the Lisbon strategy for

sustainable growth and the first European Technology Platform, which included low-carbon technologies, there was no comprehensive strategy implemented to address renewable energy and energy efficiency. This demonstrated the general reluctance of countries to cooperate, driven by their diverse interests and unwillingness to relinquish control over their national energy mixes. However, the adoption of the 2007 Action Plan marked a significant shift, laying the groundwork for a more coherent energy policy (Langsdorf, 2011).

Another reason why the 2007 “An energy policy for Europe” strategy was innovative is that it set up ambitious quantifiable goals to be reached in different areas while indicating how to achieve them. Although previous legislations have often established their goals in vague terms and were hardly enforceable the first Action Plan was different. It has been set to run for six years from 2007-2012 to mobilize the general public, policymakers, and market actors to transform the internal energy market of the EU by applying the most energy-efficient infrastructure, products, and energy systems in the world. To reach these objectives the plan has set up catchy 20/20/20 quantifiable targets, which had been defined for the energy policy of the EU (An Energy Policy for Europe, 2007).

Three targets that include commitment to reach different 20 % goals by 2020 are (An Energy Policy for Europe, 2007):

- Reduction of EU’s own emissions by at least 20 % with comparison to 1990 levels. This objective was later updated to 30 % with regards to international agreement that obliges developed countries to reduce their greenhouse emissions further and is at the heart of EU’s strategy for limiting climate change.
- Reduction of EU’s energy consumption by 20 % to be reached through a variety of efforts including compliance with energy efficiency requirements or public campaigns raising awareness.
- Increase in the use of renewable energy sources with the objective to reach the amount of 20 % in the total energy mix of the EU.

In summary, the 2007 Action Plan was an important landmark as it helped to set up the 2020 objectives that are overreaching and combine a multitude of goals and instruments to achieve them. With regards to setting the agenda for energy policy, the main three challenges were defined, that are still applicable today: the competitive energy market, the role of sustainable energy in it, and the security of energy supply. As decarbonization is not a process that can be achieved by a single instrument and broader policy mixes should be adopted to cope with it better, a particular interest was dedicated also to the role of nuclear energy and new technologies and finalization of internal market for gas and electricity which all have a role in ensuring competitiveness and sustainability of the energy sector (European Commission, 2006; Langsdorf, 2011).

The Action Plan was a success as it finally managed to include the separate energy title in one of the fundamental treaties of the EU. The Lisbon Treaty in 2007 has marked an important policy change with regards to the energy as it introduces a specific legal basis for the field of energy and its integration into TFEU. This innovation makes it possible to make interventions in the field of energy, which previously hasn't been feasible. More specifically, the EU is entitled to take measures at European level to (Treaty of Lisbon, 2007):

- ensure the functioning of the energy market;
- ensure security of energy supply;
- promote energy efficiency;
- promote the interconnection of energy networks

Although the interventions are subject to the principle of subsidiarity and therefore feasible only if EU can react more efficiently than Member States individually, it is a major advancement. Especially with regards to the security of energy supply, as it was usually a concern of member states. Despite the choices of energy resources, its importers and exploitation of natural resources persisted in the competence of the individual states, the new Article 194 created a major push towards harmonization of common energy policy, as none of the previous treaties has yet established a separate EU competence on energy. Therefore, under the newly accepted terms of the Lisbon Treaty, some of the competence and control

over national energy policy has been transferred to the EU (Treaty of Lisbon, 2007 & Langsdorf, 2011).

To achieve these 2020 objectives while linking climate and energy policies, the EU adopted a package of two cross-sector instruments. The first was a revision of the EU ETS aimed at further reducing emissions in ETS sectors compared with 2005 levels. This was to be achieved by establishing a cap for the whole EU that would be reduced annually, and by creating a new funding system, NER 300, to finance carbon capture and storage mechanisms (CCS), as well as innovative renewable energy technology demonstrations for commercial use. The second instrument was a decision on binding national targets to reduce emissions by 10%, compared to 2005 levels, in sectors not covered by the ETS, such as transport, agriculture, waste, or buildings. The package also built a legal framework for the promotion of RES, as the objectives were based on binding national targets and complemented by the construction of large-scale pilot projects to demonstrate the value of RES (Skjærseth, 2021).

Subsequent years followed a similar path, and the energy policy of the EU became more integrated and complex. While member states still retained their freedom of choice in terms of energy sources and suppliers, they faced increased scrutiny regarding final emission goals, energy efficiency, and security. An example of this is the Strategic Energy Technology Plan (SET), enacted in 2008, which aimed to accelerate the deployment of new green technologies. Funding for research in six key areas of low-carbon research, including wind, solar, CCS, electricity grid, bioenergy, and nuclear fission technologies, significantly increased (European Commission, 2009 & Langsdorf, 2011).

In the following year, the extensive Third Energy Package was adopted, representing a significant step towards further liberalization of the energy market. This legislation aimed to separate the energy supply, generation, and transmission networks, set requirements for the independence of regulators and the government, and promote cross-border cooperation, primarily in the gas and electricity sectors, made feasible by the establishment of European transmission networks, another important change that facilitated the functioning of the internal energy market was the creation of the Agency for Cooperation of Energy Regulators (ACER). As an independent body separate from the Commission, governments, and energy

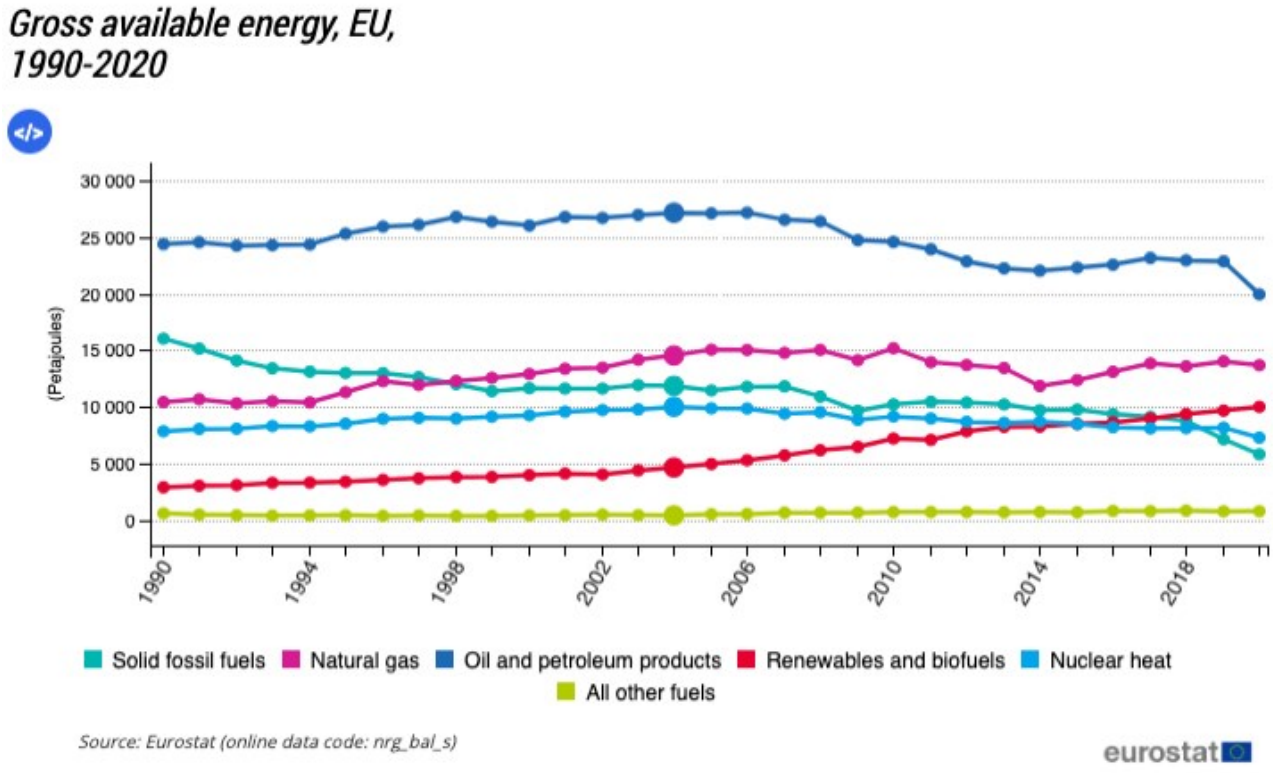
providers, ACER is responsible for reviewing EU strategies, drafting guidelines, and monitoring the functioning of the internal market for gas and electricity (European Commission, 2009 & Langsdorf, 2011).

To reach the objectives established by the Lisbon Treaty, the Commission enacted various legislative acts linking policies of climate change, energy efficiency, RES, and energy-import dependency. The laws were mostly driven by the activities of Germany, the UK and France and tried to further obligate the Member States with binding national targets, entrusting them with building their own strategies on how to achieve them. One example could be the RES directive 2009/28/EC, the establishment of National Renewable Energy Action Plans (NREAPs), or the integration of RES into newly built and reconstructed buildings. All of these policies were aimed at reaching the objectives in time and helping to funnel resources into the development of RES (European Parliament, 2009).

2.3. Role of gas and Russian imports

The role of gas in electricity generation within the EU has been growing steadily over the past two decades. This is due to various factors such as its abundance, versatility, low environmental impact, and, in the case of the EU, the existence of already constructed capacities. The incentive to prioritize gas over other fossil fuels since the 2000s has become more compelling, thanks to the support of the Kyoto Protocol and its reduction targets, as well as extensive legislation that has been adopted since then. Gas has been accounting for around 20% of the EU's total energy demand and is a vital energy source on which many countries rely when formulating their clean energy transition strategies. However, during the same period of increasing demand, the supply of gas within the EU itself has been slowly declining. Whether it is due to the depletion of gas fields, as seen in the case of the U.K., or the shutdown of the Groningen gas fields due to environmental risks, Member States have been striving to find ways to address the shortage of gas supply (Reymond, 2007).

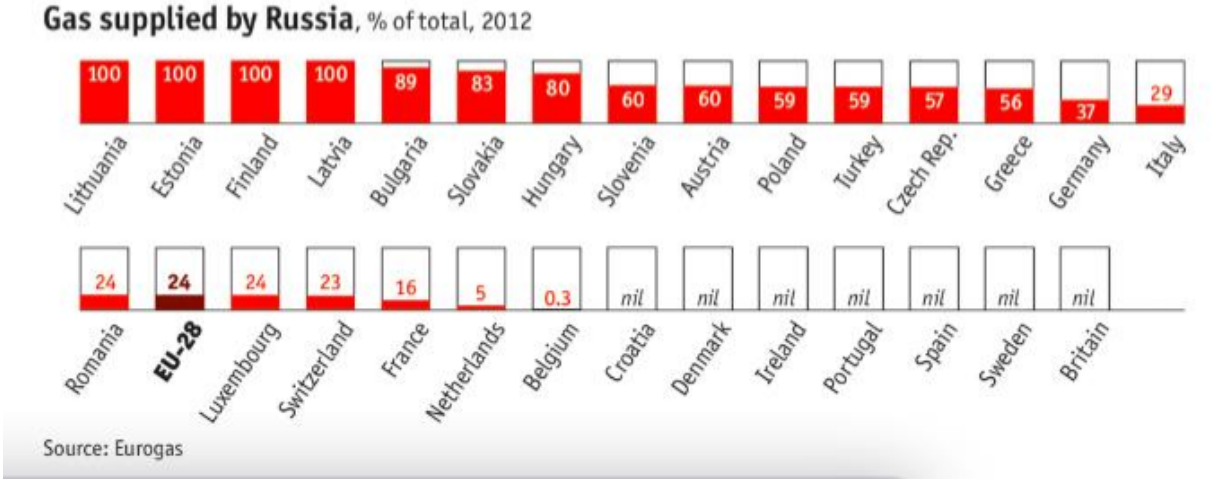
Figure 1 - Gross available energy in EU based on source



Russia on the other hand has been becoming increasingly more important trading partner and its gas deliveries are still crucial to meet the overall energy demand of the EU. The reasons for this cooperation are various, yet quite simple. On one hand we have the increase in European demand and inability to cover it by supply generated within EU, on the other we have Russia with substantial gas resources comparable to only those found in Middle Eastern countries. Already established infrastructure and proximity is another important aspect for the transactions, as in 2003 Russia was shipping over 140 billion cubic meters of gas per year (bcm/y) to nineteen European countries. Although the peaks of the amounts of gas transported into the EU were seen in the past two decades, Russia's export tradition dates to the Cold War when it built large-scale pipelines to support its satellite countries. Gas was however traded also with Western European states as their governments believed that it could be a mean for cooperation to build peace and prosperity (Stern, 2006).

These facts help to explain why it has been so hard in recent years to imagine a future of EU energetics, without Russian imports of gas. The further efforts for development of cooperation among the two actors, such as creation of "energy partnership" have deepened the EU's energy dependence as the share of Russian gas imports has been increasing. This is however particularly problematic when it comes to the question of security of energy supply in case of disruptions. These could influence considerably national accounts and mainly those of post-soviet countries. Full shutdown of gas deliveries for example could substantially affect economies of central and eastern Europe, as they are both heavily reliant on Russian hydrocarbons, and in some cases, important transit countries, as can be seen at the graphics below (Stern, 2006 & Weisser, 2005).

Figure 2 - Gas supply routes from Russia and dependence of individual MS



2.4. EU energy dependence and the gas crises

2.4.1 The crises of 2006 and 2009

Since the 2000s European energy security has been a major interest both in conceptional documents of the EU and the expert literature. The factors of low production capacity, high demands for energy, and the pivotal role of gas in the future energy transition connected to greater projected consumption, have brought about its steady supply. Weisser (2005) in his paper argues that the EU needs a coherent and proactive policy on the security of gas supply and warns of the many

risks that the energy supply dependence could bring. In short, he describes the dangers of too few sources and venues when it comes to energy acquisition, an issue that is aggravated by constructed pipeline infrastructure and warns about the possibility of political blackmailing in case of disputes.

These worries have materialized with the 2005 and 2007 Russian suspension of gas and oil flows through Belarus and Ukraine. In both cases, the amounts of both hydrocarbons have decreased rapidly within hours and were resumed only after several days of price negotiation. These first drops in gas and oil deliveries have confirmed doubts about the reliability of Russia as a sound energy supplier and the need for common policy (Reymond, 2007). In 2007 Energy Policy for Europe was adopted with various far-reaching objectives, including reduction of energy-dependence and increase of energy security. Although several steps for diversification of Europe's energy supply were undergone, including dialogues about energy cooperation with Central Asia and Northern African countries, the approach of some key countries towards Russia has been in discord with EU's set objectives. Especially Germany and Italy have been reluctant to give up convenient gas and instead of diversification were in this period opting for long-term contracts (Reymond, 2007 & *An Energy Policy for Europe*, 2007).

The gas that the EU Member States were demanding was at that time flowing almost exclusively through Ukraine, a country with an ambivalent relationship with its eastern neighbour and a history of common disputes. Ukraine has been for a long time an important transition hub, and before the finalization of the Nord Stream 1 pipeline, around 80 % of all Russian gas exports to Europe were flowing through its territory (Hafner & Bigano, 2009). On 2 January 2009, 18 European countries already reported a significant drop in the pressure of their gas pipelines, as Russia decided to completely interrupt its gas supplies through Ukraine. Reasons for this were diverse, but the most recurring ones are talking about the accumulation of Ukraine's debt for consumed gas, the inability to reach an agreement about a common price for 2009, or allegations that Ukraine was diverting some of the gas designated for the European market (Hafner & Bigano, 2009).

The outcome however was that the majority of the EU experienced a significant shortfall of gas deliveries for two weeks, as gas flowing through Ukraine

accounted for roughly one-third of European daily gas demand. Most Western European countries overcame the crisis without impacting their customers thanks to their storage capacities, however, the situation in the East was completely different. The Balkan countries have experienced a humanitarian emergency due to their heavy reliance on gas imports, their strong role in their energy mix, and the time of the year, resulting in an inability of the population to heat their homes (Hafner & Bigano, 2009).

The worst gas crisis for Europe until that time had several dramatic consequences that led to re-shaping both bilateral relationship between Russia and EU and its energy policy. The reputations of Russia as a reliable supplier and Ukraine as a safe transit country have been damaged as neither of the sides had been fully sincere with the reasons for closure of the deliveries. The dispute pointed out the fragility of the energy system that lacked diversification of energy supply, little interconnection and storage capacities and malfunction of the internal energy market that had been established. It took too long to implement simple solutions like diverting LNG shipments to countries in need, or almost impossible due to physical barriers and low capacity to apply reverse-flow mechanisms (Lochner, 2011)

As the crisis finally showed that Russia is readily able to restrict its energy supply to reach its foreign policy goals, it underlined a need for a united approach and additional investments in new infrastructures. The efforts of the EU have since then intensified as it signed a deal with Ukraine, for a large investment in its gas infrastructure, not losing hope on its most important transit country (De Micco, 2014). Germany, one of the main economies of the EU, has also since the gas blackout decided to push through project North Stream 1, an underground natural gas pipeline under the Baltic Sea. During the same year, the Nordic countries authorized construction of a pipeline in its exclusive economic zones, Gazprom – a state-owned Russian energy corporation, could start pumping 55 bcm/y of gas year the EU through the German gas distribution system (Siddi, 2015).

Another important effort to secure gas supply in case of possible disruptions was deployed during the negotiations about the Nabucco pipeline. This potential infrastructure connecting the Caspian region, Middle East, and Turkey could lead gas into East, Central, and West European markets, bypassing both Russia and

Ukraine and thus finally leading to greater diversification of gas supply. But despite the signing of agreements with several EU transit countries and Turkey in 2009, the project was abandoned later, probably due to political pressure and a lack of support. The same fate also encountered the South Stream project, which was a Russian effort to diversify gas routes and bypass Ukraine through a pipeline going under the Black Sea; however, this project was found non-compliant with EU legislation. The last idea for diversification of gas providers worth mentioning was probably the effort to increase LNG imports. This, however, was not particularly effective due to the lack of regasification capacities and the dominance of Gazprom in the LNG market at that time (Klimczak, 2015).

From a legal standpoint, somehow as a reaction to gas disruptions and effort to strengthen the energy security of the EU, Third Energy Package entered into force in September 2009. Not only was the legislation aimed at liberalization of the internal energy market, but also at protection of end customers and better reprehensibility of the energy providers. In this sense, the most important innovation was unbundling and separating energy supply from its generation and transmission networks. This was indirectly aimed at stopping Gazprom, which possessed a near monopoly to deliver gas to Europe, from owning also the distribution network. Reasoning for this was quite simple – to set up safety measures that would help to ensure a fair and efficient retail market (*Third Energy Package*, n.d.). The legislation was indeed deemed necessary as the EU had a proof that Russia is not afraid to use energy and its price as a political weapon. This was demonstrated in Ukraine during the “Orange revolution”, during 2007 in Belarus, or two years later by bringing about a gas crisis that heavily impacted also the Member states (Siddi, 2015).

2.4.2 Disputes of 2014

The beginning of another gas crisis can be spotted at the end of 2013, during the Maidan Uprising. The civil unrest showing public disapproval to foreign policy of the pro-Russian president Viktor Yanukovych, led his latter ousting and most probably spurred a backlash to Russian interests in Ukraine. At the beginning of the next year, the unrest in the regions of Donbas and Kharkiv began, supported by the Russian troops to begin an offensive and so-called fight for independence. Soon after, the Russian military was also spotted in Crimea, where it played a role in overtaking strategic points and conducting a highly controversial referendum, better known as Russia's annexation of Crimea (Goldthau & Boersma, 2014)

During the same period, the authorities of the Republic of Crimea announced nationalization of an important oil and gas company and its submission to Gazprom. In June 2014, with on-going war in the East of Ukraine, Gazprom cut deliveries for Ukraine, as it failed to pay for previous deliveries, an amount that has been inflated by cancellation of previous gas discount. The company in which the Russian state owns more than 50 % of shares, sharply declined accusations that the cut-off would be connected to events in Ukraine, whether it is Euromaidan, annexation of Crimea or ongoing battles on the eastern border (Reuters, 2014). Although Gazprom argued that the reasons for suspension of gas deliveries are purely economic, the political milieu, timing and previous experience make it very hard to believe.

Comparing the impact of the previous gas disruptions of 2006 and especially 2009, we can conclude that the one of 2014 was indeed less harmful for the European economy. This is thanks to many factors, such as favorable weather conditions, stronger legal framework that helped to prevent major disruption and the improvement of facilities. Indeed, it is essential to consider the timing and weather, as the crisis started during the summer months, after a relatively warm winter, therefore MS still had gas stored in their tanks. This provided the EU with the possibility to act with equanimity as none of the MS was in dire need of gas deliveries, as in the case of previous crises. What is more, the warm winter caused imports of both natural gas and its liquid form to decrease considerably from the previous years, giving the EU more leverage in pricing the gas deliveries (Hafner & Bigano, 2009 & Rodríguez-Goméz et al., 2016).

Another important aspect to consider is the regulation No 994/2010 that established safety measures to enhance the security of gas supply, that followed the previous gas crisis. This legislation replaced the Directive 2004/67/EC and introduced the need to carry out full risk assessments of national grids, identifying tools and instruments to increase resilience and provide skill to cope with crises. In general, it provided an enhanced framework to address potential gas disruptions and led to major improvements in the infrastructure and to some extent led to rethinking of the providers and transit routes for future gas deliveries (Rodríguez-Gómez et al., 2016).

First of those improvements is the increase in pipeline length and their compression power. These are good indicators for diversification of the transit routes, interconnection between other MS and increase in total volume of gas that is possible to transmit. An example could be finalization of Nord Stream 1 pipeline, importing a considerable amount of gas and effectively avoiding territory of Ukraine. Another important aspect were newly built LNG capacities, mainly stations for regasification of the substance leading to growth of aggregated capacity by 41% from 2009 to 2014. Although in 2014 the imports of LNG were at the lowest during the whole period, the EU identifies the liquid form of gas as one of the most important tools to respond to short-term shocks and diversify sources (Rodríguez-Gómez et al., 2016).

In the same spirit the number of underground gas storage facilities (UGS) also grew as they are vital in balancing gas disruptions, acting as a buffer. UGS are inventories which can provide necessary gas to the customers, increasing energy supply security in the short run. The total volume of them grew to 100 bcm/y which was an increase of 21% since 2009 and could roughly cover one quarter of EU's yearly demand in 2014. Furthermore, as described above, one of the critical issues with gas infrastructure in 2009 was the inability to transfer gas throughout the EU without difficulties using established pipelines. The regulation 994/2010 changed this as it obliged the gas transmission operators (TSOs) to enable permanent bi-directional capacity at relevant points by the end of 2013. This allowed the EU to increase energy supply security by adding the functional possibility to reverse the flows of gas in case of major disruptions and. Meaning that gas could flow in both directions through almost every second interconnection point, as the number of

interconnections between states increased from 24% to 40% in 2014 (Rodríguez-Gómez et al., 2016).

To further demonstrate the improvements of the 2014 grid compared to the one in 2009, authors Rodríguez-Goméz et al. (2016) in their research used the GEMFLOW method to simulate potential gas emergency crises at EU level. By employing Monte-Carlo model of stochastic calculus and simulating many computations to get a close approximation, they managed to estimate what would be the impact of 30-day and 90-day gas crises under different scenarios. The outcome confirmed that compared to the previous crises, the one in 2014 would have a much lower impact thanks to improved infrastructure that would help to bridge the supply interruption.

The end of the crisis can be mapped to 30 October 2014, when the ending Barroso Commission successfully managed to land a deal between the EU, Ukraine and Russia. The goal of the agreement was to provide for secure gas deliveries, during the upcoming winter, as the EU was still heavily reliant on Russian supplies. It included the condition for Ukraine to pay its debt for previous supplies, as the main condition of Gazprom to restore the delivery through its territory. The deal also established a new price for Ukraine and the need to pay its future deliveries in advance. Both the IMF and the EU guaranteed to help finance Ukraine's debt to some extent, although it was not clearly specified in the agreement. And although the deal delivered and assisted in accepting “winter package” that would support Ukraine's economy, it was criticized due to unclear conditions for the taxpayers (De Micco, 2014).

2.5. Conclusion

In conclusion, all of the gas crisis impacted to certain extent all the aspects regarding the European energy infrastructure. Mainly the crisis in 2009 with its timing and gravity took by chance many MS that were either unprepared for or even unaware of potential gas disruptions. The scope of the crisis itself really underlined the need for united action that translated into more comprehensive and enforceable legislation on the EU level (Hafner & Bigano, 2009). The question of energetic security ceased to be the question of individual states, as they subjected some of their power to the supranational level. The crisis also exposed the malfunctioning of the internal energy market, and it stressed the need to speed up the process to achieve the goals of the 2007 Action Plan. This finally led to adoption of the third energy package of the EU and the regulation 994/2010 which both helped to attain a better functioning internal energy market and enhance energy security (Rodríguez-Gómez et al., 2016).

When it comes to diversification and securitization of energy supply, some improvements can be seen when comparing the two major crises. An example can be seen with the efforts to diversify the gas routes to avoid the territory of Ukraine. The reliance on Ukraine as a transition country for gas dropped from 80 % to about 50 % in 2014 of all the gas imported to the EU. The main improvements were achieved by the NS1 project and marginally by newly established pipelines from Africa. But there have been other significant projects for further diversification that failed, such as Nabucco or South Stream. Other important improvements were further developments of LNG capacities, UGS storage enlargements and better interconnectivity of existing pipelines within the EU system that all would work as buffers in case of major disruptions. We can conclude that the EU to certain extent has been able to improve the security of gas supplies by enhancing capacities for its transmission and storage, however it was still heavily reliant on Russia as its main trade partner (Rodríguez-Gómez et al., 2016).

Indeed, it was Russia that provided approximately 42% of all gas imports in 2014, a share that despite the efforts for diversification, increased dramatically since the last crisis. It is important to consider this reliance, as the share of gas in total energy mix of the EU was both in 2009 and 2014 at around 22% and therefore this made just deliveries of Russian gas directly responsible for about 1/10th of

whole energy demand in 2014. Therefore, although the EU and its members tried to secure themselves against possible disruptions through construction of new facilities, such as LNG terminals, most of the LNG was still coming from its eastern partner. This problem was also stressed in the study by Rodríguez-Goméz et al. (2016), that underlined the significant risks coming from possible supply disruptions, mainly for the Balkan and Baltic states, with both relatively high consumption and import dependence of natural gas. This dependence and security of supply is an important piece of the puzzle in mapping energy transitions of the EU, as gas has been repeatedly marked as a crucial medium to achieve ambitious goals both by EU documents and by individual action plans (Reymond, 2007).

To conclude, this chapter has partly answered the question how the external factors on the Eastern front have shaped the policy change within the EU, as we can clearly see, that the MS have united in creating a common policy to better securitize the inner energy market. The gas disruptions have worked as an external push factor forcing the states to concede a part of their autonomy in deciding energy policy to the EU institutions. This for instance included obligations to impose sustainability measures in energy generation and consumption, making the energy market more functional or improvements in energy security and indirectly also alteration of the energy mixes of individual MS.

Overall, the crises once again emphasized the need for a united energy policy, as they demonstrated that the question of energy is too important to be left just on the national level. And although both adoption of “An Energy Policy for Europe” with its binding 20/20/20 objectives and the Third Energy Package brought about important changes in terms of sustainability, liberalization, and security of supply, they might not have been enough, if the 2014 crisis began during the winter months. Because one has to remember that if the deal brokered by ending the Barroso Commission failed, Europe would have had a hard time getting its gas supplies elsewhere. In this milieu, the EU desperately needed a more coherent policy that would further connect the climate and energy agenda while reassuring that the EU is still determined to be the pioneer in fighting climate change. Because despite the vast array of legislation and incentives adopted, a new overreaching strategy had to be created, one that would better reflect the established values and revisit some of the outdated targets.

3 The Energy Union and the shape of energy policy in the EU

This part of the thesis will serve to better understand the structure and raison-d'être of one of the most complex energy policy programs of the EU, the Energy Union. The author will demonstrate what events have led to its establishment and how the EU energy policy changed thanks to this document. Furthermore, the author will also uncover, what other energy-related policies were applied in the period 2014-2021 and what was the presumed role of gas in the green energy transition. This chapter aims to understand the pre-war structure of the EU energy policy and energy mix and analyse, whether the goals of the Energy Union had been pursued accordingly.

3.1 Political and legal background of the Energy Union

As demonstrated before, the idea of deeper integration of both the external and the internal energy policy of the EU has a long-lasting history. However, it can be argued that the largest step forward to creating a more unified energy sector until the adoption of the first version of the Energy Union package in February 2015, was the Third Energy Package of 2009. But these set directives and regulations provided more of an outline of common rules for operating with electricity and gas, than a coherent strategy and way for a more sustainable, secure and efficient energy sector (Siddi, 2016).

The first idea to create the Energy Union came in April 2014 by the then prime minister of Poland, Donald Tusk. It came as a reaction to his experience with Russia and its foreign policy with regards to it willingness to restrict fossil fuels as a tool of coercion. The concept was to some extent also inspired by the idea of strengthening communisation, which would link together several measures to avoid systemic risks at the EU level. As was this proposal made in the wake of the 2014 gas crisis and amid Russian interventions in Crimea and Donbas, the project quickly gained attention of other member states, the energy industry, and even EU institutions that have seen it as a chance to re-examine the orientation of the EU energy sector (Siddi, 2016).

Tusk's proposal primarily emphasized the importance of domestic fossil fuel exploitation as a means to partially replace Russian imports and suggested the establishment of a joint European gas purchasing mechanism. While his initial

program aimed to strengthen energy security, it underwent significant changes and served as a stepping stone towards further integration of EU energy policy (Zachmann, 2015).

The reasons for this included the crisis of trust with the EU's main energy provider and transit country, as well as the need to redefine climate and energy policies. In 2014, new targets for 2030 were agreed upon, accompanied by a review of previous policies and their outcomes. It became clear that although the EU had made significant emissions reductions, it was not on track to achieve its goals in terms of supply security and was paying a higher energy price than necessary. Additionally, while the EU was making progress towards its 20/20/20 objectives, it had not sufficiently strengthened the sustainability, supply security, and competitiveness of its energy resources. (Siddi, 2016).

In 2014, the EU was still heavily reliant on imported fossil fuels, and in some cases, the situation had worsened despite discussions on increasing energy security. Eurostat data confirm this discrepancy, showing that import dependency had actually risen from 46% to 53% between 2000 and 2013. The need for diversification became evident, with Russia supplying over one third of all fossil fuel imports and around 42% of natural gas in 2013. Some member states had even higher import dependencies, ranging from 60% to 80%. To address these concerns, the EU brokered a trilateral agreement known as the "winter package" in 2014 to ensure regular gas flows and prevent disruptions. However, this deal was reached under unclear conditions and only covered the following two winters, expiring in early 2016. The uncertainty surrounding the source of energy supplies raised questions about the reliability of the EU's eastern partner and prompted a re-evaluation of energy security goals (Siddi, 2016).

The concern of supply disruption and energy dependence led in May 2014 to adoption of the European Energy Security Strategy (EEES) that aimed at ensuring an abundant and steady supply of energy to the EU economy. The document recognized increasing dependence on energy delivery, especially the one of gas and crude oil, that was problematic mostly for the Baltic states. The EEES introduced eight key pillars to be addressed to better achieve the energy independence and underlined the need for common energy infrastructure projects (Zachmann, 2015).

When it comes to the environmental agenda, and climate goals, they had to be revisited as well. At the end of 2014, the EU leaders agreed to further reduce GHG emissions and boost the role of renewable sources in their energy mix. The targets for 2030 were set and they included a 40 % binding cut of GHG emissions, increasing the share of RE to at least 27 % of the total energy consumption and increasing energy efficiency by 27 %, all compared to 1990 levels. By this, the EU partly reaffirmed its role as a global leader in combating climate change at the upcoming UN Convention on Climate Change in Paris, where the negative impact of human activity on the environment, and global efforts to reduce it were discussed. These targets were achievable given that most of the EU member states met or exceeded their interim 2014 goals for renewable energy and were quite on track to meet their pledges for 2020 (Siddi, 2016).

Given the fact that certain sectors, notably transportation, were falling behind in terms of renewable energy adoption, it became evident that a reassessment of strategies was necessary to achieve established objectives. This highlighted the intrinsic connection between the environmental and energy agendas, as higher share of RES in EU energy mix would both reduce dependence on energy imports and decrease greenhouse gas emissions. Therefore, discussions around restructuring the legal framework, instruments, and objectives of the EU energy policy became imperative. Particularly, the establishment of governance mechanisms to oversee the successful implementation of the 27% renewable energy target was deemed crucial. This would effectively integrate both agendas and contribute to a more secure and sustainable energy market (Siddi, 2016).

Tusk's initial idea of shared energy policy was revitalized in July by Jean-Claude Juncker. He gave his inaugural speech to the European Parliament and outlined key policy areas for the Commission that he would also soon lead. The simple fact that Tusk, who might be considered as the originator of the Energy Union, and Juncker, who later stressed the need to establish such a body, became presidents of the two of the most important institutions in the EU, meant that this idea would be taken seriously. This is also because the new Commission created a new post of Vice-President for Energy Union, who would coordinate an overview effort of several EU Commissioners from Transport, through Agriculture to Climate

Action, Energy or Environment and others to realize the idea of European Energy Union (Zachmann, 2015).

The concept of the Energy Union underwent a significant transformation. Initially proposed by Tusk in response to the annexation of Crimea, the focus was primarily on enhancing energy security through methods like boosting domestic production or establishing a centralized entity responsible for purchasing Russian gas. However, Junker's version of the Energy Union took a different approach. It not only emphasized supply security but also prioritized renewable energy, energy efficiency, and the completion of the internal energy market. The combination of previous gas shortages and the 2014 crisis in Ukraine, along with growing environmental concerns, provided a strong motivation to address these issues (Zachmann, 2015).

Indeed although in 2014 many member states have noticed a rather Eurosceptic mood with a rise in popularity of populistic parties, the energy area provided a rather unusual ground of consensus. An exception could be the UK and the Czech Republic, which have written non-papers demanding that Brussels would reduce its influence over the energy policy of the EU. On the other hand, a strong support can be seen on the opposite camp, as a poll from Eurobarometer showed that common energy policy among EU members was favoured by more than 70 % of respondents several times in the period from late 2014 to 2017. Also, some MS were pushing strongly for this idea, such as Germany, which in its non-paper underlined the need for a strong cooperation in the fields of energy efficiency and climate change. And finally, also the private sector, NGOs and think tanks were in favor of the concept of strong energy union that would transmit the objectives of European energy and climate change policies (Zachmann, 2015; Siddi, 2016).

3.2 The main Energy Union action pillars

The Energy Union is a strategy, first published on 25th of February 2015, by the Juncker's Commission as one of their main priorities. It is built on the idea to give EU consumers, households, and businesses secure, sustainable, competitive and affordable energy. Since it was launched, the EC has released several packages altering the role of Energy Union, its competencies, objectives, and regulations regarding its function. A multitude of progress reports have also been regularly published to map and monitor the implementation of the measures that are embedded into the Energy Union strategy. There are five main dimensions of this strategy that are used as main objectives to be reached and those are further divided into main and supporting indicators to better measure progress and aid with the implementation of the strategy (Skjærseth, 2021; European Commission, 2015).

Those dimensions are:

Energy security, solidarity and trust – This dimension serves to diversifying EU's energy sources of energy and ensuring energy security through solidarity and cooperation between the MS. The progress is measured for example through net import dependency of different natural resources, or by various concentration indexes for those natural resources.

A fully integrated internal energy market – Here the goal is to enable free flow of energy through the EU by creating appropriate and functional infrastructure that wouldn't be hindered by technical or regulatory barriers. One of the main tools to measure this is comparison of wholesale prices for electricity and gas, market concentration indexes for power generation and for wholesale gas supply and electricity interconnection capacity. The energy affordability for households, and annual switching rates of electricity for those customers is also taken into consideration.

Energy efficiency and moderation of demand – The main aim is to improve energy efficiency and reduce dependence on energy imports, while lowering emissions and driving jobs and growth. The tools employed to measure this are comparison methods that measure the ratios between primary and final energy consumptions throughout various economic sectors, including measuring the final consumption per square meter in residential sectors, or final energy consumption in transport. Other tools to measure improvements are final energy intensity in services or industry sectors mapping energy-intensive sectors.

Decarbonization of economy – As the EU I considered as global leader in renewable energy and committed to attain the pledges of the Paris Agreement, this objective is aimed at doing exactly so. Used indicators measuring the progress are for example GHG emissions reductions and the gap between the latest inventory of Effort Sharing emissions, or the share of renewable energy in sectors like transport, heating, or electricity production.

Research, innovation, and competitiveness – In this last dimension the focus is given on development of low-carbon and clean energy technologies by investments into research and innovation to drive the energy transition and improve competitiveness. The indicators measured in this dimension are the share of public investments dedicated to R&I as a % of GDP, number of patents related to Energy Union per capita, or real unit cost of energy in manufacturing sector.
(European Commission, 2015).

As we can see, the Energy Union has, mainly under the Western European influence, evolved from what was initially a proposal to act uniformly in acquisition of Russian gas, to an extensive strategy encompassing many of previously established objectives. It has bundled together energy and environmental priorities to an extent that wasn't seen before, addressed unreached objectives in both of those policy areas and introduced new ones with methods on how to measure their progress. One could claim that the Energy Union is to a certain extent revolutionary,

building on the foundation of “20/20/20” objectives and the Third Energy Package, while setting even higher objectives and specifying ways how to achieve them. However ever since the start, the extent of the strategy has raised many questions regarding mainly the feasibility or the ambiguity of the statements in this document (Siddi, 2016).

One of those critiques regards the feasibility of conducting truly independent foreign policy in the light of dependence on energy imports from Russia. This is also because, the potential Russian objections to some key mechanisms of the Energy Union, such as the reverse flows of gas, could aggravate the political tensions. One of the most important objectives of strengthening supply security could be hindered not only by this, but also due to the fact that different MS have different answers on how to achieve this goal. These ideas are based largely on national interests and include extraction of local resources, including coal and shale gas, decreasing electricity demand, or switching to renewable or nuclear energy (Zachmann, 2015).

The national interests are embedded also to another critique as there was certain renationalisation of energy and climate policies within the EU. The investments into grid expansions or promotion of RES at the expense of other sources are made on a national level with little to no coordination. The importance of the European instruments, such as emission and cross border electricity trading mechanisms have declined in those years thus also driving investors away due to unclear conditions on the market (Zachmann, 2015).

Another critique targets the feasibility of infrastructure projects identified in EEES that would be essential to improve security of energy supply and market integration. It is unclear as to who would finance those projects, as the EC hoped that private investments would cover those expenses. However, in the opposite case the EC would have had to find a way to finance it through EU public funds, and if so, there would be a high need for solidarity to fund those projects in poorer states. At the same time, there is a challenge that the EU should resist the pressure from interest groups to alter the focus of the Energy Union towards fossil fuels. This was a legitimate doubt, as the large fossil fuel lobby managed to limit the ambition of the EU’s 2030 climate goals, and hence the same groups could also try to influence the implementation of the Energy Union (Siddi, 2016).

And probably the biggest challenge that was called out by the literature is the feasibility of the sustainable transformation of the energy industry. As this change requires far more than just replacing fossil-fuel power stations with emission-free ones, and fundamental change of infrastructure of providers, generators and interplay of customers would be changed. For this a strong political will of the member states and coordination of their energy and environmental policies would be needed as well as sufficient funds implemented at the European level, to finance the large infrastructure projects to success with the Energy Union. If those aspects are missing, the Energy Union might lead to a simple “repackaging” of previous efforts and fail to deliver the promised changes and unification of the energy market (Zachmann, 2015; Siddi, 2016).

3.3 Green energy and climate initiatives

3.3.1 Clean energy for all Europeans package

The Energy Union has transformed extensively as compared to its original form due to both internal and external factors. However, it is still the main guiding tool of the EU's energy policy, as its five dimensions are established to lead to creating a more secure, sustainable, and competitive energy market. Policy changes have materialised across legislative and financial instruments, as well as specific programmes and plans.

The "Clean Energy for All Europeans" package has been among the most important pieces of the EU's energy policy, setting out legislative guidance adopted in 2019, which was expected to move towards cleaner energy and help deliver the EU's Paris Agreement commitments. This package consists of eight new laws that aim to bring benefits to customers, the environment, and the economy. The legislation helps to coordinate efforts in achieving the EU's long-term strategy of carbon neutrality and underlines the leading role of the EU in battling climate change by making the goals of the Energy Union legally binding and updating certain rules.

Energy performance in buildings – As the buildings are the single largest energy consumer in the European economy, and are responsible for about third of CO2 emissions, it is necessary to make them energy efficient. The Energy Performance of Buildings Directive (EU 2018/844) outlines specific measures that the building sector should implement to tackle challenges and render EU more likely to achieve its climate and energy goals. The EU has constructed legislative framework by combining this directive with directives 2010/31/EU and 2012/27/EU, both dealing with energy efficiency and performance of the buildings, that should help with decarbonization of the building sector, save money for businesses and households and create stable environment for investments ((EU) 2018/844).

Energy efficiency – Making energy efficiency first is the main goal of this package, as energy savings are the easiest way of reducing GHG emissions, while saving customers their money. The EU Directive 2018/2002 on Energy Efficiency

addresses and by updating the directive from 2012 it sets greater binding targets of energy efficiency to at least 32.5 % by 2030 ((EU) 2018/2002).

Renewable energy – To show leadership on installations of RES the EU has updated its goals to a binding target of 32% of renewable energy in its energy mix by 2030. The Renewable Energy Directive 2018/2001/EU updates older directive and creates a legal framework for the development of the RES across all sectors of the EU economy. As this directive establishes rule to remove barriers, stimulate investments and drives cost reductions in the renewable energy technologies, it partly also answers to the doubts regarding ambiguity of the Energy Union strategy ((EU) 2018/2001).

Electricity market – A functional integrated energy market is crucial for affordable, secure, and sustainable energy supplies in the EU. To achieve this, common energy market rules and infrastructure are needed to ensure seamless energy flow and fair competition. Legislation was also prompted by the expected increase in RES and the need to efficiently transport and store electricity to areas lacking such facilities. Monitoring this process and aiming for at least 15% interconnection levels across member states were key objectives. As part of the "Clean energy for all Europeans" package, the EU introduced four legislative acts to regulate the electricity market, grid preparedness, and the ACER. These acts establish new regulations, creating a modern electricity market design that is adaptable, market-oriented, and capable of integrating a higher share of renewables ((EU) 2019/944).

Non-legislative initiatives – Apart from the legal acts mentioned above, the Commission has also released multiple non-binding initiatives to support clean energy transition across all sectors. These include the initiative for coal regions in transition that sets to help mitigate the social outcomes of the low-carbon transition in coal dependent regions across the EU. Another one is the clean energy for EU islands initiative that provides framework to help islands generate their own energy,

or the measures implemented to better monitor the energy poverty[2] in the EU (*Clean Energy for All Europeans Package*, n.d.)

Governance regulation – As a measure most directly impacting the energy union itself, the package included a robust governance system that transforms the EU's energy network. The regulation on the governance of the energy union and climate action (EU)2018/1999 underlines the need to achieve the EU's 2030 energy and climate pledges and sets out a plan how the MS and the Commission should work together to meet the energy union's goals. It considers also local specificities of individual countries and their different capacities to contribute to green transition and reaching all the environmental and energy pledges made so far by the EU's 2030 energy and climate targets, the long-term EU GHG emission commitments, and the Paris agreement (EU) 2018/1999).

The goals of the regulation are to:

- Implement strategies and measures to ensure that the targets and objectives of the energy union related to climate and energy pledges, are met.
- Foster the cooperation between MS to achieve the objectives of the energy union more easily.
- Promote long-term predictability and certainty of the market for investors across the EU and stimulate growth and social cohesion.
- To reduce administrative burdens and ensure the principle of better regulation by integrating current energy and climate planning and reporting needs of the MS as well as the Commissions monitoring obligations.
- To ensure stable reporting by the EU and its countries under the UN Framework Convention on Climate Change and the Paris agreement, replacing the annual reporting mechanism ((EU) 2018/1999).

[2] EU defines the energy poverty as a situation in which households or individuals are unable to access essential energy services and products (*Clean Energy for All Europeans Package*, n.d.)

3.3.2 National energy and climate strategies

The regulation (EU)2018/1999 brings together many of the environmental and energy pledges into one consistent and binding document, which is adjusting the functioning of the energy union. Apart from the direct enforceability of the document's provisions, the regulation has also introduced National Energy and Climate Plans (NECPs) that each MS had to establish by the end of 2019. These, together with a national long-term strategy that is part of each NCEP and integrated reporting, monitoring, and data publication, show how the regulation means to monitor the implementation of its goals ((EU) 2018/1999).

The NECPs should be implemented from 2021 to 2030 and address GHG emissions, renewable energy, energy efficiency, electricity grid interconnection, and research and innovation investments. MS initially submitted draught NECPs, assessing their initial capacities and actions necessary to meet national targets aligned with the Energy Union's characteristics. The European Commission provided a preliminary assessment and tailored suggestions to the NECPs through its Staff Working Documents, and the final NECPs were submitted by the end of 2019, considering post-COVID-19 recovery. The NCEPS regulated by the (EU) 2018/1999 should include biannual reports to track plan progress, supervised by the Commission, ensuring responsible and realistic approaches to the mentioned issues (European Commission, 2020).

The Commission's final assessment (European Commission, 2020) of the 27 NECPs concluded that if the MS were to adhere to their plans and pledges, the EU would be on track to accomplish its Energy Union's targets by 2030. The overall assessment for renewable energy combined the commitment by the EU countries to approximately 33.5%, which is above the initial target of at least 32%. And while some countries fail to include sectoral trajectories that are in line with the Renewable Directive requirements and thus remain below their cost-effective potential, others compensate this by setting objectives for their share of RES to be as high as 100% by 2030. The analysis, however, underlines that for attaining the climate ambition of reducing GHG emissions by at least 55%, the share of RES in the EU's energy mix would have to be around 38–40%. For this purpose, the EU's new renewable energy financing mechanism, which can be streamlined with other

EU instruments such as CEF or InvestEU, could help with the larger renewable energy infrastructure projects, thus helping to reach this adjusted ambition (European Commission, 2020).

The energy efficiency objective had to be reduced primary and final energy consumption by 29.7% and 29.4% respectively. Although this represents an increase compared to the conservative draft scenario, it falls short of the Union's 2030 target of at least 32.5% reduction in both areas. According to the Commission's impact assessment, a reduction of around 40% is necessary to meet the objective. Many Member States (MS) have yet to provide detailed strategies on increasing energy efficiency, despite its importance being enshrined in legislation. The Commission is preparing guidance to help MS implement the energy efficiency first principle in policy planning and investment decisions. Renovating the building sector is a key focus area, as it offers a cost-efficient way to address multiple objectives. Some MS have set ambitious targets for building renovation, while others have room to upscale their efforts. Providing recovery stimulus to the local economy and small and medium-sized enterprises (SMEs) in the construction sector is crucial, as it can lower energy bills, reduce energy poverty, and promote resilience. The EU's Renovation Wave Initiative addresses these challenges through a new regulatory and governance framework, financing mechanisms, and stakeholder engagement, providing tools to tackle energy efficiency issues. (European Commission, 2020).

The NECPs outline how Member States plan to achieve the binding objective of reducing GHG emissions by at least 40% by 2030. The Commission's assessment shows that the planned reductions, including those covered by the EU ETS, exceed the established targets, and aim for a 41% reduction. To achieve this, the plans include cross-sectoral measures such as increasing carbon pricing and discounts, such as carbon taxes for fossil fuels, pricing mechanisms for buildings and transport, and discounts for the land use sector. The land use sector can generate LULUCF credits if it reports a larger carbon sink capacity. However, to achieve the more ambitious goal of at least 55% GHG emissions reduction by 2030, the NECPs would need higher targets for energy efficiency, industry and building sector reforms, and a greater share of renewable energy sources in the EU's energy mix (European Commission, 2020).

Regarding investments, the Commisison's assessment found that while members provided an overview of funding, some plans lacked detail, making it difficult to compare and assess their potential outcomes. To achieve the 2030 climate and energy targets, additional energy-related investments are needed, particularly in building renovation, industrial decarbonization, transportation, and renewable energy generation. Priority should be given to affordable housing, industry decarbonization, sustainable mobility, energy system integration, and the development of new infrastructure, batteries, and hydrogen technologies. This becomes even more crucial as many countries plan to phase out coal earlier than initially anticipated, necessitating a transformation of extractive industries (European Commission, 2020).

The assessment also focused on energy security and the plans to enhance the resilience of the energy system. However, most MS failed to propose adequate measures in their energy security chapters, despite acknowledging the vulnerability of their energy sectors to climate change and decarbonization. Some MS emphasized the need to strengthen energy efficiency and increase the role of renewables. Regarding external energy supply security, the EU still relies on imports for over half of its primary energy consumption, with gas supply being particularly problematic due to continued dependence on Russia. NECPs lacked significant efforts to address this issue, with few plans mentioning investments in alternative capacities like LNG terminals or nuclear plants. The primary goal highlighted in the documents was to build more resilient clean technology supply chains while meeting security standards during extreme events. (European Commission, 2020).

The provisions relating to the internal market have also concluded that the supply security is not at risk, however the energy market could benefit from a higher share of renewables. It has also underlined that few members have introduced a holistic approach to adopt necessary changes of the energy system in their countries by building the needed infrastructure. On the other hand, most members have addressed and even exceeded the target of 15 % electricity interconnection through the Projects of Common Interest (PCIs)[3], that most members give

[3] PCIs are a category of projects launched in 2013, which the European Commission has identified as a key priority to interconnect the energy infrastructure in the European Union (European Commission, 2020)

importance to when tackling this issue. With regards to Research and Innovation, the Commission found that members fail to pay sufficient attention to the funding needs to effectively tackle the climate and energy objectives and there is a severe lack of funding and clarity of fund allocations. The document underlined that there is a need for a new strategic approach to clean energy R&I to accelerate the clean energy rollout and supported this with revision of SET-Plan strategy. This should help the state to finance this objective and focus more for example on the development of hydrogen technologies or investments in battery production that would help with decarbonisation of the transport sector (European Commission, 2020).

3.3.3 National long-term strategies

The Energy Union's governance provisions (EU) 2018/1999 also set the need for EU countries to establish their national long-term strategies. These are plans that are set for a period of 30 years, until 2050 and reviewed every 10 years are meant to ensure consistency between long-term objectives and the NECPs. Another motivation to establish these strategies was to build an economy that would move towards the goals set by the Paris Agreement and ensure that the countries will attain their climate pledges.

Areas that are covered in these strategies for a period of at least 30 years are ((EU) 2018/1999):

- total greenhouse gas emission reductions and enhancements of removals by sinks
- emission reductions and enhancements of removals in individual sectors, including electricity, industry, transport, the heating and cooling and buildings sector (residential and tertiary), agriculture, waste and land use, land-use change and forestry (LULUCF);
- expected progress on transition to a low greenhouse gas emission economy, including greenhouse gas intensity, CO_2 intensity of gross domestic product, related estimates of long-term investment, and strategies for related research, development and innovation;
- to the extent feasible, expected socio-economic effect of the decarbonisation measures, including, inter alia, aspects related to macro-economic and social development, health risks and benefits and environmental protection;
- links to other national long-term objectives, planning and other policies and measures, and investment.

With regards to the revision of the strategies, The Commission will support MS with its preparation by providing scientific knowledge and by sharing knowledge and best practices. The Commission will also do a concluding assessment of the existing strategies to see whether the EU is able to collectively achieve established objectives and provide objections in case there is a space for improvements (EU) 2018/1999).

3.3.4 The European Green Deal

In November 2018, the Commission introduced its long-term strategic vision of the European economy in the document “A Clean Planet for All”, where it demonstrated several paths that would help achieve the Paris Agreement objectives. Although this strategy failed due to several members, such as Poland, Hungary, and the Czech Republic, it paved the way for one that was even more ambitious and detailed. In December 2019, the new von der Leyen Commission managed to launch the European Green Deal (EGD) as a comprehensive strategy for a “greener” European economy. For the first time, the EU has managed to place climate and environmental policies at a centre of a plan leading to greater sustainability encompassing all sectors. The EGD promises to fundamentally transform the European economy into one that is modern, resource-efficient, and competitive in particular by investing in environmentally friendly technologies, decarbonising the energy sector, or ensuring that buildings are more energy efficient. The three main ambitions stated are to achieve zero-net emissions of GHG by 2050 and decouple economic growth from resource use while ensuring that no person or place is left behind. The EGD is not a mandatory law by itself but rather a general strategy outlining the ambitions and goals in different sectors, while the implementation of this strategy is subjected to regular revisions and new laws and norms are being applied. The main eight founding policy areas that make up the Green Deal are (European Commission, 2019):

1) Increasing the EU’s climate ambition for 2030 and 2050
2) Supplying clean, affordable, secure energy
3) Mobilizing industry for a clean and circular economy
4) Building and renovating in an energy and resource efficient way
5) A zero-pollution ambition for a toxic-free environment
6) Preserving and restoring ecosystems and biodiversity
7) Farm to Fork: a fair, healthy, and environmentally friendly food system
8) Accelerating the shift to sustainable and smart mobility

All those areas to certain extent overlap with the goals of the Energy Union and both the short- and long-term action plans of the member countries. For feasibility and to simplify the analysis, however, the primary focus will be on policy areas numbers 1 and 2, and partially on numbers 4 and 8 as mentioned above. Their progress and achievements are closely intertwined with the clean energy transition of the EU and the objectives of the Energy Union (European Commission, 2019).

The key areas of action

1.) Increasing the EU's climate ambition for 2030 and 2050

The climate pledges for 2030 are debated due to changing reduction targets. Initially set at 40%, they were raised to 50% and finally to at least 55% compared to 1990 levels. However, some argue that even 55% is insufficient. The European Parliament favours at least 60% reduction, while the IPCC suggests a 7.6% reduction in greenhouse gas emissions annually to limit global warming to 1.5°C. This would require the EU to reduce emissions by at least 65%. To monitor progress, the Commission will use measures provided by the Climate Law, which amends the 2030 climate goals. The legislation of the EU and its member states will be reviewed for compatibility with the targets, and if necessary, the Commission will propose recommendations that must be followed. An example of such a revision is the Carbon Border Adjustment Mechanism (CBAM), which aims to prevent "carbon leakage" by imposing fees on carbon imported from countries with less strict climate policies, encouraging companies to produce within the EU and adopt cleaner practices (Fetting, 2020; European Commission, 2019).

2.) Supplying clean, affordable, secure energy

The NCEPs are key tools for achieving the clean energy transition. They prioritize decarbonization at the lowest possible cost while also addressing energy poverty. In 2020, approximately 36 million Europeans were unable to adequately heat their homes, and around 62 million lived in dwellings with issues like dampness, leaks, or rot. Energy poverty is linked to social issues and is considered an essential service in the European Pillar of Social Rights. The challenge lies in mapping and identifying the problem, but the European Commission has developed data to assist member states in identifying vulnerable households. Furthermore, the review of Trans-European Networks – Energy (TEN-E) regulations now includes smart technologies, grids, hydrogen power, and other renewable energies to guide the cross-border energy infrastructure in the transition (Fetting, 2020; European Commission, 2019).

4.) Building and renovating in an energy and resource efficient way

To achieve the EU's climate target of a 55% reduction in greenhouse gas (GHG) emissions, the building sector, which accounts for approximately 40% of energy consumption, needs to undergo modernization. Specifically, GHG emissions from buildings should be reduced by 60% and energy consumption by 14% to meet the 2030 targets. Renovating existing buildings and ensuring new ones meet energy efficiency and insulation standards are effective ways to achieve this. The Commission has introduced incentives and funding opportunities to support these efforts, benefiting local SMEs and addressing energy poverty. The importance of energy efficiency is emphasized in the Recovery and Resilience Facility (RRF), a key instrument of NextGeneration EU ((EU) 2021/241) Flagship projects like Power up focus on clean technologies and renewables, while the project Renovate aims to improve energy efficiency in public and private buildings. The Renovation Wave Strategy sets the objective of renovating 35 million buildings and doubling the current renovation rate of 1% (Fetting, 2020; European Commission, 2019).

8.) Accelerating the shift to sustainable and smart mobility

The aim here is to reduce emissions in the transport sector by at least 90% by 2050. The Sustainable and Smart Mobility Strategy serves as a foundation for investing in infrastructure and incentives to decarbonize transportation. The Connecting Europe Facility is the main funding tool, focusing on sustainable infrastructure through digitalization, expanding high-speed rail networks, and creating safe bike lanes. The goal for 2030 is to have at least 30 million zero-emission cars in the EU, while aiming to develop climate-neutral passenger airplanes by 2035 and zero-emission technology for all modes of transport by 2050. This initiative also involves revising and expanding the Energy Taxation Directive and the European Emissions Trading Scheme to limit fossil fuel subsidies and tax exemptions (Fetting, 2020; European Commission, 2019).

3.3.5 Fit For 55

As EU countries are working on new legislation to achieve the goals like the climate neutrality by 2050, the EU also adopted the Fit for 55 packages, that sets out interim targets to better cope with the transformation. This set of proposals to revise the EU legislation has set the goal of reducing EU emissions by at least 55 % by 2030 a legal obligation, while giving a particular focus on renewable energy and energy efficiency. Other priorities are also connected to EGD, as they concern the circular economy, biodiversity or smart mobility practices and advancements. The major evolvement of this package will be discussed in the next chapter, as most of its amendments were done in the second half of 2022.

3.4 The role of gas imports in energy transition

Natural gas is a major fuel for electricity production and heating in the EU, representing over 20% of the EU's available energy, with imports reaching around 400 bcm/y. The role of gas has been on a steady rise with the green energy transition, as it is oftentimes seen as an optimal transitory medium to complement renewable energy. The eagerness to support this source on the EU level is also demonstrated through the inclusion of gas and nuclear activities into the European taxonomy as environmentally sustainable economic activities (European Commission & DG FISMA, 2022).

Although this action has met environmental concerns that calling gas green is greenwashing, its unique properties, such as relatively low carbon emissions compared to other fuels, render it a good complement to renewable energy that is difficult to store (Nugent, 2022). Furthermore, the strategic role of gas is stipulated to attain both 2030 and 2050 goals, as its input is important in energy-intensive production, like that of steel or cement. The Commission has also released a document on the role of clean gases, including hydrogen, and their potential replacement of fossil fuels. Here they underlined the importance of such alternatives in increasing energy security due to domestic production and in decarbonizing industry and long-distance transport. This is based on the EU Hydrogen Strategy[4] from July 2020 and aims at establishing a market for hydrogen, while decarbonising the gas market. This is connected also to gradually reducing the dependence on natural gas and its partial replacement by, for example low-carbon gasses (European Commission & DG for Energy, 2021)

On the other hand, the question of the energy mix is a matter o.f individual states who choose what kind of sources they will use to attain the binding climate goals. Therefore, to decarbonise their energy sectors, different MS choose different paths and the position of natural gas seems to be very debatable. Although the support of gas is time limited and should be seen only as transitional activity helping to mitigate climate change, many member states consider it as a major tool to cut

[4] The EU strategy on hydrogen (COM/2020/301) was adopted in 2020 and suggested policy action points in 5 areas: investment support; support production and demand; creating a hydrogen market and infrastructure; research and cooperation and international cooperation (COM/2020/301)

down on emissions and have been investing heavily into additional natural gas capacities. On the other hand of the spectrum, we have states that see all investments in fossil fuels as short-sighted and call for a quicker rollout on renewables instead (Lo, 2022).

Most of Central and Eastern Europe for example, is in the first camp, seeing natural gas as an optimal way to lower their emissions, mainly through phasing out of even more polluting oil and coal. Significant coal-to-gas switching can be seen in most of the EU countries and an exemplary case could be the one of Poland. The role of gas imports is on the rise there as the country is set to increase them by about 50 %, to around 30 bcm/y and has been building additional capacities for distribution, storage, or regasification. The Czech Republic is another similar case, as despite almost non-existent production of natural gas it is considered as an important medium for energy transition and mainly phasing out coal. Furthermore, as a landlocked country without any realistic possibility of building LNG terminals, Czechia is left reliant on the imports from neighbouring countries like Germany or Slovakia. Moreover, the support of gas is here reasoned by the key position of the country in supply chain for Central and Eastern Europe, that has made it an important source of revenue for the economy (IEA, 2022b; IEA, 2022c)

The last and the most important example is the one of Germany and its attitude towards the role of gas in its energy mix. Its positive inclination to use gas as a transition medium during the phase out of coal and nuclear, and at the same time supporting source of energy to renewables, has been stipulated in multiple documents. Partly for the purposes of Energiewende[5], and partly due to the important gas lobby in the country, Germany has been trying to secure gas supplies for several decades, which has led to increased reliance on Russian imports. An example of that could be the support of the projects Nord Stream and Nord Stream 2, that despite strong political backlash have been finished and marked the direction of German energy policy. At the end of 2021 Germany still expected a strong role of the gas-fired generation to meet the power sector needs and supported this also with construction of additional LNG investment. Due to the structure of the energy

[5] Ambitious German energy policy, literally „the energy turn“ indicating replacement of the old fuels by the new ones. The main goal of Energiewende is to phase out coal and nuclear energy, while stimulating the investments into renewables (Hake et al., 2015).

sector of Germany, policies of its government and need for decarbonisation, it is no wonder that the country was one of the most vocal supporters of natural gas in the years preceding the war (IEA, 2020; Eckert, 2022).

On the other side of the block, there are countries disputing the Commission's decision to include gas as transition fuel under the sustainable finance taxonomy. Denmark, Netherlands, Austria or Luxembourg have been fighting over the green label, bringing this matter even in front of the European Court of Justice. This however seems paradoxical, as some of those countries will probably need to cover a large part of their output by gas, while switching to renewable energy as the main source of their energy mix (Priyafp, 2023).

Austria, for example, as a major transit country with important capacity for transmission of gas to other states, counts on feeding biogas and renewable hydrogen into existing natural gas infrastructure to replace it and plans tax advantages for LNG. On the other hand, in 2021, natural gas still occupied one third of its energy mix, while having import dependency around 75 %, which is higher than the EU27 average. To give another example, the Netherlands is a country which is heavily reliant on gas, both in terms of its energy mix and electricity generation, where in both of those cases natural gas took up about 50 % in 2021. Although the Netherlands is slowly turning its back to gas both by phasing out its domestic production by closure of its gas fields and speeding up rollout on renewables, the future might not be as the country pictures it. In both of those cases, the current role of gas in the energy mixes of the countries, its rising import dependence and lack of short-term viable energy replacement make their critiques towards the EU taxonomy rather hypocritical, as it seems that both of them will need the natural gas exactly for the reason of bridging the green transition (Directorate-General for Energy, 2022; Cole, 2022).

The role of gas has since the introduction of the Green Deal in 2019 gradually been on decline, as the climate agenda was becoming increasingly more important. The ultimate goal of EC of reaching climate neutrality by 2050, which is also enshrined in the EU Climate Law, is to be reached also due to the declining role of the gas in the EU energy mix. The Commission and also the European Parliament, while declaring a climate emergency at the beginning of 2020 and calling for an end of fossil fuel subsidies, indirectly condemned the role of gas in the future. And as

we could see, many MS have also been calling for quicker replacement of gas with more sustainable alternatives, condemning those members that still count on it in the future. But is it really necessary for gas to be replaced immediately and completely by other sources of energy?

Although both the IEA and the EC with their projections count on a drastic decline in the role of gas after 2030, achieving climate neutrality does not imply 100% electrification (IEA, 2019). Furthermore, coal to gas switching has proven very effective in reducing the GHG emissions in the short term and still has its potential, mainly in states that are heavily reliant on the former source and or important part of their economies based on heavy industry. Another reason for the importance of gas deliveries in the near future is also the built infrastructure, mainly in the heating of buildings where in some MS gas plays an important seasonal balancing role that is difficult to replace with electricity. Therefore, not only are there little viable low-carbon alternatives to gas, in some cases it might still be better to invest in the infrastructure for future use, although the investments must be considered carefully.

The report of IEA concludes that the role of gas in the future decades needs to change fundamentally, from a source that provides an important share of energy mix to one that provides a balancing function. The coal-to-gas switching can provide faster emission than to renewables in the first few years due to lengthy commissioning, however the window for this is shrinking (IEA, 2019). Additionally, the gas business needs to go through transition as the natural gas pumped through the infrastructure could theoretically be more sustainable. “Greening” the commodity could be done by development and utilization of renewable gasses like biomethane hydrogen, and their mixes with natural gas. Some claim that this new form would be possible to transport through existing capacities, that would not only provide for more sustainable form of energy, but could also boost the energy security of EU, that was to a large extent dependent on the deliveries of natural gas from the Russian federation (Mathioulakis & Levoyannis, 2020). The hydrogen however is not expected to replace the natural gas fully and immediately, at least not in the following decades. Although it was given priority in the “Hydrogen Strategy for a Climate Neutral Europe”, large infrastructural investments are expected to make hydrogen production climate neutral and to renovate the

pipelines to transport gas mixes with higher hydrogen percentage (Mathioulakis & Levoyannis, 2020).

Therefore, with the increasing share of natural gas in energy mixes of certain MS, that saw it as an opportunity to decarbonise their energy sector due to little viable alternatives, and with the slow pace of replacement of this hydrocarbon by more sustainable mixtures, we can spot that European energy sector was still set to be heavily dependent on the Russian deliveries at the end of 2021. During this year, Russia accounted for around 45 % of all natural gas imports into the EU, which is around the same value as in 2013. Thus, although the EU improved its energy security by building additional storage, transmission or regasification capacities, it still relied on its eastern partner for a large part of its gas, but also oil and coal demand. This, as we could see, was set to be changed during the first months after the beginning of the war in Ukraine, as the EU restructured its energy policies completely by searching for new strategic allies to replace Russia and by speeding up its energy transition (IEA, 2022a).

4. The war on Ukraine

This chapter will focus on the immediate aftermath of the war in Ukraine and its impact on the EU, and more specifically, the radical change in its energy policy. The main aim here is to answer what the roles of major EU institutions were in redesigning EU energy policy and to introduce their initiatives. This will help us understand what the current energy policy framework is, how it was shaped, and how the energy mix of the EU changed as a response. By using recent data, the author will try to assess the roles of different energy sources and partners used to compensate for surges of Russian gas and outline the post-war structure of the EU energy market.

4.1 The beginning of the war

The escalation of tensions near the borders could be already seen at the end of 2021, as Russia conducted large military drills and moved its troops near the Ukrainian borders months before the start of the war. The military manoeuvres of Belorussian and Russian army and the escalation of violent conflicts in the separatist regions of Donbas at the beginning of 2022 lead to the escalation of tension as Ukraine also conducted drills at its borders (Wintour, 2022). The video of Vladimir Putin unilaterally recognizing the independence of Donetsk and Luhansk People's Republics, stipulating the need for friendship and mutual aid, made headlines and caused the first package of sanctions by EU and NATO to be adopted as a sign of disapproval with Russian decision (Borger et al., 2022). Three days later, on February 24 Russia launches a full-scale invasion in the territory of Ukraine, from south, east and north. Under the pretence of aimed "denazification" and "demilitarization" the country launches so-called special operations to protect ethnic Russians on the Ukrainian territory. The rest of the world calls it differently and as the Russian military sweeps through the territory of their enemy, the symbol "Z" marking Putin's troops becomes the emblem of some of the worst atrocities of modern history (Human Rights Watch, 2022).

When launching the war, Putin probably based his strategy on previous experience with western reactions. His previous violent ventures, such as the war in Georgia in 2008 or the annexation of Crimea in 2014 and subsequent initiation of conflict on Donbas that had been clearly tied to the Russian military, might have led to assumption that also in this case NATO and the West would remain dormant (Dickinson, 2021). The same goes for the reaction of the EU, from which the involvement and sanctions were expected, but probably not at such a rapid and comprehensive pace. In contrast, in 2014, the EU adopted a set of sanctions restricting imports of a rather limited amount of Russian goods, an action that was mirrored and extended by Russia to pay back for the blow. While these Western sanctions over 2014-2016 targeted a small part of businesses and individuals and resulted arguably into bigger loss than gain due to Russian counteraction, the action and sanctions adopted in 2022 were very different (Veebel & Markus, 2015). The unjustified invasion of a sovereign country has unleashed a chain reaction of widespread condemnation that led to military and financial aid to Ukraine and economic isolation of Russia (Sebastian & EPRS, European Parliamentary Research Service, 2022).

4.2 International response and the role of EU

The NATO response was clear and loud, condemning Russia's war on Ukraine in strong terms and calling it "the biggest security threat in a generation". In comparison to similar ventures in Ukraine in 2008, when international opinion remained rather muted and the Moscow regime suffered few consequences, the response in the case of Ukraine was different. Although the different international milieu, the scope of the war, and its duration, are things that need to be considered too,the war in Georgia was merely a matter of days.n the case of Ukraine, NATO called for an immediate ceasefire, the withdrawal of Russian forces from the territory, and the establishment of diplomatic solutions. NATO, however, has distanced itself from any direct involvement in the conflict through the deployment of its forces, the enforcement of a no-fly zone, or the supply of weapons to Ukraine. These efforts, including the sanctions imposed on Russia and equipment supplies to Ukraine, have been predominantly organised through frameworks outside of NATO. The Alliance has limited itself to a defensive stance through the deployment of forces on the eastern flank of its territory to not escalate the conflict further while underlining its commitment to apply Article 5 if necessary (Dickinson, 2021; Sebastian & EPRS, 2022).

As mentioned above, to avoid the outcomes of direct involvement of NATO in the conflict that might lead to an escalation and possible use of nuclear weapons, the members have organised themselves to provide the aid directly. The USA has been by far the biggest contributor, providing security assistance, weaponry, and loans, which form the largest part of aid. Military expenses have the biggest share here, but also financial and humanitarian aid are important, summing up to around 80 billion USD since the beginning of the conflict to the end of 2022. The role of the USA in Ukraine’s counteroffensive is pivotal, as it has provided for weapons systems, training, and advanced equipment but has stalled in providing, for example, F-16 fighter jets, as it claims that it would escalate the conflict (Masters, 2023; Duggal, 2023).

The US has also introduced unprecedented sanctions as a reaction to Russia’s invasion of Ukraine, covering multiple sectors. The most used are the “classic” sanctions, placing export control, blocking US-based assets of individuals,

and preventing entities from engaging with them. There are also sectoral sanctions targeting for instance Russia's financial sector, such as major industries or banks and financial institutions, including the Central Bank of Russia. It also introduced export controls on advanced technologies, software and equipment and total import ban on Russian energy products, gemstones, and precious metals. There have also been individual sanctions applied on the most important members of the Kremlin's administration as well as to people connected to them. Extensive sanctions on several entities covering banks, such as Sberbank, technology conglomerates as Rostec, or the energy company Nord Stream 2 AG have also been applied and coordinated with the EU (Szczepański & EPRS, 2023).

The EU, on the other hand, has been rather reluctant both to take a stance and to provide financial support during the first months of the war in Ukraine. Christoph Trebesch (2022), an economist overseeing a database of military, financial, and humanitarian aid to Ukraine, mentioned that in April 2022, US aid accounted for far more than that of the whole EU. Whereas the eastern countries, such as Estonia, Poland, and Lithuania, were more likely to mobilise resources and financial aid quickly, the western members were more unsure of their support. The most prominent example is Germany and its initial weak reaction. Germany, as the country heavily relying on gas as an energy medium for their Energiewende programme and with infrastructure delivering large amounts of gas straight from Russia, has been slow in adopting restrictive or supportive measures. Despite political pressure from Kiev and Washington, Olaf Scholz pushed back on import bans or any sanctions on energy supplies coming from Russia, claiming that the energy supplies are of critical importance for heat generation in Europe. The same goes for support for sending military equipment, which was practically nonexistent at the beginning of the war due to the fear of possible retaliation (Von Der Burchard & Sugue, 2022).

Although Germany has to a certain extent improved its reputation, becoming the third largest donor to Ukraine, it is still often criticized for spending very little on aid, compared to the investments covering the crisis on its territory. In numbers, Germany has spent around 7 billion USD, while announcing around 275 billion USD in subsidies to cushion the energy prices for domestic consumers. In comparison, the EU as a whole spent about 60 billion USD in 2022, investing mostly in macro-

financial assistance and loans, that helps rebuild the country's infrastructure and finance government expenses. A considerable amount is also invested in military assistance and training missions for Ukrainian soldiers. The final important parts are the direct loans, grants, and guarantees and the humanitarian aid that is provided on the territory of Ukraine (EU Solidarity With Ukraine, 2023).

EU sanctions and their coordination with the USA have played a crucial role since 2014, given the bloc's economic ties with Russia. The EU-US Trade and Technology Council (TTC) has facilitated united approaches to common threats. Sanctions imposed by the EU and the US against Russia are often similar, but differences arise due to the intertwined nature of their economies. For instance, the US bans all new investments, while the EU focuses on the mining and energy sectors. The EU has imported Russian gas and LNG, whereas the US prohibits imports of coal, LNG, and oil. The EU has expanded its list of sanctioned individuals and entities, targeting high-ranking officials, soldiers, and individuals connected to incidents like the massacres in Bucha or Mariupol. The entities subject to sanctions extend beyond banks and financial institutions to include armed forces, paramilitary groups, political movements, and the Russian private military group known as the "Wagner Group." The timing and impact of EU sanctions on energy will be further discussed to provide context for current Russia-EU energy relations. (Szczepański & EPRS, 2022).

Whether the Western sanctions have worked or not is an ongoing debate and the answer depends on different perspectives. Even though Russia hasn't expanded its military actions to other states or even over most of the territory of Ukraine, the war is still raging, and the end is nowhere to be seen. Furthermore, its economy is coping with the outcomes of the sanctions better than presumed, and even though it is shrinking, based on most estimates it is still better off than during the 2008 economic crisis. Russia is also trying to avoid Western sanctions through cooperation with other regimes that are too targeted by international measures, such as North Korea, Syria, Iran, or Cuba. What is alarming is also the deepening cooperation between Russia and China, mostly in the supply of goods, tech, and military equipment that the Russian army desperately needs. There have been reported surges of trade between the Kremlin and its neighbouring countries, suggesting that they supply the former with products banned by the West (Williams,

2023). On the other hand, the financial sanctions that froze around 300 billion USD worth of Russian Central Bank assets and caused losses worth hundreds of billions of USD to Russia's financial sector effectively contracted the financial flows of the country. The same goes for the access to advanced technologies that Moscow is deprived of, which will likely have a long-term negative effect on its defence and industrial base growth. In addition, the sanctions imposed on oil in late 2022 are expected to significantly reduce the revenues of the Russian government, which is heavily dependent on its export. The latest official figures of the Ministry of Finance already show plummeting energy revenues due to forcing Moscow to sell its energy at a discounted rate (Stognei, 2023)

4.3 The role of EU main institutions in the transformation of the energy sector

More than one year after the unjustified Russian invasion of Ukraine, the global energy landscape has changed. Europe, arguably more than others, has experienced the soaring prices of energy-related commodities that hit consumers, bringing about economic decline as energy became a more important issue. Consequently, the dependence of the EU on fossil fuel consumption came into question as the reliance on gas imports has caused spikes in the prices of electricity and all alternative fuels. Now, more than ever, the calls for acceleration of the energy transition have amplified as green and nuclear energy are seen to reduce GHG emissions in energy generation and increase energy security in Europe (IEA, 2023). Now, before tackling what the situation of the energy market is now and what the implications are for the future, it is necessary to understand how the European institutions reacted, what policies and restrictions they introduced, and what the changes were to the market in the process. For this reason, the focus will be given to the three main bodies—the Council of the EU, the European Commission, and the European Parliament—and their major contributions to the discussion of speeding up the rollout of green energy.

4.3.1 The Council of the EU

Since the beginning of the war on Ukraine, the EU has condemned the Russian invasion and adopted strict measures that resonated through all its organs. It also cooperated closely with its partners, including the US, UK, Canada, or Japan in implementation of unprecedented strict sanctions against the aggressor and led to something that was labelled a “sanction revolution”. The rapid succession of ten packages of increasingly more stringent restrictive measures against Russia was conducted by the Council that plays a very active role in shaping the energy market right now (EPRS et al., 2023).

Even before the war started, the first set of sanctions was adopted in 2014 as reaction to Russia’s annexation of Crimea and its support of separatists on the east of Ukraine. This signalled a breakthrough from a policy of isolation, when a similar situation happened in Georgia, which despite the condemnation from the EU didn’t lead to any sanctions being implemented. These measures firstly included individual and diplomatic sanctions, leading to worsening of mutual negotiations. Economic and sectoral sanctions followed later with restrictions on trade, energy, and financial cooperation with Russia, and in addition to those “geographical” sanctions, the EU also implemented “thematic” sanctions related to war (EPRS et al., 2023).

With the outbreak of the war Russia was met with escalation of these means that are meant to limit its potential military ventures by depleting its resources and drastically isolating the country. The first package of the EU sanctions on Russia was adopted at the wake of war on 23 February 2022 when Russia unilaterally recognized the independence of the Donbas region and sent their troops there. Other packages were adopted in swift succession as nine more of them were adopted within one year, gradually broadening their scope since 2014. The newest sanctions also for example banned imports from the annexed regions of Kherson, Zaporizhzhia, Donetsk and Luhansk (Council of the EU, 2023c).

Major restrictive measure introduced by the Council was the ban of Russian banks from access to the SWIFT banking system. This tool powers most of international money and security transfers and is used by financial institutions to send and receive information quickly and securely. This provision applies mainly to

Russian financial institutions such as Sberbank, Bank Otkritie, Rossiya Bank or Sovcombank, but also prohibits investors from participating in projects that have connections to the Russian Direct Investment Fund. Furthermore, the supply of euro denominated banknotes to Russia or any entity within was strictly prohibited (Szczepański & EPRS, 2023).

To supplement the individual and economic sanctions, the Council has also introduced diplomatic restrictions. For example, suspension of visa facilitation between Russia and the EU, or denial of the most-favoured-nation treatment for Russian products and services by the EU and World Trade Organization (WTO). The EU has also adopted additional measures against countries that are cooperating with Russia and have direct or indirect involvement in the war. These for example include Belarus, in response to the use of Belarusian territory as a cross point for the Russian military, or Iran, due to the supply of Iranian drones, that were used in the war (Szczepański & EPRS, 2023).

As was mentioned before, the EU coordinated the sanctions with other international partners and mainly with the G7, therefore the main restrictions are similar to the ones applied for example by the USA. The main aim is to weaken the Russian economic base and reduce its ability to wage war, through hampering its access to technologies. The political and economic elites are being targeted through series of actions to undermine the support of the regime and the main sanctions involve:

Targeted sanctions - mainly asset freezing and travel bans targeting Russian elites, top public officials, and other associated entities, such as the Wagner Group.
Banning transactions - with some state-owned military industrial entities, including a far-reaching ban on new investment in the Russian energy sector.
Blocking access – EU and the G7 countries have collectively blocked more than € 300 billion worth of assets of the Central Bank of Russia.
Disconnecting from SWIFT – ten leading banks were prohibited from the use of this financial exchange service.
Export restrictions – mainly regarding the dual-use technology and military equipment, but also certain goods in the technology sector, or the luxury goods.

The export of goods and technologies for the oil refining sector has also been banned.

Import restrictions – banning imports of Russian coal and other solid fossil fuels and crude oil and refined oil products. The ban on imports of these fuels was meant to significantly reduce the revenues of the Russian government, yet the question of banning gas hasn't been proposed.

Transport restrictions – closure of EU airspace, seaports, and roads to Russian operators in different sectors of transportation

(EPRS et al., 2023).

Global energy markets have been tightening since the 2021 due to the quick economic rebound that followed the pandemic. High energy prices also driven inflation and pushed households into poverty, slowing growth and affecting Europe that has been particularly vulnerable due to its historical reliance on Russian gas. Thus, even before the invasion, energy started to be an important topic drawing attention of the EU institutions and initiated a debate about tackling the price surge and protecting the EU customers (IEA, 2023).

At the wake of the war the Council and mainly the Transport, Telecommunication and Energy Council (TTE) and their extraordinary meetings started to shape the energy sector of the EU. The energy ministers have for example discussed the state of energy supplies right after the invasion and concluded that the EU was not in immediate risk in terms of gas or fuel supplies even in case of sudden disruptions (Council of the EU, 2023). However, the suspension of the gas deliveries to certain MS has led the energy ministers to reconsider the situation and the energy security supply agenda has become more important. This led to the Council reaching a mandate for negotiating the proposal on filling the gas storages to ensure the security of supply for the upcoming season. After discussion with the EP, the Council adopted gas storage regulation in late June 2022, providing that the UGS facilities must be filled to at least 80 % before the winter 2022/2023 (Council of the EU, 2022b).

The question of increasing security of gas supply and its role in the future was also addressed by the EU energy ministers. A political agreement to reduce

natural gas demand by 15 % in winter 2022/2023 in order to make savings for the winter due to possible disruptions of the gas supply was reached and in early August adopted as regulation by the Council. To alleviate the burden of high energy prices and make additional actions to prepare for winter, the Council agreed on emergency measures to reduce energy prices. The main tools for this were reduction of electricity use, capping the revenues of electricity producers and solidarity levy for businesses operating in the fossil fuel sector (Council of the EU, 2022a).

At the extraordinary TTE meeting on 24 November 2022, the EU energy ministers agreed on the content of new rules that would aim to accelerate the procedure for granting permits for renewable energy projects. The regulation was set to be valid for 18 months and the maximum deadlines for permit granting of projects that enhance power generation or grid connection was drastically reduced. This was done through introduction of presumption of overriding public interest for RE projects that provided a simplified assessment of environmental obligations (Council of the EU, 2023c)

The last significant measures introduced by the Council to cope with the energy crises were the market correction mechanisms of mainly oil and gas through price capping and joint purchase or solidarity mechanisms. The Council set the price cap for barrels of Russian oil at 60 USD, whereas for gas it set temporary emergency measures to limit its high prices. Main mechanisms include pooling the demand at the EU level ensuring that the MS don’t outbid each other, setting a new benchmark for gas prices including pricing LNG and setting default rules for sharing gas between states and sectors in case of genuine emergency. Lastly, both the MS and the Council formally adopted to reduced previously mentioned 15% gas demand reduction target for a period of one year and set a possibility of triggering a “Union alert” mechanism in which case the gas demand reduction would become mandatory (Council of the EU, 2023e)

Throughout the timeline, the Council of the European Union addresses the challenges posed by rising energy prices and focuses on measures such as market transparency, diversification of energy sources, energy efficiency, enhanced regulation, infrastructure investment, and the transition to clean energy. It also

stresses the importance of coordination and cooperation among member states to ensure the security of energy supply (Council of the EU, 2023f).

4.3.2 The European Commission

As is known, the role of the European Commission is fundamental in shaping the overall strategy of the EU. It does so through proposing new laws and policies, monitoring their implementation and enforcing, and managing the EU budget. The main tools of the EC with regards to reshaping the energy landscape of the EU and its relation to Russia, was in this case its legislative initiative and management of EU policies. Whether we talk about the numerous proposals of the Commission to EU countries and the Council, or the introduction of plans and overreaching policies, the Commission played an active role in reacting to the energy situation in the EU and transforming its energy sector. The most active part of the Commission was in this case unsurprisingly the DG for Energy (ENER), which is a department responsible for EU's main energy policy goals of secure, sustainable, and competitively priced energy for Europe (Directorate-General for Energy, n.d.).

Before the beginning of the war, the European Council invited the Commission to analyse the causes for the electricity and gas price surges and propose some solutions (European Council, 2021). The Commission came up with solutions both on national and EU level, including measures like taxation, stepping up on storage and market integration capacities, or acceleration of renewable projects permits (European Commission, 2021b). Another important project was the Commission initiative Fit For 55 initially introduced in July 2021, presenting a legislative package originally composed of twelve directives and regulations aimed at reducing the carbon emissions by at least 55% by the end of 2030. However due to complexity of the package and different EU institutions involved in its adoption and changes employed, the Fit For 55 will be discussed at the end of this chapter.

Just weeks before the war, the Commission had also initiated talks on the revision of the security of supply and storage levels of gas across the EU. As the situation in Ukraine began to tighten, the Commission has proposed a set of contingency measures to better cope with possible disruptions. As those measures were partly implemented after the war, the role of EC was then to re-examine the role of imported fossil fuels and find a way to reduce dependence on Russian gas. Part of those measures is also a Temporary Crisis Framework which is a form of

state aid measures to support the economy due to the impact of the Russian war on Ukraine (European Commission, 2023).

REPowerEU

On March 8 the Commission released a communication about the REPowerEU plan, that is outlining a plan on how to rapidly reduce the dependence on Russian fossil fuels and bring the imports of its gas to minimum by the end of 2022. This plan is both a response to how to fight the gas supplies blackmailing through its artificial price and volume fluctuations and how to tackle the climate crisis. The measures once again stressed in REPowerEU include energy savings, diversification of energy supplies, and accelerated roll-out on RES to replace fossil fuels. The Recovery and Resilience Facility (RRF) is at the centre of the plan as it supports planning and financing of energy infrastructure projects (European Commission, 2022a). The detailed plan, that has been presented on May 18, 2022, outlined five key areas of implementation which include:

Energy savings – Here the Commission proposed to address the long-term energy efficiency measures including the increase of binding energy efficiency targets from 9 % to 13 % under the Fit for 55 package. The Commission also encouraged behavioural changes that could reduce the demand of gas and oil by 5 %, and with this also lower the energy dependence of the EU. The MS are also encouraged to introduce fiscal measures to encourage energy savings and lastly the Commission sets contingency measures in case of supply interruptions that would be employed at the EU level (European Commission, 2022b).

Diversification of energy supplies – In this section, the main focus is given to the importance of coordinated joint purchasing mechanisms to cover the energy demand at EU level. The main tool used for this is the EU Energy Platform that serves the purpose of common purchase of gas, LNG and hydrogen and maximizes the efficient use of gas infrastructure, while securing the commodities from different international partners. Secondly, the Commission also introduced the EU External Energy Strategy, which should facilitate energy diversification and cooperation on

application of green technologies. This document also underlined the need to stand with EU's vulnerable partners, including Ukraine and stressed the importance of future implementation of hydrogen (European Commission, 2022b)

Acceleration of the rollout on renewables – As the claim that renewable energy could increase energy independence, attain climate targets and also reduce prices over time is widely accepted within the EU, the Commission decided to support the rollout also in its REPowerEU Plan. This is demonstrated mainly through increase of the 2030 targets for renewables from 40 to 45 % and setting other initiatives and strategies to reach this including:

- EU Solar Strategy – Settling to increase the photovoltaic capacity and namely double it by 2025 and install 600 GW by 2030
- A Solar Rooftop Initiative – Introduces a legal obligation to install solar panels on new buildings in the commercial, residential, and public sector.
- Acceleration of permit-granting - Commission Recommendation on speeding up permitting of renewable projects and amendment of the Renewable Energy Directive.
- Hydrogen related acts – Setting a target to produce 10 million tonnes of renewable hydrogen and import another 10 million tonnes by 2030. Two Delegated Acts on the definition and production of renewable hydrogen as well as additional funding was introduced to reach this cause.
- Biomethane Action Plan – Presents the goal to increase the biomethane production to 35 bcm/y by 2030, and tools how to achieve this (European Commission, 2022b).

Reduction of fossil fuel consumption – Replacement of fossil fuels mainly in industrial and transport processes is seen as a major tool to strengthen energy security and competitiveness while reducing GHG emissions. With regards to industries, additional 35 bcm/y of natural could be replaced through the transition to renewable hydrogen and biogases by 2030. The uptake of renewable hydrogen will be financed also using emission trading revenues and the Commission will provide guidance on renewable energy and power purchase agreement. To

accelerate the greening of the transport sector, the Commission plans to enhance energy savings and efficiencies through the Greening of Freight Package that is planned for 2023 (European Commission, 2022b).

Smart investments – Finally, the Commission has stressed the need for additional necessary funding to reach the objectives of the REPowerEU Plan. It has also outlined the means through which could be the funding accessed as it relies primarily on the RRF and its loans, or additional funding through the EU Emission Trading System allowances. Furthermore, other resources leading to green transition could be pooled from MFF, where up to €100 billion is dedicated to renewable energy projects or through the Cohesion Funds and Common Agricultural Policy. Lastly, the Commission also highlighted the need for additional gas infrastructure investments, under the PCI to fully compensate for future losses of Russian gas imports and create more interconnection and storage capacities (European Commission, 2022b).

The overarching principle of the REPowerEU Plan is to phase out Russian gas and kickstart investments and growth in the clean-energy sector leading to faster green transition. Although this would be economically beneficial for the EU and would save based on Commission's estimations up to €100 billion per year, the plan still needs additional €210 billion of investments until 2027 and significant innovation of infrastructure to reach its targets. It will be however the MS and their cooperation that will determine the success of this strategy as most of the measures call for national implementation and thus a high engagement of the countries will be crucial (Tagliapietra, 2022).

To address some of these doubts, the Commission has acted in many areas and approved for example a list of renewable energy cross-border projects. All of those projects aim to develop cost-effective exploitation of renewable energy and examples of this could be a hybrid offshore wind park between Latvia and Estonia, or a cross-border heating grid based on RES between Poland and Germany or a gas interconnector between Slovakia and Poland (European Commission, 2022c).

Another case of Commission's action is the proposal of new regulation that would address high gas prices and energy security. This proposal underlined pooling the gas purchase demand, price limiting mechanisms on TTF gas exchange and new measures on transparency and solidarity concerning gas consumption (European Commission, 2022d). Lastly, the Commission has also acted in favor of states that are willing to make a change and implement the measures outlined in its plan. This was mainly in the form of state aid provided to the MS through funding that covers either losses of energy-intensive companies and their support or the investments into the green sector. Examples are many, but some of those are the €13.5 billion French scheme to compensate companies for high energy costs, the €1.2 billion Czech scheme to promote green district heating, or the €34.5 billion German measure to recapitalise Uniper SE and avoid major gas disruptions (DG for Energy, 2023).

4.2.3. The European Parliament

The European Parliament is a directly elected body with three main areas of function: legislative, supervisory, and budgetary. As it has the power to pass EU laws together with the Council, review the Commission's programme, question the Commission and the Council, or co-establish the EU budget and approve the MMF, the European Parliament has been using its competences to address the energy situation in the EU. Probably the biggest role that the Parliament played in this sense was in the agenda-setting part of the policy cycle, as it often called for the adoption of action by other main institutions, or the MS, and also in the policy adoption part, during the two Parliament readings of the ordinary legislative procedure (European Union, n.d.).

The Parliament has been a vocal critic of Russian aggression and a proponent of harsh sanctions ever since Russia's annexation of Crimea in 2014. Since the beginning of the war, the Parliament has demanded more sanctions be implemented and enforced, including the confiscation of Russian assets in the EU. For example, in its special plenary session on March 1, 2022, it recalled its previous calls to reduce energy dependence, welcomed the decision of the German government to halt the certification of the NS2 project, and called on member states to prepare plans for subsidies for households to avoid the energy crisis. This was followed by the adoption of a resolution on April 7, in which the Parliament called for an immediate and full embargo on Russian imports of oil, coal, nuclear fuel, and gas. As we know, the Parliament did not manage to persuade the immediate phase out of Russian gas, but it did help to put political pressure on MS aligned with Russia and EU member candidates in the question of energy deliveries (EPRS et al., 2023).

In the resolution from 4th of October 2022, the Parliament has already accounted for this reality, however stressed the need for concerted policy that would reduce dependence on Russian gas import. It has also called on the Commission to analyze the price cap on gas imports, focus on financing of key energy infrastructure and urged the Council to consider the energy crisis as a priority in its budgetary negotiations. In this light, the Parliament has also criticized the MMF as unfitting and called for its reform, while supporting the Commission's initiative of

European Sovereignty Fund[6] In its resolution of 6th of October, considering spiking violence in Ukraine, the Parliament further called on MS to actively prosecute any circumvention of applied sanctions and on Commission to act quickly in actively prosecuting Russian assets. In the same document, the Parliament discussed the dangers of energy dependence on Russian imports due to weaponization of fuel imports and used the explosion of NS pipelines as a reason to accelerate the rollout on renewables (2022/2830(RSP).

Lastly, in the resolution from 24th of November, the Parliament has criticized more broadly the state of the Energy Charter Treaty (ECT) as an outdated instrument that no longer reflects energy policy of the EU. The Parliament further underlined that even the modernized ECT is not aligned with some crucial documents, like the Paris Agreement or the EGD, mainly due to its clause about protection of fossil fuels for at least another 10 years. Due to this, the Parliament calls on MS and the Commission to coordinate an exit from the ECT, which would provide for better withdrawal negotiation (2022/2934(RSP).

The Parliament has also often acted with the Council on adoption of regulations or directives. Example of which could be stated above, which is the adoption of regulation on gas storage, setting a binding target of EU gas storage capacity. In late 2022, the Council and the Parliament have also decided to redirect funding of the RRF loans and leverage other funding instruments. Based on Commission's proposal and own-initiative report of Parliament, the latter has decided to adopt a resolution that would favor the redirection of funds, underlining the role of RRF in the REPowerEU plan and renewable energy initiatives (EPRS & D'Alfonso, 2022).

Other actions of the Parliament include also amendments of existing directives, such as the Directive on the promotion of the use of energy from renewable sources, the Directive on the energy performance of buildings and the Directive on energy efficiency. Another example of initiative of the Parliament is also the data collection on the energy saving measures targeted on households and enterprises by the governments of the MS. From the findings of the study, it is evident, that some members, like Germany, Sweden or Estonia introduced vast

[6] It regards the announcement made by the Commission President Von der Leyen on 14 September 2022, when she called for the establishment of a new funding instrument to finance cross-border energy infrastructure projects, reinforcing the path towards EGD (2022/2830(RSP).

array of both voluntary and mandatory energy-saving measures across all sectors, whereas others, like Netherlands, Denmark, Croatia or Latvia either didn’t introduce any, or their scope was very limited (European Parliament, 2022).

4.2.4. The Fit for 55 package

The Fit for 55 package is a set of legislative proposals to revise and update EU legislation and it is based on an overriding goal that is embedded into the European climate law which makes reduction of GHG emission by at least 55 % by 2030 a legal obligation. The proposed package is supposed to make this steppingstone towards a climate neutral future, envisioned in the EGD, realizable by setting higher binding objectives in different climate and energy areas. The package aims at providing a coherent framework for reaching climate targets, which ensures just and socially fair transition, maintains and strengthens innovation and underpins the leading role of the EU in fighting climate change. It is an example of complex action that needed coordination of all the major institutions and some of its parts are still being negotiated (Council of the EU, 2023h).

The original climate ambition of emission 55 % emission reduction was already discussed in October 2020, to be later discussed and finally approved in the final text on the EU climate law. The Commission presented its proposal in July 2021 and since then discussion both with the Council and the European Council and its different parts took off. Debates about common challenges in transport, energy, industrial and climate sectors, and the impact of the legislation on citizens started to form the progress on the package (Tagliapietra, 2021). Although Fit for 55 can in no way be considered just as the EU's response to the war on Ukraine and energy insufficiency, the beginning of Russian invasion is an important factor that sped up the negotiations of the package as the urgency of greater energy independence and faster transition became more evident. As the worries about energy disruptions and its prices intensified, so did the negotiations between the institutions. Mainly the role of the Council became prominent, as it was active in different Council configurations where it exchanged views on various proposals. The role of the European Parliament was also important, mainly due to its role in the ordinary legislative procedure (Council of the EU, 2023h).

The final form of the Fit for 55 is still yet to be decided, but the core aspects of it were formed by the end of 2022, when the Council and the Parliament reached provision agreements on different initiatives. On 18th of April 2023, the Parliament

approved key pieces of legislation of Fit For 55, that plan to reduce the emissions significantly and the already agreed goals include:

- Emission Trading System reform: Increased ambition for 2030 includes further cuts of emissions in ETS sectors which is now set at 62 %. It also sets a separate ETS II for road, buildings and manufacturing sectors and puts a price on GHG emissions from these sectors.
- New carbon leakage instruments: The Carbon Border Adjustment Mechanism (CBAM) aims to incentivize non-EU countries to increase their climate ambitions. It does so by putting a price for the carbon footprint emitted during production and transportation of the goods and covers products like steel and iron, but also electricity, or hydrogen.
- A Social Climate Fund to combat energy poverty: The aim of this initiative is to finance the vulnerable households and small enterprises that are affected by energy and transport poverty. The fund also plans to finance long-lasting structural investments, like building renovation, integration of renewable energy, creation of infrastructure for low-emission vehicles and is supposed to be financed mainly through ETS allowances (Haahr et al., 2023).

The Council has also adopted regulations providing piece-wise measures and climate obligations aimed at different sectors of the economy. These for example include updates on the effort sharing regulation of GHG emission reduction target, setting it to at least 40 % by 2030. Another case is the new regulation on the LULUCF sector aiming at further removal of CO_2, or the new regulation on emissions for new cars and vans aiming at 100 % CO_2 reduction for new cars from 2035. Furthermore, apart from the planned legislation focused mainly on reduction of emissions in the maritime and aviation transport by introduction of new fuels, the Council and the Parliament still have to find a common ground for a number of energy-related revisions of legislation (Council of the EU, 2023h).

These include:

Renewable energy directive – The proposal is to increase current EU targets of RES in its energy mix from 32 % to at least 40 % by 2030 and further binding targets on GHG emissions in transport and uptake of renewable energy by transport sectors. Members will need to update their NCEPs to be able to collectively achieve the set targets (Council of the EU, 2023a).

Energy efficiency directive – The main goal of this proposal is to reduce final energy consumption at EU level by 11.7 % by 2030, compared to the forecasts. This should be achieved for example by specific obligations for the public sector that would have binding annual targets of energy consumption reduction and renovation of public buildings (Council of the EU, 2023b).

Energy performance of buildings directive – The main objective of the revision is to make all new buildings by 2030 zero-emission, as buildings account for 40 % of energy consumed and 36 % of energy-related GHG emissions in the EU. The existing buildings would have to introduce minimum energy performance standards setting a maximum amount of primary energy the building can use, leading to gradual phase-out of worst-performing buildings (Council of the EU, 2023c).

Energy taxation directive – Revision of the directive aims to provide a coherent framework for taxation of energy products and electricity that would include all existing EU energy and environment policies. Another aim is to preserve the ability of MS to generate revenues, while updating the EU's internal market of new energy products and their tax rates (European Commission, 2021a).

Hydrogen and decarbonized gas market package – This package consists of a regulation and a directive, which both will set common internal market rules for natural gasses and hydrogen. The main novelties are the clear rules for tariff discount for hydrogen and low-carbon gasses or addition of the clause of temporarily limiting gas imports of Russia for security reasons (Council of the EU, 2023d).

4.2.5. Summarising the responses of EU institutions

To summarize political reactions and attitudes to twar on a European level, namel y Fit for 55 and REPowerEU, it may be suitable to answer the questions, whether the principles of energy union have been addressed accordingly and if this strategy is still a major document of European energy policy. To answer those questions, we should remember why the Energy Union was established in the first place and what its main dimensions and goals are. The energy union started in 2014 as an idea of collective action to make the energy market more resilient to supply disruptions from Russia that were felt after the annexation of Crimea. Only later it developed to a larger strategy that builds on five mutually reinforcing dimensions, all aiming to build a secure energy market and provide affordable and clean energy for all EU citizens. As these goals are very abstract and hardly traceable, they were transposed into NCEPs and further specified with various directives, mainly the Clean Energy for all Europeans package, setting binding objectives in many areas.

On the contrary, summing up the contents of the two programs launched as a response to the war in Ukraine, we can indeed say that the EU has adhered to the main principles of the Energy Union. Of course, one could claim that the energy crisis and its skyrocketing prices could have been managed better, the fact however remains that the combination of pooling mechanisms deployed, state subsidies and diversification of energy suppliers have achieved what they were supposed to. This was rendered possible mainly due to additional financing opportunities of green transition, through revision of ETS, creation of Social Climate Fund, Sovereignty fund or the pressures deployed to restructure the MMF.

Furthermore, when it comes to more specific objectives, whether ambitions of the EU, or its binding targets, we could see that the benchmarks were logically increased also here, compared to the 2019 Clean Energy package. First example can be the share of RES in the energy mix which increased, and whereas Fit For 55 upgraded its ambition from the previous 32 % to 40 %, the REPowerEU set this goal to 45 %, introducing various plans and strategies to achieve it. The same goes for other goals, like energy efficiency, or energy performance in buildings, where the EU either increased its targets through the two programs, or introduced new

binding objectives to areas that were previously not specified. Other areas in innovation were also newly covered, such as the benefits of hydrogen and greener fuels and their possible roles in different types of transport.

With all those changes adjusting the EU energy landscape and legislation introduced in those two programs, it can be concluded that they effectively replaced the Energy Union in the role of a major instrument of EU energy policy. In most cases, such as in boosting energy security, they have even surpassed the effects of the Energy Union since the structure of energy suppliers is now much more diversified. Another achievement was made in clean energy and in boosting the role of RES in the EU energy mix, as those resources have for the first time become a major source for generating electricity. Lastly, the newly introduced or increased objectives in green transition and in plans to achieve them, including their funding, have in fact better embodied the Juncker Commission's idea of the Energy Union, than their own propositions to achieve it. For these reasons and more, although the energy union remains an important strategy of reference that helped to rethink energy policy of the EU, it is no longer its main device. While looking at the details from previous year about various indicators like total energy demand of the EU, its energy mix and supplier structure, or the amount of new RES installations, and comparing them to the period 2015-2021, it can be inferred that the EU has really stepped up its efforts in green transition as a response to the war.

4.3. The impacts of the war on energy markets in the EU

More than one year after the beginning of Russia's invasion of Ukraine, the global energy landscape has transformed substantially. Countries and regions all around the world have experienced sharp increases in energy prices, leading to soaring inflation that has hit both consumers and enterprises hard. The volatility in energy markets caused by artificial and real scarcity, the weaponization of energy sources, and political responses has led to a re-examination of the role of fossil fuels, which had been until then a vital part of the energy mixes of most countries (IEA, 2023). This has been particularly true for the European energy market, which found itself in a difficult position split between the imposition of harsh sanctions on Russia and fears about their potential implications due to its energy dependence. The calls for energy transitions have started to resonate even more, as this shift would move countries away from highly polluting fuels owned by a handful of producers to more sustainable and secure sources of energy. But as it is not possible to immediately replace all fossil fuel imports in the eurozone by RES, Russia's backlash, and motivation to finance its war through energy revenues led to some immediate economic impacts for the EU (Adolfsen et al., 2022).

The impacts could be felt mainly in the prices of all the hydrocarbons, which spiked immediately after the beginning of the war and have been volatile ever since. The price of energy commodities began to rise at the end of 2021, and shortly after the invasion, the prices of oil, coal, and gas rose by about 40%, 13%, and 18%, respectively. Mainly, the gas prices have driven up the wholesale price of alternative sources, like electricity, whose price has also increased and remained very volatile. The energy price increase felt heavy on EU households, as consumer energy prices grew to 39% in October 2022, and it is estimated that around one quarter of households live in energy poverty (Adolfsen et al., 2022). It is important to mention that these vulnerable groups usually live in older, poorly insulated buildings, using inefficient appliances and older vehicles with lower performance levels, thus not only paying more in bills but also dwelling in houses with worse living conditions (IEA, 2023).

The economic measures introduced, such as the pooling the demand for buying gas and electricity, funding mechanisms to fight energy poverty or state aid

for compensating losses of enterprises heavily dependent on fossil fuels tried to balance the impacts of the war (Adolfsen et al., 2022). Other factors have also helped to overcome the winter months relatively easily in Europe and rein the energy prices that could have been much higher otherwise. One factor was relatively mild winter leading to lower than presumed demands of energy commodities. Another one might be the reintroduction of strict COVID-19 measures, including lockdowns in China at the beginning of 2022, leading to lowering pressure on global energy demand. Thirdly, the IEA has announced two large strategic releases of oil stocks from its emergency reserve. The combined amount of these was roughly 180 million barrels of oil, which is the largest release in the IEA's history, to a large extent financed by the USA (IEA, 2023).

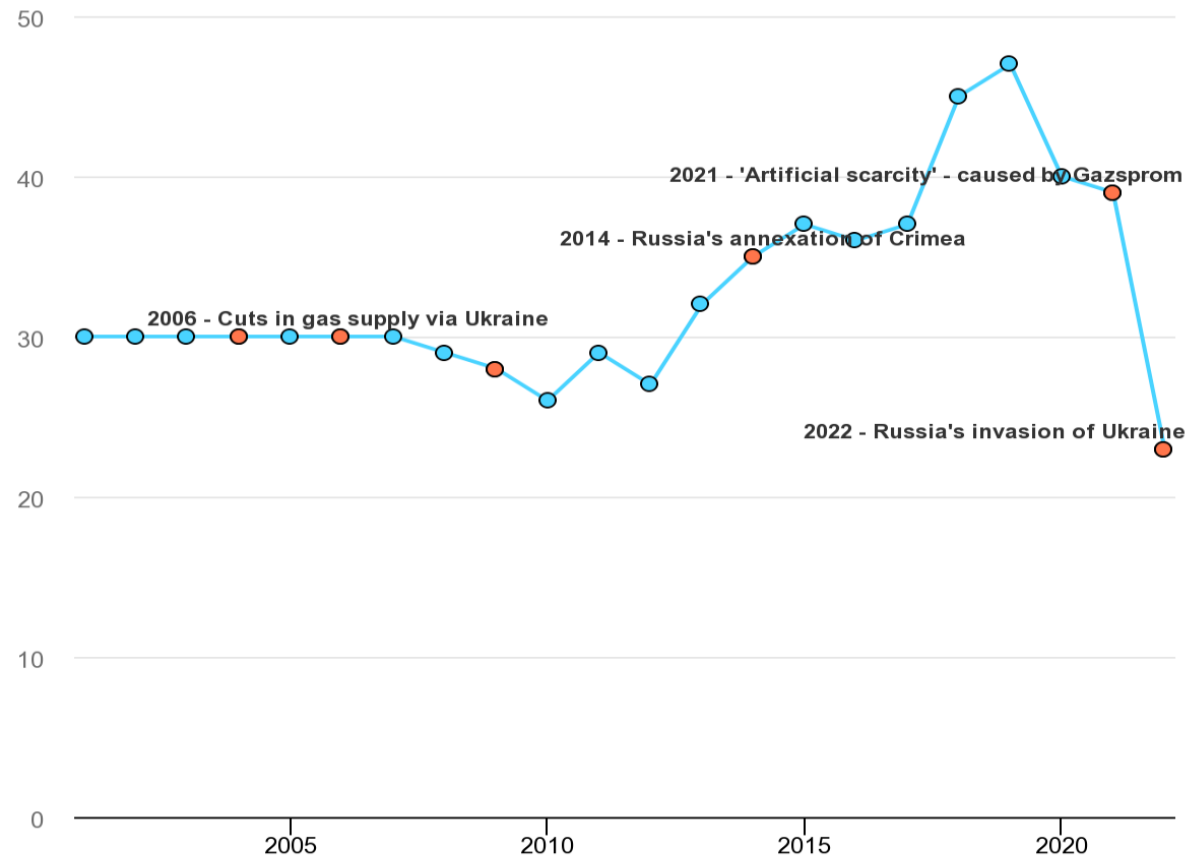
The EU and many governments in the eurozone have introduced additional measures to cope with the impacts of the crisis. Most of the MS have provided the households support to compensate for high energy prices, reduced excise duties or VAT, lowering the volume of the inflation. But despite all the mentioned measures and realities, the inflation of energy commodities rose dramatically in the aftermath of the war. The energy commodity prices magnified the pressure on customers as the HCIP energy inflation was around 40 % from February to May, reflecting the strong monthly upsurge of prices of all main energy components (Adolfsen et al., 2022).

The combination of economic sanctions, unilateral decisions of the governments and individual companies to cut ties with the Russian energy sector caused a significant drop of shipments of Russian fossil fuels to Europe. Furthermore, the disruptions in physical flows of gas created an environment of instability and fundamentally restructured the energy market in the EU. This does not concern just oil and coal deliveries, that were decided to not be imported from Russia anymore, but also the shipments of praised transition fuel on which Europe was heavily dependent on, natural gas (Adolfsen et al., 2022; IEA, 2023).

Although at the beginning of 2022, it seemed that the war will not have a significant impact on flows of Russian gas into the EU, based on the recent data we can conclude that the shipments of gas plummeted. The will to phase out fossil fuel imports from Russia was expressed already in March 2022 in the EU's Versailles Declaration (IEA, 2023). This commitment, condemning the war and promising

support to Ukraine pledged to phase out dependency on Russian hydrocarbons as soon as possible and to recreate the EU's energy market. Another strong impetus is the REPowerEU plan that aims to reduce dependence on Russian gas by about two-thirds by the end of 2022 and to phase out of it by 2027. As compared to other fossil fuels this one is hard to substitute due to infrastructure required, the member states have been working on other alternatives. These include mainly construction of regasification capacities for LNG, that can be deployed quickly as for example did Italy and Germany, or by finding new suppliers, such as Norway, or Algeria. Although the countries replaced a small part of their gas imports by these measures, these combined with energy saving measures leading to lower demand led to significant drop in Russian gas supplies to Europe (Zachmann et al., 2023).

Figure 3 - Share of European Union Gas demand met by Russian supply, 2001-2022. Source: IEA 2022



As we can see on the graph, the share of Russian imports on the total gas demand of the EU has dropped significantly in 2022, reaching a record low 23 %. Compared to other important moments, like the gas disruptions of 2006 and 2009, after which the volume of gas imports to the EU dropped only negligibly, or the

annexation of Crimea after which the imports actually rose, it seems that now the EU pledges of energy diversification will actually be put through. This drop is even more important, considering that the natural gas consumption in the EU fell by an estimated 13 % or 55 bcm/y in 2022, compared to 2021 levels (IEA et al., 2022). This is the steepest decline in absolute terms in EU's history and is in line with the REPowerEU goal to reduce the demand in 2022 by 15 % compared to 5-year average. Considering the drop in the demand and both the diversification of energy routes and sources, the EU has managed to almost halve the Russian gas imports in one year, from about 155 bcm in 2021 to an estimated 82 bcm/y (Kardaś, 2023).

To contextualize better the situation with energy mix in the EU, based on the estimation from the ENTSO-G[7], the total gas imports to the EU were by the end of 2022 on minimum values compared to the period 2015-2020. And whereas the amount of Russian gas imports plummeted mainly in September 2022 after the Nord Stream leaks, the energy imports from other countries became more important. This is particularly true in the second half of 2022, as for example in November, Russian gas covered about 13 % of total demand, compared to the situation until the second half of 2021, when the Russian imports amounted to around 50 %. Furthermore, as Russia was losing its prominence, the natural gas production in the EU also plummeted (Zachmann et al., 2023). This stemmed mostly from the gas production at the Groningen field in the Netherlands, which fell by more than one third while other fields in the Netherlands declined their production as well (IEA, 2023).

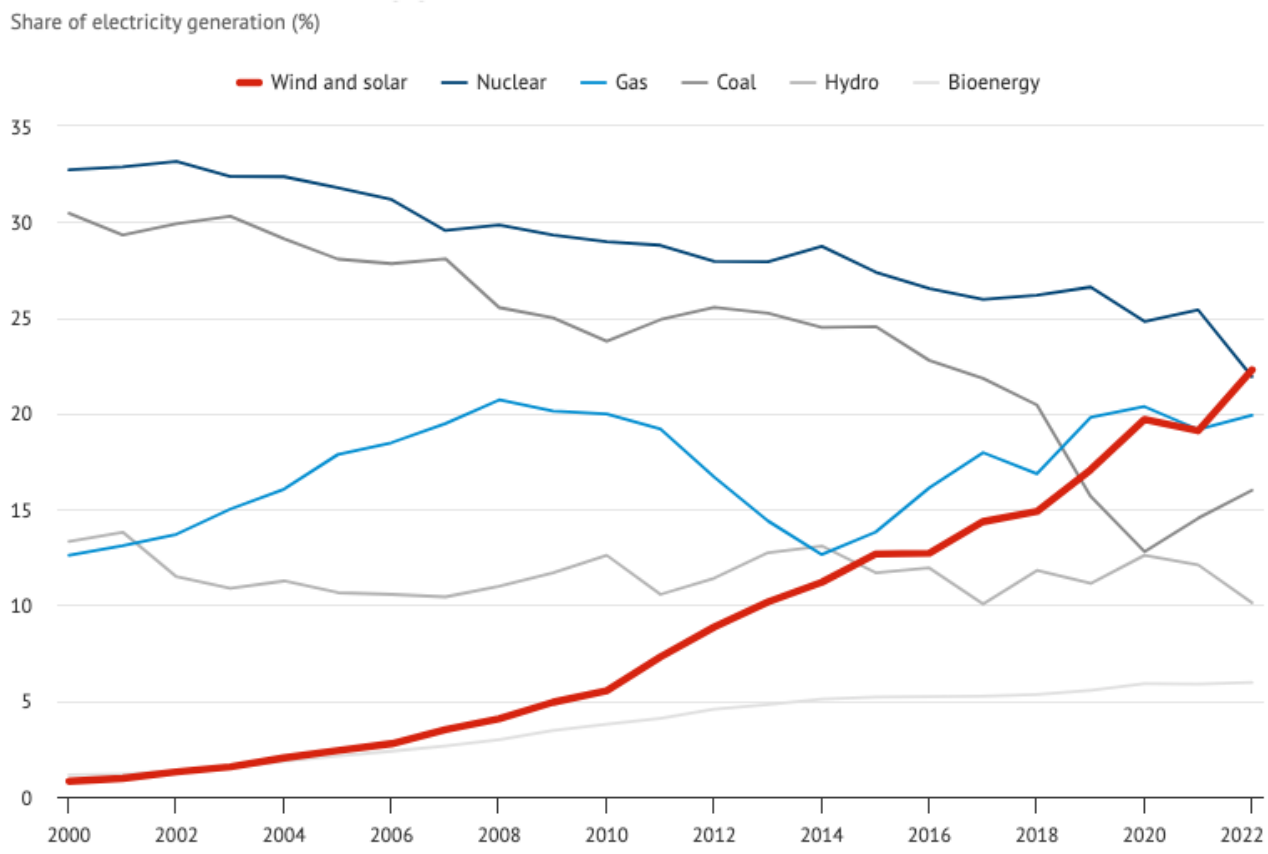
This loss was covered mainly through LNG imports from abroad, since the EU imported just over 130 bcm/y of LNG in 2022, compared to just around 80 bcm/y in the previous year. While different sources state different numbers, the USA occupied a dominant role in the shipments of LNG to the EU with numbers as high as 74 bcm in 2022, an amount that has increased mainly in the second half of the year. This is more than three times the amount that was imported in 2021, which was around 22 bcm and the US in this way roughly matched the imports from Russia of 25% (Mettrick et al., 2023; Zaretskaya & Energy Information Administration, 2023). Another important trade partners were Norway and Algeria, which accounted for about 25 % and 12 % respectively, of total gas imports into the EU (Council of

[7] European Network of Transmission System Operators for Gas (European Parliament, 2009).

the EU, 2023b). While Norway is becoming the most important gas importer into the EU mainly into countries like Germany, or Denmark via existing pipelines, Algerian gas is determined mostly for Spanish and Italian and is delivered through underwater pipelines (Buli, 2023; Butt, 2023).

On the other hand, other energy sources have become much more prominent since 2022 as well, especially renewable energy. The solar generation, rose with quick pace thanks to record additional installations in many countries. The Netherlands, being the leader of this trend, produced 14 % of its power through solar panels, overtaking coal for the first time. The combined power generation through renewable sources amounted to a total of 33 % of the total electricity generation, with wind and solar being the top power source in 2022. While the Netherlands was the country that installed most new solar systems, other MS like Greece, Hungary, or Poland significantly increased their capacities (Dunne, 2023).

Figure 4 - Shares of EU electricity generation by source, 2000-22, %. Source: Ember. Chart by Carbon Brief



At the beginning of the year, it seemed that coal would see its comeback in 2022, as several EU members signalled that they are considering increasing their coal dependence to replace other sources. This was aggravated by unexpected drought and nuclear outages around Europe, causing a dip in power generated by nuclear and hydro plants. But although there was a slight increase in coal use, according to the analyses it seems that only about one sixth of the drop of electricity generated by hydro and nuclear plants was replaced by coal (Dunne, 2023).

Finally, what also helped the markets to absorb the impacts of the energy crisis was a combination of inner policy measures, like increase in energy efficiency and savings. Increased policy support and incentives have for example caused sales of heat pumps to grow by nearly 40 % in the EU compared to previous year, mainly in Nordic and Baltic countries (IEA, 2022a). Furthermore, the already mentioned energy saving measures, for example the 15 % gas demand reduction introduced by the governments have also helped to overcome the crisis (Council of the EU, 2023e).

All things considered, the Russian war on Ukraine had a significant impact on the European energy market and shaped its structure due to contra measures that the EU adopted. One of the most significant changes was the increase in price and volatility of electricity and energy products, mainly the natural gas. The war has also changed the qualities of this commodity and the once cheap, clean and readily available source of energy has become an inscrutable and incredibly overpriced one (Adolfsen et al., 2022). Moreover, the embargo imposed on coal and oil, that was to some extent retaliation for Russian weaponization of energy, changed the European energy landscape. These actions, in fact, did not just trigger efforts for diversification of EU energy suppliers, using for example its LNG capacity as a temporary balancing mechanism, but also its energy mix itself by speeding up the energy transition. The unparalleled situation has created a strong political reaction in the EU, where RES are seen as one solution to many problems. It however remains a question whether this political will persist, or fade in near future and where is Europe going to find a replacement for possible gas shortages (IEA, 2023).

5. The future of the European energy market

In this chapter, the author will try to summarise the current EU energy policy framework, its goals and initiatives that aim to achieve them. By doing so, the author can provide sensible assumptions and scenarios on the development of the structure of EU energy mix, by analysing different sources of energy. This will be attempted by thorough research of current commercially available technology for which the author will provide important information. These will include current installations of concerned source of energy, its pace of development, price of the electricity generated, or the amount of GHG emissions produced. This chapter aims to provide different scenarios of the shape of EU energy sector towards 2030 interim targets, by assessing the energy sources separately.

5.1. Introduction

The provisions for the energy market in 2023 and subsequent years are difficult to establish due to the extensive number of guiding policies, principles, and interests within the field of EU energy policy and climate. This is particularly evident now, following the intensified pressures for affordable and secure energy resulting from the outcomes of the conflict in Ukraine, coupled with growing environmental concerns. The challenges faced by the EU are numerous and encompass various issues, such as limited diversification of energy supply, volatility of energy prices, the escalating global energy demand, decarbonization efforts, the need for further integration and transparency of energy markets, as well as the increasing share of renewables and the associated problems. These issues resonate both on a national and international level, necessitating the prompt implementation of appropriate policies (European Parliament, 2023).

In general, however, the current policy agenda and its alignment of EU energy and climate targets are driven by the Fit for 55 packages. This plan builds on the already established Energy Union strategy that provided for an overarching general framework that would strive to create a market where the energy supply would be secure, sustainable, competitive, and more affordable. The NCEPs that were established under the “Clean energy for all Europeans” package are crucial

to the EU energy landscape where countries need to report progress on the strategic energy objectives and develop a consistent long-term strategy to achieve the Paris Agreement goals. The REPowerEU plan is another major document driving the EU energy policy, providing goals for it and useful strategies on how to achieve them. Both REPowerEU and Fit For 55 are still far from being completed and they add further adjustments to the energy landscape of the EU. Many of the proposed directives from the Fit For 55 package regarding for instance hydrogen, or energy taxation still haven't gone through the whole legislative procedure, while others like RES share in the energy mix are still being adjusted. The same applies to the REPowerEU, which has through its new regulation (EU) 2023/435, increased the financial benefit the MS can access through the RRF, which has been put at the heart of the financing (European Parliament, 2023).

Despite the fact that the final form of all the policy areas remains to be specified, we can already see what are so far the main objectives and their indicative targets for 2030. To summarize the previous legislations and policies and provide better picture and direction of the European energy landscape in the future, we can conclude that there are six main areas to be targeted, stemming already from the energy union:

1. Completing the internal energy market – Fully integrated and functioning internal energy market is desirable to ensure affordable energy prices and give incentive for investments into green energy. The Fit For 55 continues with the tradition of previous energy packages building on introduced systems and networks like ENTSO-E, ENTSO-G or TEN-E. Under this objective we can also find the proposal of revision of regulatory framework for gas market, including a development of hydrogen market.

   Some of the indicative measurable objectives for this area currently are (European Parliament, 2023, p.4):

   a) Interconnection of at least 15 % of the EU's electricity systems
   b) Reduction of emissions by at least 55% compared to 1990 levels

2. Increasing energy efficiency – The main idea behind this area is to reduce primary and final energy consumptions, while keeping the production and quality of life as they are, thus using energy more efficiently. The goal is to make those energy savings throughout the whole energy chain, by introducing innovations and renovations to different sectors, that would help mitigating environmental threats without impairing the economy. The energy efficiency measures focus on sectors with greatest saving potential like building, industry, transport, or energy supply, by approaching them uniformly across the member states.

   Some of the measurable targets for this area currently are (European Parliament, 2023, p. 5-6):

   a) Reduction of final energy consumption by 36 % and 39 % for primary energy consumption compared to 2007 reference scenario.
   b) Annual energy saving obligation of 1.5 % of final energy consumption
   c) From 2030 all new buildings would have to be under the new category A0, corresponding to zero-emission buildings

3. Increasing the share of RES – While solar power, onshore and offshore wind, ocean and hydropower, biomass, biofuels and hydrogen generated powers are mostly getting cheaper, it is still necessary that national and international schemes are established to deliver sufficient amounts of RES. This is logical, as most of the benefits brought by increased uptake of renewable energy, like reduction of GHG emissions, diversification of energy supplies leading to more independent energy policy, are hardly quantifiable.

   Some of the measurable targets for this area by 2030 currently are European Parliament, 2023, p.6-7):

   a) Binding objective of 42.5 % share of RES in EU total energy consumption with possible increase to 45 %
   b) Double solar capacity by 2025 and install in total 600 GW.

c) Produce 10 million tons of renewable hydrogen and import 10 million more by 2030
d) Increase production of biomethane to 35 bcm/y

4. Strengthening external energy relations – This goal regards building a better engagement of EU and its partners to reach its climate and energy policy objectives. The biggest progress could be seen through additional imports of natural gas from other international partners, or by publishing EU external energy strategy. Important success was also the EU Energy Platform, which is a tool used to pool demand, coordinate infrastructure, and facilitate joint gas and hydrogen purchases.

   Some measurable targets and pledges for this area currently are (European Parliament, 2023: p.7):

   a) Procuring additional 50 bcm/y of LNG per year from international partners until at least 2030
   b) Concluding hydrogen partnerships mainly with African countries
   c) Mobilizing around € 3.5 billion of grants for RE projects in Africa, under the Global Gateway initiative.

5. Improving energy security – This area stands already on a robust legislative regulating mainly the gas and electricity markets, introducing safeguard and crisis response mechanisms, minimum stocks, or internal and external trading rules. This goal is closely connected to other objectives, as attaining energy supply security relies on diversification of supplies and rollout on RES, energy savings or keeping the storage levels of critical hydrocarbons sufficiently high. Here the dependence on Russian gas is most often mentioned, hence phasing out of it is the ultimate goal in this area.

   Some of the measurable targets in this area are (European Parliament, 2023, p.7-8):

   a) Phasing out Russian fossil fuels by 2030
   b) Keeping storage levels of gas at 90 % of total capacity

6. Investing into research and development – A total of over 100 billion is available for funding this area under Horizon Europe and NextGenerationEU programs. Goal of the EU under this area is to invest in cutting edge technologies that would speed up the energy transition and decarbonize the energy usage and generation. Although there don't seem to be any quantifiable targets, most of the attention and funding is aimed at increasing uptake of alternative fuels, mainly hydrogen and its integration into the transport sector.

   Some of the general objectives in this area are as follows (European Parliament, 2023: p. 8-9):

   a) Coverage requirements for light and heavy-duty vehicles fuelled by electricity and hydrogen
   b) Setting a minimum share of synthetic fuels for aviation sector

Having said that, the energy landscape of the EU, including policies that are shaping it, is very complex and under constant change, it is very complicated to make predictions about its future form. We could bear witness that unpredictable events such as the pandemic of COVID-19, or the invasion of Ukraine can suddenly transform our lives considerably. The same goes for the energy and climate policies that were in the past few years due to both external and internal pressures and the final forms of the legally binding targets are often still unknown (European Parliament, 2023).

On the other hand, what can be inferred from previous experience with policy change in these fields, it is highly unlikely that the EU would try to rewind or limit its pledges. What is clearly more likely is that those ambitions will be increased and in order to reach a zero-emission economy, the EU will heavily invest into all of the main goals mentioned above. It can be deduced that the uncertainty around natural gas delivery unleashed by the Russian aggression has and will play a big role in shaping the European energy landscape. As reducing the dependence on energy

supply and fast decarbonization are two of the major energy policy goals, reaching of which would also help attaining other objectives like energy affordability more easily, they will be the driving force behind recommended policy considerations (European Parliament, 2023).

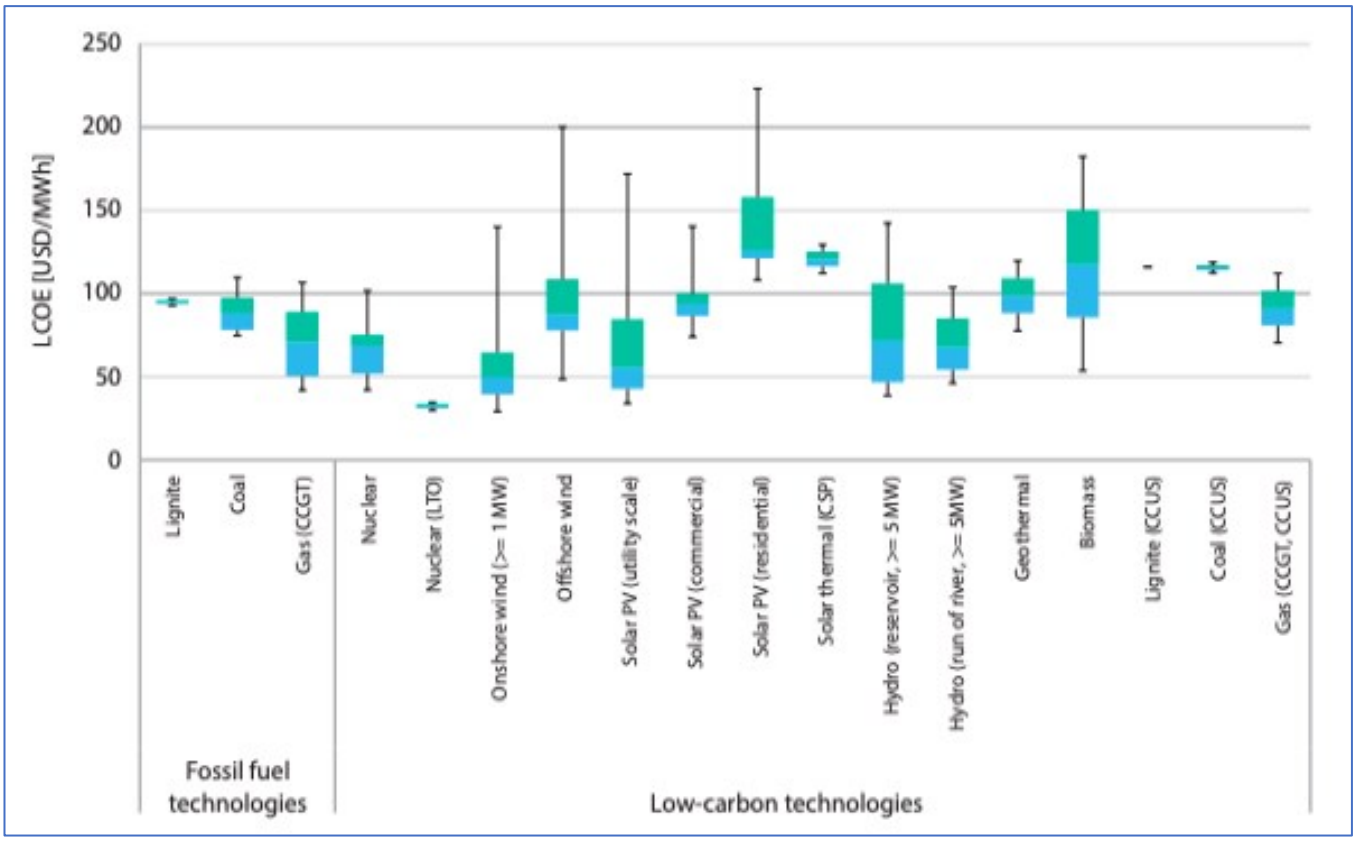
Renewable energy has in the past years emerged as one solution to many issues. Given the need to decarbonize the economy and find energy replacement, the RES can on the one hand provide almost for emission-free electricity, while diversifying the energy supply. It is therefore not surprising, that these sources have been pushed by governments both on national and on the EU level, and that also since they have gradually become the most market-efficient solution. Recent events have unprecedentedly sped up the uptake of renewable energy, as countries seek to strengthen their energy security, resulting in sharp acceleration of new installations. This trend is also visible in the NCEPs where many member states have introduced ambitious plans that would increase the uptake of RES in their energy mix, outlining the way how to achieve that and adjusting their previous plans (IEA, 2022b).

On the contrary, renewable energy cannot be a solution to all the energy related issues in Europe, as at least until 2030, it is unthinkable to decarbonize energy generation completely. The challenge of moving to RES is not just in the production capacity, but also in its connectivity to the grid or in finding suitable storage. And although some solutions to those problems are on the table, like installation of solar panels on households which consume a part of the power and sell its excess, the implementation still requires time. Therefore, some other non-weather-reliant source of energy, like natural gas, is necessary. It is both for its balancing role and for its current importance in the residential and industrial sector (IRENA, 2022).

Therefore, in the following analysis, the author will collect data from various studies, trying to underline recurrent opinions and analyse some of the energy sources. This part focuses on providing considerations regarding current trends in the energy sector, highlighting existing projects and trying to explore several overlooked solutions for the goals outlined in EU energy policy. The main principles that will be followed are those outlined in the Energy Union Strategy thus, to find solutions to make energy secure, sustainable, and affordable for EU consumers. For this reason, aspects like price, measured by using the levelized cost of

electricity (LCOE), possible threats and benefits stemming from factors like location of the facility and GHG emissions of the source, will be taken into consideration. More than to provide recommendations, the author aspires to map the direction of the European energy sector and its road ahead, towards the pledges made for 2030.

Figure 5 - Projected LCOE by technology in 2025. Measured in USD/MWh. Source: IEA 2020



5.2. The role of different energy sources

5.2.1. Solar energy

Solar is the source of energy that has been for some time growing at the quickest pace inside the EU. In 2022 alone, solar power grew by about 50 % from the last year, generating in total 209 GW of power, which is roughly equivalent to 22.5 bcm/y of natural gas. The leading countries in total installations are currently Germany, followed by Spain, Poland and Netherlands, that together accounted for 27 GW of capacity in 2022 alone. This soar has various reasons and has been partly caused by the effort to replace shortage of energy during 2022, partly by extensive EU efforts to increase the deployment of renewables but certainly also by the decrease of costs (Frost, 2022).

As we could see from the table above, the LCOE in 2020 of solar power was rather low, however thanks to technological advancements and decline in cost of crystalline solar modules, the average cost of solar power decreased further. The LCOE of solar power in 2021 was around 48 USD/MWh, which is around 88 % drop during a decade, with expectations of decreasing further in the next few years. This makes solar energy currently one of the cheapest and most accessible sources on the markets. This is also because solar PV panels can be relatively easily installed on residential, public, or industrial buildings to generate energy, which is also highlighted in the Solar Rooftops Initiative (IRENA, 2022).

Example to that can be Germany and its state Bavaria, with cumulative solar PV capacity of over 19 GW in 2023. Over 40 % of total capacity was added through installations on the roofs here, whereas about a half of them was made on the ground. Compared to the rest of the country, this region is relatively sunny and is the leading one in Germany, largely contributing to achieving its ambitious solar capacity target of 215 GW by 2030. Furthermore, Germany is also planning to revive its once prominent solar sector, as the PV module production is now dominated by China (Lepesant & ifri, 2023).

On the other hand, the rooftop installations, important in Bavaria, are only a part of the story, as utility-scale plants are responsible for the largest chunk of solar PV capacity additions. This can be seen in the example of Spain, which is set to be one of the key engines of the EU for stimulating uptake of solar energy. A proof to

that is that Spanish company Iberdrola recently put into operation the largest solar plant in Europe, with a capacity of 590 MW. In future Spain plans to triple its capacity to reach 39 GW by 2030 and thanks to its vast territory and high number of sunshine hours it has the capacity to do that relatively easily. This is also thanks to large projects like Aragon solar PV park that is expected to add around 2.5 GW of capacity and is expected to be operational in 2025 (Carmen, 2023).

Germany and Spain are in fact currently the largest contributors to solar PV additions, and they are expected to be in the future years as well. Based on the outlook provided by analysis of SolarPower Europe, Germany and Spain, respectively, are expected to add about 63 and 51 GW of solar power into the system in the period 2023-2026. The market outlook for the solar additions is very positive and the cumulative solar PV scenarios range from the capacity of about 420 GW to 590 GW. This upper target is even 50 % higher above the interim REPowerEU target. This is largely due to speeded up permit granting in many countries, and faster possibility to install those plants and provide their connection to the grid (SolarPower Europe, 2022).

On the other hand, the analysis provided by the IEA pictures a completely different story. In their main forecast, the capacity of the solar PV is insufficient to meet the REPowerEU goals, as for 2027 it forecasts only around 396 GW out of 471 GW needed for the interim targets. To phase out Russian gas by 2027, the Union would have to speed up its solar energy uptake and address issues like insufficient policy support, permitting challenges or grid congestion. According to the same analysis, the EU would need to install around 60 GW of solar power in 2023 to address its goals properly. Despite the differences however, what is often addressed in both analyses, is the lack of skilled workers in the future (IEA, 2022f).

What seems to be a not-so-discussed solution to generate more power, is the external cooperation of the EU with other countries to provide for renewable energy. Although some European countries like Spain, Italy or Portugal, provide a good environment for solar panels, many of them have not ideal weather and special conditions. Solar panels in North Africa, on the other hand, have the capacity to generate multiple times more energy than on average in Europe and can be installed on large scale in infertile desert African areas. And although the

EU-Morocco Green Partnership was signed last year, being the EU's first partner country to do so, it seems that there is still much more potential (Pearce, 2023).

Compared to about €8,7 billion planned in EU total investments in Morocco by 2027, the UK for example plans to invest around $22 billion for submarine high-voltage cables and solar energy plants, that would respond to roughly 8 % of UK electricity demand. However, about half of this money would go to investments into the cables that would spawn under the ocean, this is a trouble that the EU could avoid, due to already existing grid connections of Morocco and Spain. And while there are ethical and environmental concerns regarding the construction of large utility-scale plants, there is possibility that North Africa, and more importantly the region of Maghreb, could play important role in the EU energy transition and help it reach its interim 2030 targets sooner (DG NEAR, 2023).

5.2.2. Wind energy

In Europe, the wind energy is currently the most used source of energy, with a combined capacity of both onshore and offshore wind farms reaching around 225 GW in 2022, representing roughly 24 bcm/y of natural gas. On the other hand, the trend of new instalments of wind farms seemed to slow down drastically in 2022. Based on the analysis of Wind Europe, the financing of new wind power was in this year lowest since 2009, which is an element that cannot be explained just by a price drop, especially since in 2021 the investments were more than two times higher. In 2022 therefore the EU installed merely a total of 19 GW, which is well below the 31 GW per year target that is needed to achieve the 40-45 % renewable energy target by 2030. Vast majority of these installations were done through instalment of new onshore capacities, since most offshore projects didn't reach the Final Investment Decision (FID) and were conducted by a handful of states (WindEurope, 2023).

Similarly, to the solar capacities the LCOE of onshore wind dropped drastically in the last decade becoming in 2021 the cheapest source of renewable energy. In Europe the weighted average LCOE of newly commissioned projects fell to 65 USD/MWh for onshore and as low as 33 USD/MWh for offshore energy wind farms. This drop in price was driven by technological advancements, such as larger turbines with longer blades, optimization of wind farm placement including moving them further from the shore, but also economies of scale. On the other hand, the installation of new farms in 2022 was becoming more expensive due to higher input costs and supply chain disruptions, amplified by the Russian invasion of Ukraine (IRENA, 2022).

Germany was unsurprisingly one of the leaders in expansions of wind farms also in 2022 installing about 2.7 GW of new capacity. Germany currently generates around 66 GW out of wind energy, having by far the largest share of electricity coming from this source in the EU. Furthermore, the government of Germany released an "Easter Package", one of its largest energy reforms in decades where it outlined the plan to install more than 10 GW of new wind power per year from 2025. Germany plans to make this possible through changes in legislation and defining RES as an overriding public interest, speeding up the permitting process (WindEurope, 2023 & BV Swagath, 2022).

In second place in new installations were Sweden and Finland, both of which installed about 2.4 GW of wind farms in 2022 each, while having combined cumulative capacity of around 20 GW. Sweden, as the Europe's biggest net exporter of electricity, is having ambitious plans for the new additions of around 15 GW that could become online before 2030. One of the biggest ones is for example the Aurora offshore wind farm that would be able to generate around 5.5 GW of energy, covering around 17 % of Sweden's electricity output (Tang, 2022 & WindEurope, 2023).

Based on some experts, for example Paweł Czyżak, senior energy analyst at the think tank Ember, the wind power might be the EU's most important technology for decarbonization, as it has a potential to be the cheapest source of electricity in many countries. Yet the EU falls short both on its final and interim targets, installing much less power than it needs both to cover for the losses coming from phasing out fossil fuels and to meet its climate pledges. For example, the regions of Central and Eastern Europe, namely the Baltic countries, but also Romania and Bulgaria need to step up their efforts, as wind energy is still largely underdeveloped there. Recommendations provided in these regions are to update NECPs of the states and aim for higher targets, as connecting the Baltic and Black Sea grid to existing one, is a viable and cost-effective solution. Based on the report of Ember, even historically fossil fuel reliant countries with not ideal conditions for RES, like Czechia, could largely benefit from increased ambition of new wind farms (Czyżak & Fox, 2023).

Another example where the EU could gain additional sources of energy are floating wind turbines, increasing considerably the sea area available and thus being an attractive project for countries like Spain, Portugal or Greece. The floating technology is currently in its pre-commercial phase, and for example France was experimenting with it last year, installing two farms in its seas. Although the instalments finalized in 2022 had very low power output, by the end of 2022, there were plans for around 48 GW of floating wind farms. The floating wind technology might be crucial for future decarbonization efforts as due to some reports, about 80 % of all offshore wind power lies in waters deeper than 60 meters. The cost of this technology is currently substantial, as its LCOE is around 250 USD/GW, which is multiple times higher than both offshore and offshore wind (Chestney, 2023). We

can however expect a drop in prices caused by the economies of scale and investments into this sector. In fact, the immense potential of this technology is expected to outweigh the high initial costs, but it is unlikely that the floating offshore wind farms will play an important role in EU's energy generation, at least not until 2030 (WindEurope, 2023).

5.2.3. Hydro energy

Compared to the previous two sources, energy generated through hydro plants has a long history, as it already played a significant role in the first half of the last century and contributed to industrial development. Significant increase of hydropower was seen after 2011, yet in recent years, the deployment of new capacity slowed down significantly. Since some years, the capacity has stabilized at around 250 GW, or around 650 TWh yearly, however unlike solar or wind energy this is very strongly influenced by hydrological situation. In fact, the power generated last year was the lowest in more than two decades due to extreme droughts across Europe, falling to 283 TWh, and thus less than half of its maximum capacity (HydroPower Europe, 2023 & Van Halm, 2023).

Although the global weighted average LCOE for newly commissioned hydropower projects increased slightly, they still were around 48 USD/MWh in 2021. The price of the electricity last year generated by the plants in Europe however might be higher due to the droughts striking this region and due to general rise in price of building materials. Compared to other renewable sources, the decrease in the popularity of hydropower is a phenomenon visible around Europe for some time. In fact, last year most newly commissioned hydropower projects was conducted in China, adding more than 20 GW in 2021, with Europe accounting for only about 4 % of total power added (IRENA, 2022).

In the EU the leading country both in installing new capacity and having the highest total capacity is Norway. Thanks to natural advantages Norway can produce hydropower very cheaply and with minimal emissions and environmental impact. In 2021 Norway added around 390 MW of newly commissioned plants, making its installed capacity equal to roughly 34 GW. With this, Norway can generate about 96 % of its total electricity demand just through this source of energy and export the potential excess of it abroad, thanks to its good interconnection capacity (International Hydropower Association, 2022).

Ranking second is France, where all the larger hydropower facilities are operated under state concessions. Although France is second in the EU and generates around 26 GW through hydropower, this responded in 2021 to only about 10 % of its electricity demand being covered through hydro plants, most of which is

covered through nuclear energy. For France both are important sources of energy for its decarbonization efforts, yet there does not seem to be much more potential in future for other hydro plants (International Hydropower Association, 2022).

Based on the report for the International Hydropower Association, there remains an untapped potential for hydropower in the future, especially due to the increasing role of renewable energy, further emphasized by the war in Ukraine. On the other hand, most of this additional potential capacity can be found on other continents, like North America, Africa, or Asia. Europe seems to have already depleted its capacity, as there seems to be only about potential extra 70 GW that could be harnessed through new hydro plants (International Hydropower Association, 2022). Therefore, although in 2021, this source accounted for around a third of total renewable electricity production, its importance seems to decrease in the next few years, due to the increasing role of other RES. This is not just because despite its nickname of “forgotten giant of clean electricity”, its potential in Europe is low, but also due to greater unpredictability, compared to other sources of energy. This can be seen in the case of Norway, which even though its electricity production potential is quite high, has concerns about its future security of supply, due to increased electrification but also increased risk of droughts (Mathis, 2023).

5.2.4. Hydrogen and synthetic fuels

With the ongoing war on Ukraine, the deployment of hydrogen and its role in partial replacement of fossil fuels has been discussed vividly in the EU. Hydrogen is promoted as alternative fuel and it is claimed that it could account for up to 20 % of energy or cover up to 50 % of the transportation needs. Although being the most abundant element on Earth, it is extremely rare to find it in its pure form that could be used as an energy medium, therefore there is a need for its production. The natural gas is currently the main source for hydrogen production, as it is used for steam-methane reforming that through high-temperature steam separates hydrogen from a methane source. Although this method is incredibly energy intensive and emits large amounts of CO_2, in the EU it accounted for 96 % of hydrogen production in 2022 (Cooper et al., 2022). In its hydrogen strategy however, the EU has pledged to produce 10 Mt of renewable hydrogen and import the same amount from abroad. This renewable form can be produced through a method called electrolysis which can use electricity generated through RES to split water into hydrogen and oxygen, thus theoretically both decarbonizing production and storing energy for later (DG for Energy, n.d.).

The cost of hydrogen production was quite volatile in the last year, as were the costs of gas and electricity. Taking into consideration the hydrogen produced by alkaline electrolysis, its price was relatively stable at around 150 USD/MWh, however that changed in 2022. That year the production of hydrogen using this technology reached prices as high as 750 USD/MWh, being multiple times more expensive than other alternatives at the same point in time (Market Observatory for Energy DG Energy, 2023).

The support of hydrogen technology in the EU stems mainly from the REPowerEU program, which also foresees a “hydrogen accelerator” to increase the uptake of the fuel in different sectors. Not only it expects that hydrogen will play a prominent role in energy-intensive industries and heavy-duty or long-distance modes of transport, but also that it could substitute some of the fossil fuels even in the use for households. The role of hydrogen was further affirmed by adoption of all twenty action points from the EU Hydrogen Strategy and 15 MS have included hydrogen in their Recovery Resilience Plans, with Germany, France and Italy being

the most generous with the funding. Furthermore, this strategy outlines the way how to stimulate the investments, boost demand and scale up production, but also how to construct a framework supporting this source of energy. That is because currently hydrogen cannot be delivered efficiently through existing infrastructure, due to its elusiveness and therefore currently the mixture of hydrogen and natural gas is promoted as an alternative that could reduce the dependence (DG for Energy, n.d.)

This is however problematic for several reasons, and that is not only because currently only about 5 % of hydrogen can be injected into the mixture. The major reason might be simply that it is too expensive and inefficient as a substitute due to its nature. The outlined process of using electricity to create hydrogen that would later need to be stored in special containers, in order to be used again to create energy can be considered as wasting the potential In addition, the widely spread usage of hydrogen for households might pose a security risk, due to the fact, that is flame is invisible and the gas itself is highly explosive Furthermore, the usage of so-called synthetic fuels in existing infrastructure might be considered as green-washing and actually worsening the dependence on gas. This is because hydrogen easily escapes through the pipeline into the atmosphere and the final solution of the synthetic fuel at the end of the supply chain is debatable (Lorenzoni, , 2023).

This creates an issue for several reasons and while the economic ones might be apparent, the environmental ones should be considered as well. Although there has not been a lot of research on the area, hydrogen leaks are often underestimated and can be a bigger problem than it seemed before. This is mainly because unlike its burning, which creates mostly water, its leaks in the pure form can cause environmental damage. Although additional research on the environmental impacts of hydrogen needs to be done, the current literature suggests that hydrogen leaks might prolong the presence of other GHG, like methane (Cooper et al., 2022). To avoid this, substantial investments into new infrastructure would need to be made all across Europe. Therefore, for hydrogen to be used as a decarbonization medium on a large scale there are several challenges that the EU would need to cope with first, and it seems that the price is just not worth it (A. Lorenzoni, personal communication, May 23, 2023).

According to prof. Arturo Lorenzoni, the sectors where hydrogen might have its benefits would be those that are hard to electrify. These include the traditional heavy industries that fabricate for instance building materials, and which require sources of high-energy density. Another important future use of hydrogen as fuel could be in aviation, maritime sector, long-haul freight, or public transport as otherwise outlined in the program Fit For 55. Here the hydrogen, as it is already in some cases, would need to be stored in special containers on the site, that would minimize its leaks through infrastructure. However, hydrogen use for either domestic purposes or personal transport, does not seem to hold as it would require substantial investments into the infrastructures, and it could pose more potential danger (Lorenzoni, 2023).

5.2.5. Natural gas

As was highlighted in the previous chapter, the role of gas and particularly its pathways, has been completely re-examined after the beginning of the war in Ukraine. The pledge of the REPowerEU to phase out of Russian gas from 2027 and a plan to slash its imports by two thirds by 2023, have in fact been defining points of the European energy policy. LNG, which became an important instrument to fill the security stockages of countries, became imported mainly in the second half of 2022. That was due to different factors, but the explosion of the Nord Stream pipeline, at the height of gas refilling season, was surely the deciding one to drive the LNG demand in the last quarter of 2022. During this period the Russian imports fell by 74 %, compared to the last year, while the imports of LNG were up by 89 % at an amount of 32 bcm/y, with USA being the main provider (Market Observatory for Energy DG Energy, 2023).

Although the LCOE of natural gas was about 40 USD/MWh on average in 2021 worldwide, the European prices in 2022 skyrocketed. Especially at the end of August, when the prices rose to all time high and the Dutch TTF spot reached a price of about 340 USD/ MWh. In the following months, thanks to the strong signals from the EU, and the willingness of the states to reduce demand, gas wholesale prices started to decrease. In summary based on the newest data, the average price for European households in 2022 was around 120 USD/MWh. It is important to note, that there were considerable regional differences as for example the price for natural gas in Sweden was almost ten times as high as its price in Hungary in the second half of 2022. Currently the gas prices are down, as for example the LNG is traded for prices as low as about 28 USD/MWh. If there is something to be stressed about the price of gas in the last year and a half, it is its volatility that was caused by high demand, yet relative scarcity and instability on the market. All these aspects have driven prices of the other energy sources to heights that haven’t been seen before (Market Observatory for Energy DG Energy, 2023; Eurostat, 2023).

Figure 6 - Daily traded natural gas price during the period September 2021 - May 2023. Measured in EUR/MWh. Source: Dutch TTF

When it comes to the structure of LNG imports and its amounts in 2022, these can be found in the previous chapter. It is important to say however, that the EU imported over 130 bcm/y in the last year, out of its total consumption of around 360 bcm/y, therefore LNG is set to be an important way to meet its demand. The current capacity of about 160 bcm/y and this number is supposed to increase drastically by 2030 due to new projects, many of which will become operable by the end of 2023 (Holbrook, 2022).

Germany, as historically the largest importer of Russian gas, was last year unsurprisingly also among the top importers of LNG. Furthermore, the country plans to enlarge its capacity significantly in the following years turning to floating storage and regasification units (FSRU) as an answer for its demand. A total of 10 FSRUs are planned to be deployed until 2030 to reach a maximum capacity of about 70 bcm/y. Many of those units are already online and others are planned to be operated by the end of 2023 (Senior, 2023).

Spain already has an immense capacity of LNG terminals amounting to about 60 bcm per year, or more than one third of the whole EU. It is therefore

logical, that imports of LNG to Spain increased vastly and in 2022 Spain was second only to France which overtook it, despite smaller capacity. The current maximum capacity of France is around 36 bcm/y and unlike Spain, it plans to expand it extensively, mainly through maximizing potential of existing terminals. Italy has been also working extensively to replace the delivery of Russian gas and has thus plans to enlarge its LNG facilities too (Market Observatory for Energy DG Energy, 2023). From its current capacity of 17 bcm it aims for 27 bcm in near future, and the newly added FSRU in Piombino is the first step towards it. Lastly, very important countries to consider are also UK, Turkey, and Norway, all of which are closely linked to the EU gas market and have considerable regasification infrastructure, which they also plan to enlarge soon (Cooper, 2023).

All of the LNG infrastructure and ambitions for its expansion surely have the aim of attaining greater energy security and independence, however it is debatable, whether these efforts will actually deliver. In his speech, prof. Arturo Lorenzoni warns against the trend of commissioning new LNG infrastructure in the EU, as its market and its policies count with gradual phaseout of gas. Building new LNG capacities and creating new links of reliance on foreign fossil fuels, that have demonstrated to be extremely volatile, might not be the ideal way to pursue the goals enshrined into the Energy Union (LEDS - L'Energia Degli Studenti & Lorenzoni, 2022).

This argument is further supported by different analyses, as for example (IEEFA, 2023) confirms that we will reach an import capacity of around 400 bcm/y by 2030 and quite possibly even by 2025. Taking into consideration that service life of newly commissioned LNG terminals reaches up to 50 years, to fully exploit their capacity, the EU would still have to use gas for a large part of its electricity generation until about 2070. This is clearly not the case, as if we believe that the economy can be decarbonized by 2050, it seems completely illogical to commission so many of these projects. Furthermore, if we consider also that the gas imports in the EU dropped by about 17 % in 2022 compared to previous year, a trend which is likely to continue thanks to energy efficiency measures, we will soon get to a situation where a large part of our gas capacity will remain unused. IEEFA confirms this also in their analysis, where it concludes that the estimated LNG demand in

2030 will likely range between 150-190 bcm, therefore leaving more than half of the capacity unused (IEEFA, 2023).

On the other hand, saying that the extensive expansion of terminals seems futile, does not mean that LNG will not be important for EU energy demand in near future. In fact, it seems that with decreasing production of natural gas in Europe yet still relatively high demand for it, the LNG imports will be crucial to cover a big part of total energy demand. This is especially true in the winter 2023, where in case of unfavourable conditions, Europe might potentially need all the gas capacity available. There are for instance doubts that the economic restart of China and its demand for LNG, or exceptionally hard winter might cause a shortage of gas. These worries however don't seem to be backed by recent market signals, as most of the EU gas storages were left filled to an amount that is usually reached only months before the winter starts, thus giving the EU a good head start. This fact combined with unusually low prices seems to indicate that filling the remaining storage for winter 2023 should not be such a big problem, as sometimes claimed (A. Lorenzoni, personal communication, May 23, 2023).

Finally, it is important to underline that with rather extensive existing infrastructure, trends confirming drops in energy demand in future years and increasing role of renewable energy, it seems that over-fixation on LNG does fulfil the main aims of the Energy Union. And despite the undisputed advantages of LNG in the short term, the goals of clean, affordable, and sustainable energy for EU citizens could be attained more effectively than through building other links of reliance on potentially scarce and volatile fossil fuel. The reliance on LNG is especially considerable, if we account for the substantial emissions and leaks of methane into the atmosphere, that are higher than in the case of shipping natural gas in its gaseous form (Swanson & Levin, 2020).

5.2.6. Oil and coal

Oil and coal are two of the most emitting conventional sources of energy available on the market and have been for a long time the ones that the EU wants to phase out from. This was further supported by condemnation of Russia's war on Ukraine, as the EU is largely dependent on import of those fossil fuels from Russia. In the EU's fifth and sixth sanction package, both the coal and oil import embargoes were applied cutting the coal imports from August 2022. For oil the situation was similar as the crude oil import stopped from December 2022 and refined oil products from February the subsequent year, cutting the oil imports from Russia by 90 %, with the remaining 10 % exempted from sanctions until the end of 2023 (*European Council,* 2023).

Russia's actions and measures adopted by the EU left Europeans particularly vulnerable, as all 27 states are net energy importers with limited capacity to increase fossil fuel production. The price of coal, in particular, skyrocketed in 2022 and if the estimates for LCOE from coal in 2021 were around USD 215/MWh at a price of coal at about 110 USD/T, then we can conclude that in the next year when the price of coal was often over USD 350/T, the LCOE of goal was much higher (TRADING ECONOMICS, n.d., & European Commission, 2022e). This is true similarly for oil, which unlike coal is used primarily in transportation and not energy generation. This commodity did not experience such a surge in price the last year and the price of crude oil despite its initial spike, declined significantly since summer (Eurostat, 2023b). Now the prices of both commodities are stabilized to approximately pre-war levels.

The structure of the countries exporting both fossil fuels to the EU diversified significantly during 2022, in its effort to phase out Russian imports. When we compare for instance imports of oil during the first and fourth quarter of the year, we can see that Russia's share dropped from 26 % to about 10 %, with countries like the US, Norway and Kazakhstan getting more important (Eurostat, 2023b). As the coal imports from Russia were slashed during the 2022, making the share of them around 18 %, compared to 44 % in previous year, other countries made its way to be more prominent imports into the EU. For the West of the EU, for instance, the countries like Colombia, South Africa and Mozambique, but also USA and

Canada became much more important during the last quarter of 2022 and the beginning of 2023 (Argus Media, 2022).

The role of both commodities and their importance has also changed in 2022 and it is debatable how important they will be in the next few years. Germany, for instance, has increased its hard coal-fired available capacity significantly since the beginning of the war, to compensate both for shortage of gas and its long-planned nuclear phaseout (Brown, 2022). Other countries, such as Netherlands, France or Austria announced in 2022 their plans to fill their gas storages as soon as possible, diverting gas from electricity generation there and partly replacing it with electricity generated through coal combustion, resulting in highest share of coal in energy mix since 2018 This trend however does not seem to last as already by the end of 2022, the coal generation dropped across the EU significantly and the MS are still on track to phase out coal until 2030. To conclude this, based on EU climate pledges and the recent market developments, it does not seem that coal will play an important part in the future energy mix. What might be a role of coal in the next few years to come is its potential balancing role in case of gas shortages. As many of the coal units were brought back as a standby emergency addition, it is highly probable that they will be temporarily used if needed (Jones, 2023).

When it comes to oil, we could see that in 2022 many alternative countries have stepped in as a “friend in need” helping the EU to bridge the gap of Russian supplies. The future of oil however does not seem to be as clear as the one of coal, due to potential problems with transformation of infrastructure and with the supply chain of oil. The latter, for instance, is caused for instance by mismatch between EU willingness to commit to long-term contracts, such as in the case of Qatar or Norway, and the interests of the exporting states. Different issue, yet still connected to the supply chain might be in the case of Kazakhstan, as 90 % of oil exports from this country in 2022 led through Russia (Kardaś, 2023b).

On the other hand, the phase out of oil to decarbonize the economy is another issue to tackle. Although the EU has recently presented a stance before the COP28 to push the fossil fuels phase out well before 2050, it was not followed with clarification on how it intends to do so, with the biggest issue here being the transportation sector (Abnett, 2023). Despite the legal obligations to produce and sell only zero-emission cars from 2035, and decreasing their emissions by 55 % by

2030, the search for alternative fuels, engines and infrastructure remains a great challenge, not just for the automotive industry (Haahr et al., 2023).

5.2.7. Nuclear energy

Energy generated through nuclear fission, currently the only viable way, has been a subject of vivid debates and divides both European society and its stakeholders due to doubts about its safety. The most iconic example is the diametrically diverse approach of Germany and France and while the former has decided to phase out nuclear energy already in 2011, the latter relies on it for a large part of its decarbonization efforts. The trend of the decreasing share of electricity generation through nuclear fission, that has been in the EU for the past twenty years, points out that many MS decide to move away from this technology. In addition, the electricity generated last year through this source dropped rapidly as many of the reactors across French territory were shut down for maintenance reasons, aggravating the energy crisis (Frost, 2023).

With regards to the price of generating electricity, there don't seem to be many changes throughout the years, and the LCOE of nuclear energy in the EU has been rather stable (DG for Energy, 2020). Both based on the research conducted by Trinomics, under the DG for Energy and one done by the IEA (2020), the LCOE in the EU has been around USD 70-80/MWh in the past years. And although this is higher than most other low-carbon technologies, when compared to other fossil fuels it seems to be lower and less prone to price increases, also due to better diversification of suppliers already prior to 2022 (EURATOM, 2021).

As was stated above, when it comes to support of nuclear energy, the situation in the EU is rather ambiguous. While approximately 13 members who are using nuclear energy in their energy mix welcome inclusion of this source between clean energy sources, others oppose it, pointing out mainly the security threats. This was perceived also during the debates for RED III and bargaining for the position of nuclear, which ended up being classified as neither renewable, nor fossil fuel energy. The efforts for labelling nuclear as green were led mainly by France that pushed hard on including hydrogen generated through nuclear energy to meet its climate goals (Gavin & Jack, 2023). However, one undoubtable issue with nuclear energy in the EU is the aging of its fleet, which should be reduced by one third by 2025, due to the end of lifespan of many reactors. Furthermore, newly built

reactors are extremely rare and the only one that has been built in over 15 years is Olkiluoto 3, in Finland, finishing its construction after 18 years (Lehto, 2023).

On the other hand, there are still countries that rely heavily on nuclear power to generate its electricity and either plan to keep its fleet, or even expand it. The stance of France is the most iconic, since with its nuclear fleet of 56 reactors, France generates more than half of the nuclear energy in the whole EU. Furthermore, the approved nuclear renewal plan to accelerate construction of six to eight new reactors with the works starting as soon as in 2024, indicates the direction of French energetics towards 2030. Considering though the French pledge to decrease share of nuclear power in their energy mix and increase the share of RES to at least 50 % by 2035 the expansion seems counterintuitive. Especially considering the indications of willingness to prolong lifetime of existing reactors with efforts deployed to construction of new ones. It will therefore be interesting to see how the NCEP of France will change in 2023 and how will it combine its increasing dependence on nuclear energy with its renewable energy pledges (IEA, 2021b).

Other EU countries also plan to keep or enlarge their nuclear fleet to make their ends meet and one of those is Finland that has recently connected to grid a new reactor. This plant, however, has taken 14 more years to construct than planned, and required around three times as much time as estimated (Lehto, 2023). At the same time, the countries of V4 also plan to construct multiple plants to either replace the old ones or step up their decarbonization efforts by phasing out coal and supersede it with nuclear. The Czech Republic, for instance, is planning to build two to four new reactors and the tenders for some of them are in the final phase. However, these projects have encountered a harsh critique as even in its initial phase they are extremely costly. It is estimated that even a construction of one reactor will be the most expensive project of the Czech state in its history (IEA, 2021a & Kubátová, 2023).

Apart from the expansion of large-scale nuclear fleets in the EU, there are two technologies that might be the future of nuclear energetics as they should be versatile, fast, and cost-efficient. The first of them is so-called long-term operation (LTO), which is a technique of prolonging the lifetime of an already existing reactor, eliminating the construction costs and the administrative burden that often prolongs the launch of the reactors. LTO is currently among the cheapest sources of energy

available, having its LCOE at around USD 30/MWh and at certain points beating even offshore wind (IEA, 2020). Countries considering this technology are multiple, among which France is unsurprisingly dominant, planning to prolong the lifetime of its 56 reactors up to 80 years. However, this technology could be extended to other plants as well, as both the PWR and BWR[8] that are planned to be decommissioned, could use LTO to keep them in operation (Pécout, 2023 & IEA, 2021b).

Another technology that has been on the table for a long time are so-called small modular reactors (SMR)[9]. Smaller nuclear plants that can be built on which would be inconvenient for larger plants and be easily connected to the grid seem to be a fitting complement for EU decarbonization efforts. In fact, the recent declaration (EU SMR 2030, 2023) proves the political will to support development in this field, that besides underlining the role of SMR in the EU energy mix, also presented a funding opportunity to submit a working design of these reactors. To give an example of SMR development in the EU, Poland has so far announced seven locations for this type of reactor, each having a capacity of 300 MW. If this type of technology is developed in the EU, not only it could provide an affordable source during inconvenient times, but also boost its energy independence (Reuters, 2023). At the same time, it is necessary to ensure that the EU will not build extensive dependence on US technology and nuclear fuel, which is currently the main trade partner for this technology, as this would impair one of the main benefits of this technology.

All things considered, it is rather foolish to think that countries such as Germany or Austria will ever go back to nuclear, considering their stance towards this technology and current development of RES. On the other hand, there is still a great potential for nuclear energy on the way to decarbonization, as with the use of modern methods, MS could avoid most of the negative effects usually connotated with this technology. Both the LTO and SMR are novelties that could bring down not only the environmental, but also the financial costs of nuclear energy, while keeping the undisputable advantage of high energy density, that make it suitable for instance for heavy industry (IEA, 2022b).

[8] Pressurized water reactors (PWR) and boiling water reactors (BWR) account for the vast majority of nuclear reactors built in the EU (Eurostat, 2022).

[9] Small modular reactors are advanced nuclear fission reactors usually with capacity up to 300 MW (EU SMR 2030, 2023).

6. Conclusions

This thesis has attempted to map out the energy relations of the European Union with particular attention to its Eastern dimension, with the Russian invasion of Ukraine being its decisive moment. However, as policy change is often a gradual process that may be stimulated by both internal and external actions, the author aimed to provide a general historical background of energy relations between the EU and Russia to illustrate how they affected the EU's energy policy pathway. This analysis has shown how complex the development of European energy policies has been over time, and how their internal and external dimensions were intertwined with one another. There have been indeed some important lessons to be learned about the past external conflicts and their impacts on the European energy market.

Since the early years of European integration, the EU has gradually developed a comprehensive structure for joint energy and climate policies. Over time, the EU has acquired more competence in the energy sector, leading to the implementation of extensive legislation and commitments related to energy and climate since the 2000s. Notably, the first two energy packages and the Kyoto Protocol have significantly contributed to the growth of the energy partnership between the EU and its eastern counterparts. This development was mostly driven by a growing preference for gas as a fossil fuel, owing to its relatively lower emissions, abundant availability, and competitive price. As the EU's gas consumption has increased, so has its reliance on Russia and this was made possible by the accession of several Eastern European countries into the EU in 2004, which granted the bloc improved access to well-established gas infrastructure.

However, the EU's increasing reliance on Russian gas combined with a decline in gas production and a growing consumption posed a significant vulnerability to potential supply disruptions. While previous shortages in 2005 and 2007 prompted the adoption of an energy efficiency action plan and highlighted the importance of energy security, it was the 2009 gas crisis that truly impacted Europe. This crisis caught many countries off guard, revealing the weaknesses of the internal energy market and raising doubts about the reliability of Russia as a trade

partner and Ukraine as a transit country. The EU was ill-prepared for such a severe shortage, leading to the implementation of the Third Energy Package in 2009. This package aimed to diversify supply routes and supplier structures while establishing safety measures such as UGS, increased interconnection capacities, and LNG terminals. These efforts proved crucial when compared to the 2014 gas crisis, as the latter was not as detrimental due to these implemented measures and other contributing factors.

The Energy Union was established in 2015 in response to the previous crisis, introducing five dimensions to attain the established energy policy objectives of the EU. This document underwent several subsequent amendments. However, it was through the implementation of the "Clean energy for all Europeans package" that the EU's energy policy underwent significant transformations, as it introduced or revised specific objectives across various areas of energy policy. It is also important to note the initiation of National Energy and Climate Plans (NECPs) and national long-term strategies, which serve as essential tools for monitoring the progress of countries towards climate neutrality and tracking the advancements of Member States (MS) in energy and climate policies. On the other hand, despite the EU's efforts to enhance the integration of these two issues and lay the groundwork for future policy development and relationships, substantial changes, particularly in energy security, have not been achieved. One notable example is the natural gas supply chain, which remained largely unaltered from 2015 to 2021. Europe continued to import nearly identical amounts of gas from Russia, disregarding its claims to reduce dependence.

This became important in 2022, as we could see that the disastrous war in Ukraine has also had an intense impact on the situation in the EU, as the MS found themselves paying a hefty price for years of building energy dependence on Russia. Since the war began, however, the EU has managed to decouple most of its demand from Russian imports, which have been crucial for it until then. And although the sanctions are not yet complete and based on some estimates the EU might end up paying about €30 billion for its fossil fuels imports from Russia next year, this amount decreased dramatically from around €140 billion during the last year (Demertzis & McWilliams, 2023). As explained above, a combination of policy actions leading to a massive diversification of energy suppliers, improved energy

efficiency and a surge in own sources of energy helped to radically cut dependence on Russian imports. And while this trend is likely to continue in the future, the bloc will have to face a series of challenges to restructure its energy landscape (Demertzis & McWilliams, 2023).

The invasion of Ukraine has also created an ideal policy window for boosting EU energy and climate goals in many areas. RES was given a major push as a source of energy that can lead to greater supply independence, help reach the climate pledges and provide affordable electricity to households in the EU. The massive projects that have been already constructed since the war started or are planned to be finished by 2030 in countries like Germany or Spain give an idea about the structure of EU energetics in the years to come. On the other hand, not all members are as keen to boost the share of renewables in their mix, for instance, France is still lagging, despite its potential (Mouterde, 2022; IEA, 2021b).

But the increased uptake of RES is hardly the only issue that the EU will have to cope with soon as problems with storage, transmission, and utilization of electricity arise. For this reason, there will not only be a need both for investments in these areas but also for alternative sources of energy to bridge the period until the EU energy generation and usage can be fully decarbonized (Lorenzoni, 2023).

One of the key factors in achieving a successful transformation will undoubtedly be political action and the support of measures to accelerate transition efforts. A crucial legislative revision to monitor is the Renewable Energy Directive (RED III), which will classify renewable energy projects as being of paramount public interest and will specifically target technologies for short-term solutions (Widuto, 2023). This revision would build upon existing legislation and further facilitate the expansion and adoption of renewable energy by expediting the permit granting process, particularly for solar installations, heat pumps, and grid expansions (European Commission, 2022f). However, additional policy measures are required to fully complete the transition process, particularly in the areas of the Emissions Trading System (ETS) and its extension to other sectors, supporting solutions for transforming the transportation sector, and revising the electricity market in the EU (Widuto & EPRS, 2023).

Among the major challenges of successful energy transition and the gradual phaseout of fossil fuels, one of the most important, yet rarely debated is the

electrification of the energy supply chain. This process however calls for substantial and timely investments in power grid optimization and expansion. The EU has currently set an objective of a 15 % electricity interconnection target by 2030, meaning that each country should have in place electricity cables to export at least 15 % of its production (European Commission, 2019). As many countries have already surpassed the objective, it seems fitting that more ambitious targets are set, especially as some regions would require much higher numbers. To effectively reach better energy independence the report from WindEurope suggests multiple viable actions, such as planning the RES installations and grid expansion simultaneously or applying the decision-making at the EU level as it is a question of European energy security (WindEurope, 2022).

Getting electricity from where it is produced to where it can be consumed is the most cost-efficient way to decarbonize the economy. This is certainly also recognized by the EU but is far from being successfully implemented. As demonstrated in the recent EU action plan about digitalizing the energy system. Here the Commission estimates that around €584 billion will need to be invested in the period 2020-2030 into the electricity grid, the majority of which will need to go into the expansion of the distribution grid. A costly grid modernization is therefore ahead and whereas the European super grid is likely to be finished soon, it is just an instance of a project to be followed and not the final solution to the construction of a functional transnational distribution network. Furthermore, the declaration signed by ENTSO-E and EU DSO Entity in late 2022, to create a virtual model of the European electricity grid is an important stepping stone for developments in this area that will play a great part in energy transition (European Commission, 2022).

Successful and sufficient electrification is an important predisposition for many other areas that the EU needs to tackle to reach its climate objectives. One of those is, for instance, energy efficiency which can be greatly enhanced by the increased rollout of heat pumps that are multiple times more efficient than regular gas boilers. These are great technologies to help decarbonize the heating and cooling sector which accounts for roughly half of all energy consumed and runs predominantly on fossil fuels. The EU has recognized this and plans to deploy about 30 million heat pumps in the period 2020-2030 to increase energy efficiency. But there are multiple hurdles to overcome as well, that regard the high upfront cost of

the technology, worsened by the need for better insulation, lack of skilled manpower, or the need for better pricing mechanisms, all of which could hinder the quick deployment of heat pumps in the EU (Farrell, 2022 & DG for Energy, n.d.)

While renewable energy sources (RES) and sufficient electrification are crucial for the future European energy landscape, a significant challenge that needs to be addressed is the storage of energy during periods of abundance for use during periods of need. The determination of the ideal storage capacity will be essential in decarbonizing not only residential and commercial usage but also sectors like transportation. A wide range of technologies is being considered, including traditional lithium-ion batteries, thermal energy storage, and advanced supercapacitors, each with their potential applications in different sectors (Kebede et al., 2022). It is crucial to develop and deploy these capacities, along with others, on a large scale if we are to envision a future with a decarbonized economy. However, until that is achieved, there will still be a significant demand for other energy sources with different qualities that offer greater flexibility, ease of use, and higher energy density (De Rosa et al., 2022).

This is most easily covered by fossil fuels combustion, which are however highly emitting, and as recent events have shown, a highly volatile commodity. But even though the path to climate neutrality is set, fossil fuels will still be important sources of energy in the near future. Oil will still play a dominant role in the transportation sector; gas will remain to be heavily used in heating and many MS will require quite some time to replace coal as well. This means that although rapid developments in RES and electrification are expected, the EU and member states should continue fostering good energy relations with other countries (Kardaś, 2023b).

This is particularly applicable to gas, which currently plays a vital role in ensuring energy security, especially in the upcoming winter of 2023. In the short term, Europe not only needs to reduce its energy demand but also ensure the availability of various delivery routes to mitigate the risk of gas shortages (IEA, 2023a). The phasing out of Russian gas could only be feasible if there are sufficient supplies of viable alternatives, either through underground pipelines or LNG shipments. However, there is a growing concern about the potential overbuilding of

Floating Storage and Regasification Units (FSRUs) and other capacities that are likely to remain unused even before 2030 (IEEFA, 2023).

For the mentioned reasons other technologies such as different nuclear reactors and forms of hydrogen have come into the light, as both of those sources of energy have their applications and could very well serve the purpose of complementing RES while keeping the emissions low. On the other hand, further research has to be done to better assess their impacts and suitability. Hydrogen seems to be a promising technology however besides better investigation of leaks incurred in its supply chain, its applicability for the commercial market should be evaluated as well, since the potentially needed infrastructure investments might increase its already high costs. As far as green hydrogen is concerned, alternative sources of storage and utilization of excess renewable energy should be assessed as well to correctly evaluate its applicability (Cgep, 2023). Moreover, nuclear power seems like an ideal option to cover the electricity shortages in the periods of low output of RES and could provide low-cost electricity and be connected to already needed grid expansions. Here it is important to underline, however, that rollout on SMR and LTO should be preferred instead of typical nuclear reactors, as they could not only cut the financial and environmental costs, but also diminish the doubts of the vocal critics of nuclear power (EU SMR 2030, 2023). To make this possible, substantial political support would be required, accompanied by impact assessment of the specific projects.

To sum up, the European energy landscape has changed rapidly after the war in Ukraine started and will continue to do so. The EU on its way towards better energy independence should gather every possible alternative to Russian hydrocarbons, and especially its gas. On the other hand, replacing reliance on fossil fuels from one country to another, does not seem an ideal way to achieve the goals enshrined into the energy union. And whereas the relations with other countries that are currently crucial for European energy security should be fostered, the EU should be careful not to lock itself in long-lasting energy contracts and other interests than only financial should be considered (Kardaś, 2023).

Whether it is due to the whim of a superpower, genuine scarcity in the markets, or a combination of both, the conflicts between Russia and Ukraine have taught us a valuable lesson: reliance on external energy sources can come at a

high cost. Examining the consequences of the 2014 conflict serves as an example, where the EU opted to diversify its energy supply routes but not its imports or energy mix. Only now can we truly comprehend the impact of those decisions. With the Russian invasion of Ukraine posing perhaps the greatest threat to the EU's common energy policy, the Union is once again confronted with a significant challenge, and the ramifications of its current choices will be evaluated in the years to come.

Thus, not only the experience of past gas disruptions but also the ideals of the Energy Union should serve as a reminder in constructing new energy policies and partnerships. Hence, as many experts agree, to create true energy independence and reach its climate targets, Europe should focus primarily on building its capacities and infrastructure to minimize the risk of energy disruptions (Lorenzoni, 2023; Kardaś, 2023; Brown, 2022). And while the energy will remain a matter of individual MS, the EU should deploy maximum capacity to support the cross-border energy infrastructure investments as one of the instruments that help building a truly functional internal energy market.

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