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Priorities and challenges of the EU energy transition: From the European Green Package to the new Green Deal

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Abstract

As decarbonization and climate policy are gaining relevance in the European Union (EU) energy policy, the present paper seeks to present both priorities and challenges for of the EU energy transition. As priorities, we outline the key targets and initiatives proposed and set by the European institutions in relation to the energy matters. The EU identifies renewable energy sources, energy efficiency and reduction of the greenhouse gas (GHG) as the three pillars to achieve its carbon neutrality. The final goal for the EU energy and climate targets is to achieve climate neutrality by 2050. Nevertheless, since given energy policy is being a “shared competence” between the EU institutions and Member States, each Member State plays a critical role for the achievement of the EU energy transition. Different socioeconomic structures and the energy mix across Europe have caused the implementation process of each EU target to develop at a different pace among European countries. We illustrate this drawing on four countries: Italy, the UK, Germany and Poland. We assess their political commitment to the energy transition and their actions regarding energy transformation. These four countries are only an example of the different pace in the implementation of the EU energy and climate targets. The last part of the paper is devoted to the ambitious plan, called Green New Deal, launched by the present Commission President, Ursula von der Leyen. It sets key priorities, reaffirming European commitments to the energy and climate transition. However, the plan faces significant obstacles. For example, division among Member States (North-South and West-East) might be a factor that could undermine the achievement of the European energy transition, due to multiple and divergent interests (also on the future role of the energy transition in the aftermath of COVID-19 and the resulting economic crisis). Another challenge is constituted by popular opposition, especially from those people that see the energy transition—and consequent economic and industrial transformation—as a potential threat to their well-being and jobs, as the French *gilets jaunes* show. Lastly, we explain that the European energy transition will impact also its external relations, for

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example with Russia, proposing how the two blocs can preserve their energy relationship in light of the energy transition, notably through the conversion of natural gas to hydrogen and storing/using the resulting CO₂.

Keywords: European Union, energy policy, climate policy, decarbonization, energy transition.

JEL classification: N54, Q48, Q54.

1. Introduction

Decarbonization and climate policy have gained a new momentum in the public debate around the world, especially in the European Union (EU) which has declared its strong commitment to take the lead in this global energy transformation. The need to achieve a low-carbon future and reduce greenhouse gas (GHG) emissions to zero by mid-century is becoming a pressing issue for European policymakers.

At the beginning of the European integration process, the European institutions focused more on energy security and competitiveness. But later, climate change and sustainability has become more relevant to European energy policy. Especially, the need for the world's decarbonization—thus the need of a global energy transition—has become to appear globally in the 1990 following the 1992 “Earth Summit” in Rio de Janeiro and the 1997 Kyoto Protocol, which set the international framework for the world's climate agenda. Since then, climate change—thus energy issues—has gained more and more relevance in the global (and European) political agenda. A call for action was reiterated by two international documents, which stressed the pressing issue of global warming: the 2015 Paris Agreements and the 2018 Special Report of the Intergovernmental Panel on Climate Change (IPCC). The 2015 Paris Agreements emphasized the urgent need to “hold the increase in the global average temperature to well below 2° C above pre-industrial levels and pursuing efforts to limit the temperature increase 1.5°C above pre-industrial level.” The goal set by the Paris Agreement was to reduce greenhouse gas emissions to zero. The EU actively participated at the negotiations and was among the signing parties. A further call for decarbonization actions was made by the most recent 2018 IPCC Special Report on Global Warming of 1.5°C, which claimed that achieving the 1.5°C objective will require a significant drop in GHG emissions of about 45% already by 2030, and zero net emissions in 2050.

Given the great concerns over climate change and global warming, the EU expressed its serious political commitment to tackle the issue, setting numerous targets on energy efficiency, renewable energy sources and reduction of GHG emissions. These targets highlight the key priorities for the EU. However, some targets are more likely to be reachable than others. Indeed, there are some challenges that need to be faced, both at the European level and the national level.

This paper is divided into six sections. After Introduction in the second section, we highlight the role of energy in the creation of the EU and the different approaches used by the European institutions in relation to energy matters over these years. Then, in the third section, we represent the main target and initiatives set and proposed by the European institutions in recent years with the precise goal of reaching carbon neutrality by mid-century. This part will also be devoted to

the ongoing implementation developments, both at the European level and national level. The fourth section will highlight the current development of the transition in some Member States, namely Italy, the UK, Germany and Poland, underlining the different speed of the transition among Member States. The fifth section will focus on the importance of coal in the European energy and economic system as well as potential challenges in the phase-out for some Member States. The sixth section will be devoted to the New Green Deal, released by the last European Commission (EC) at the end of 2019, highlighting the key features of the plan and its ambitions. In conclusion, the paper highlights the potential consequences of the EU energy transition for its external relations, namely with Russia, and how the two blocs can preserve their energy relationship.

2. Energy at the center of the European integration

Since the end of World War II, energy has been an important topic for the European continent and the process of its political unification. The history of the EU formation and integration can be divided into three phases related to European approaches to energy: initially it was focused on energy security; then since the late 1980s it was focused on free and fair competition in the internal energy market; and lastly, since the mid-2000s, the focus has been on sustainability and climate policy.

The European integration started with the creation of the European Coal and Steel Community (ECSC) in 1951, whose main goal was to deal with production of coal—the main energy source for European countries in those years. A few years later, in 1957, European countries created the European Atomic Energy Community in the aftermath of the Suez Canal crisis. These first steps provided for a common policy with specific tools based on supranational powers vested in a European authority.

In the following decades, the European activities were about energy security and competitiveness. In the 1980s and 1990s, the European Commission mainly worked on European internal energy market issuing several directives, pursuing competitiveness in Europe through the liberalization of the energy markets. Another key pillar of the European energy policy is the security of energy supply, mainly driven by the high import dependency on external suppliers, among which Russia is the largest.

However, the European Union lacked an overarching legal basis and a common energy policy for dealing with energy issues. An important decision on this issue was taken in October 2005. Indeed, the concept of introducing a mandatory common European energy policy was only approved at the meeting of the European Council. This concept led to the publication of the first policy proposals, entitled *Energy for a Changing World*, published in January 2007 by the EC. The document was driven by the need to set a benchmark on which to measure progress in leading Europe's energy economy towards sustainability, competitiveness and security supply, proposing seven Action Plans on key topics to achieve it.

Another milestone for the European energy policy is the Lisbon Treaty. With the Treaty, amending the former treaties which comprise the constitutional basis of the EU, energy emerged substantially as a “shared competence” in European policy between the European institutions and Member States. The treaty was

signed by the EU Member States on December 13th, 2007 and entered into force on December 1st, 2009. The three goals of the European energy policy are laid down in the Lisbon Treaty:¹ competitiveness (internal market, interconnections, European electricity and gas network); security of supply (diversification, European stock management of oil and gas, refining capacity and energy storage) and sustainable development (renewable energy, energy efficiency, emissions trading).

3. The European targets to tackle the new global urgency: Decarbonization

Following the great efforts and commitments regarding the security of energy supply and its competitiveness, the EC has turned its attention and activities to today's one of today's the most pressing global issues: decarbonization. As mentioned above, several international agreements and documents highlighted the importance of tackling the disrupting effects of increasing CO₂ emissions as well as the need to decarbonize the world's economy, energy system and society. Since the 1992 Rio Earth Summit, held in Rio de Janeiro, climate policies have played an increasingly important role in European energy policy-making. The urgency for a transition of the world's energy systems is driven by the disruptive consequences of climate change and global warming. In the efforts to contain the damage of climate change as well as reverse the process, the EU decided to tackle the GHG emissions through several policies and targets. Back in 2009, the EU was the first to set ambitious energy and climate targets with its 2020 objectives launched in the “Green package—A European strategy for sustainable, competitive and secure energy” (EC, 2006). This package set three targets, commonly known as “20–20–20” by 2020. These targets consist of achieving a 20% GHG emission reduction, 20% in renewable energy and 20% energy efficiency. A further target, included in the renewable target for 2020, provided for increasing the use of renewable energy in transport sector to a 10% share by 2020. In the same year, the EC established the Effort Sharing Decision which set binding annual GHG emission targets for countries for the period of 2013–2020. These targets concern emissions from most sectors not included in the EU Emissions Trading System (ETS), such as transport, buildings, agriculture and waste. The national targets will collectively deliver a reduction of around 10% in total EU emissions from the sectors covered by 2020 compared with 2005 levels.

Proposed in 2007, the Green Package was finalized in 2009 due to the extended debate among Member States; especially, some Member States from Central and Eastern Europe were concerned about the potential impact of such policies required for achieving targets proposed in the Package on their social and economic structure—traditionally heavily reliant on the coal industry.

Additionally, in 2011, the European Council formally adopted the objective to reduce emissions by 80–95% by 2050 in comparison to 1990 levels. On January 22nd 2014, the EC proposed the 2030 Climate and Energy Framework to be met by 2030. According to these objectives, the European Member States will: (1) need to reduce their GHG emissions by 40% compared to 1990 levels; (2) need to increase the share of renewable energy sources in final energy consumption to at least 27%

¹ Article 194 of the Treaty on the functioning of the European Union (TFEU).

by 2030; and (3) need to increase the energy efficiency of their economies by 27% compared to a 2007 baseline (EC, 2020a).

In recent years, European efforts to create the first climate-neutral continent have grown. Indeed, in November 2018, the Commission presented its strategic long-term vision for prosperous, sustainable, competitive and carbon-neutral economy by 2050. With this long-term strategy, the EU shows its ambition to lead the transition to a carbon-neutral world. Indeed, at that moment the Strategy did not intend to launch new policies, nor did the European Commission intend to revise 2030 targets. It was meant to set the direction for EU climate and energy policy, and to frame what the EU considers as its long-term contribution to achieving the Paris Agreement objectives in line with UN Sustainable Development Goals, which will further affect a wider set of EU policies (EC, 2018).

In 2019 and in line with the EU's 2050 long-term strategy, the EU also presented a comprehensive update of its energy policy framework to facilitate the transition away from fossil fuels towards cleaner energy and to deliver on its Paris Agreement commitments for reducing GHG emissions. This new framework is called the "Clean energy for all Europeans package," consisting of 8 legislative acts (EC, 2019a), several of which are of central importance for reaching the EU's 2030 targets on energy and climate.

In these documents, the EC reconsidered and extended the Renewable Energy Directive, with a binding EU-level target to increase the share of renewable energy in the energy mix to at least 32% with a possible upwards revision by 2023; updated the Energy Efficiency Directive, with an indicative target at EU level of reduced energy consumption by at least 32.5% by 2030, with a possible upwards revision by 2023 (European Council, 2014). An additional aspect was that the EU had identified energy efficiency as a key objective in order to achieve a dual goal: saving money for consumers and reducing GHG emissions.

Besides the great political commitment at the European level, Member States are indispensable players for the achievement of the European targets on energy and climate. Since 2009, Member States have taken actions in order to meet both 2020 and 2030 targets through national policies. As the socioeconomic structure and the energy mix vary widely across Europe, the implementation process of each EU target has been developed at a different pace among European countries. Indeed, data shows different trends in the implementation process of each target and their possible achievement across the EU.

In general, a recent report released by the European Environment Agency (EEA) shows that the 2020 targets appear to be achievable for GHG emissions reductions while they are just within reach for renewable energy developments. At the same time, meeting the energy efficiency target appeared increasingly difficult (as shown in Fig. 1).

Because of great public concerns over the consequences flowing from climate change and global warming, the most pressing issue for Europe is to reduce GHG emissions. In 2018, the GHG emissions across the EU have reduced by 23.2% below 1990 levels; thus the EU was on track to meet its upcoming target by 2020. Yet the EEA report showed that the current efforts by Member States were still insufficient to achieve the EU targets set for 2030. In order to achieve its long-term goal of decarbonization, the EU would need faster rates of meeting its targets. For example, in order to reach its 2030 emissions' target, the EU needs

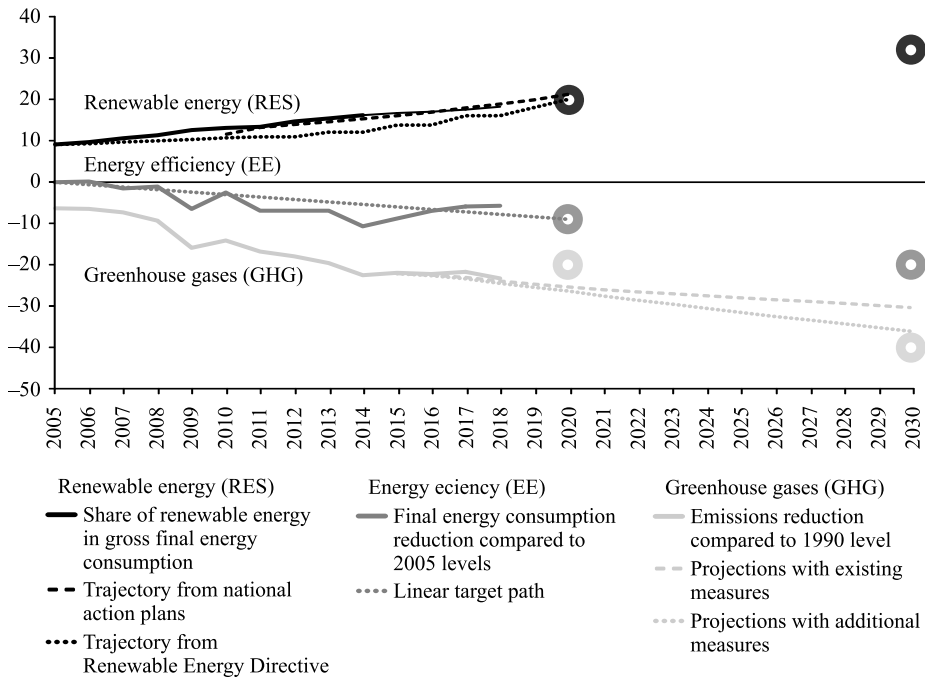


Fig. 1. EU progress towards 2020 and 2030 targets on climate and energy (%).

Source: EEA (2019, p. 9).

to reduce its emissions by 81 million tonnes of CO₂ equivalent (Mt CO₂e) every year from 2017 until 2030, which is almost twice as high as the 46 Mt CO₂e had achieved since 1990. The projections submitted under the Monitoring Mechanism Regulation (MMR) in 2019 indicate a reduction in emissions by 2030 to 30% below 1990 levels.

Although political commitment and decisions helped to reduce European GHG emissions, a further two factors also contributed to this reduction: delocalization of industrial production and economic crisis.

Firstly, the process of delocalization of industrial production and activities out of the EU climate jurisdiction helped the reduction of GHG emissions regionally, but not globally. Indeed, the GHG emissions generated by European companies that moved their production to third countries are not taken into consideration in EU statistics. Part of the EU CO₂ reductions are thus just outsourced at a price of EU job destruction. Secondly, the 2008–2009 global financial crisis deeply affected EU economies, leading to a sharp reduction of industrial output. The reduction of industrial activities contributed to the decrease of GHG emissions in the EU. This also produced a secondary consequence which is the contraction of the prices of CO₂ ETS quotas. They have fallen (from 15–17 €/tonne of CO₂ in the late second phase of EU ETS (2008–2012) to 4–8 €/tonne of CO₂ in its third phase (2013–2020). Only recently, due to strengthened EU regulation lately and an improved economy, the CO₂ prices have soared, hitting an 11-year record in July 2019 (29 €/tonne) and subsequently the price was about 25 €/tonne.

Carbon prices are expected to rise further as the economies recover post-COVID-19. A higher carbon price should incentivize industry to reduce its carbon

emissions and enhance implementation of low-carbon technology, thus speeding up the low-carbon energy transition.

As mentioned above, one key element for achieving the reduction of GHG emissions in Europe is energy efficiency. The EU's targets on this matter are expressed in terms of both primary and final energy consumption. On this issue, in 2012 the Energy Efficiency Directive (EED) 2012/27/EU set the 2020 target, declaring that the EU's final energy consumption should not exceed more than 1,483 million tonnes of oil equivalent (Mtoe) of primary energy consumption (in 2018 revised to 1,273 Mtoe by 2030) and more than 1,086 Mtoe of final energy consumption (in 2018 revised to 956 Mtoe by 2030). In terms of a percentage, these figures equal to a 13.8% reduction (in 2018 increased to a 26% reduction by 2030) from 2005 levels for primary energy consumption and a reduction of 9% for final energy consumption (in 2018 increased to a 19.9% reduction by 2030). However, following a gradual decrease between 2007 and 2014, also due to negative economic performance, both primary and final energy consumption levels increased steadily during the 2014–2017 period, contrary to the goal of achieving greater energy efficiency and reduction of energy consumption (EC, 2019b). Indeed, to reach the 2030 targets, the EU will need to achieve an annual reduction of 22 Mtoe (primary) and 13 Mtoe (final energy consumption) from the 2017 levels each year until 2030—more than twice the average pace that was achieved over the 2005–2017 period (EEA, 2019). European activities and efforts, aimed at the improvement of energy efficiency, are focused mainly on the buildings sector. Indeed, buildings are responsible for approximately 40% of EU energy consumption, being the single largest energy consumer in Europe. This figure is also due to the fact that about 35% of the EU's buildings are over 50 years old and almost 75% of the building stock is energy inefficient. At the national level, Member States set their own national non-binding targets for energy efficiency both for 2020 and 2030.

Energy consumption growth can reduce the share of renewables in the energy mix, undermining the achievement of the European targets related to the renewables as well as energy efficiency. Currently, the share of energy generated from renewable sources in the EU's gross final energy consumption reached 18% in 2018. Therefore, it appears that the EU as a block was on track to meet its 20% target for renewable energy for 2020 before the COVID-19 Pandemic and Recession 2020. Since 2005 there has been a steady increase in the overall share of renewable energy sources, but this trend has slowed down since 2014. Indeed, between 2014 and 2017, the EU witnessed an increase of both non-renewable energy consumption and total final energy consumption. Since 2015, in absolute terms, the consumption of fossil fuels has increased faster than the consumption of renewable energy.

Fig. 2 illustrates that in absolute levels there is a significant increase of consumption of renewable energy in EU-28 from 189 to 204 Mtoe (+8%) in the period 2015–2017; however, the figure represents the increase of gross final energy consumption, which hindered the impact of the share of renewable energy across Europe. Concerning the implementation progress at national level, it must be said that the renewable energy shares reflect the historic diversity in Member States' energy mix and their differences in renewable energy potential, with shares ranging from 6.4% in Luxembourg to 54.5% in Sweden in 2017 (EC, 2019c).

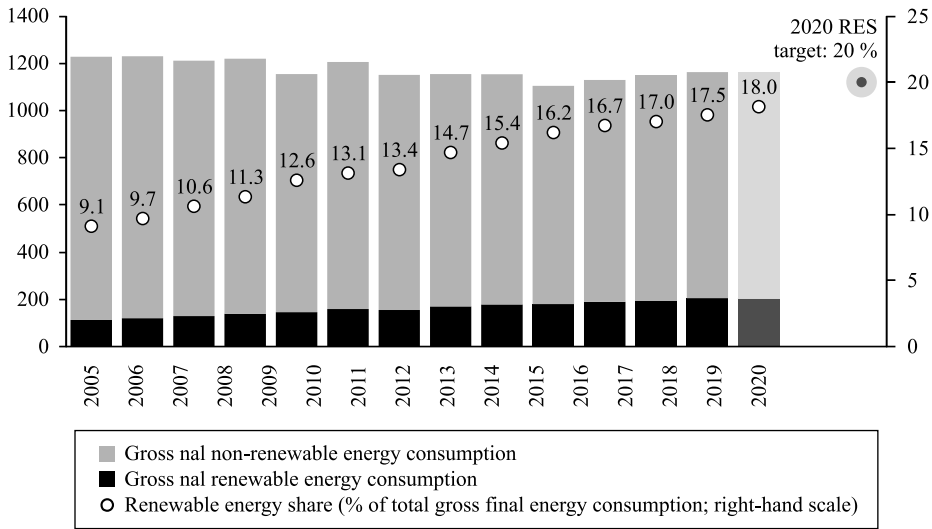


Fig. 2. Gross final energy consumption from renewable and non-renewable energy sources, 2005–2017 and proxy 2018 (million tonnes of oil equivalent).

Source: EEA (2019, p. 42).

In 2017, all but seven Member States (Belgium, France, Ireland, Luxembourg, Netherlands, Poland and Slovenia) were on track towards their 2020 renewables target, having renewable energy shares equal to or higher than their indicative trajectories set under the Directive on renewables. Also, in eleven Member States (Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, Hungary, Italy, Lithuania, Romania, and Sweden) the share of renewable energy used in 2017 already surpassed the 2020 renewable targets.

One sector in which the use of renewables is critical to meet European GHG emission targets is transport. The sector is the only one in Europe that witnessed a growth of its GHG emissions during the period 1990–2018, while GHG emissions from other sectors (industry, buildings, electricity and heat) decreased. Just to mention, GHG emissions from road transport increased by 23% from 1990 levels. Among transport, road transport is responsible for more than 70% of overall GHG emissions. For this reason, the EU set a 10% target for energy from renewable sources — including liquid biofuels, hydrogen, biomethane and ‘green’ electricity among others — in the transport sector by 2020. On this target, in 2017 the share of renewable energy sources used for transport in the EU reached 7.6%, substantially increasing from a 3.1% share only ten years before. Despite this steady increase across the EU, only two Member States exceed the 2020 target in 2017: Sweden (38.6%) and Finland (18.8%). Most of the other countries had shares between 5% and 8%, while Austria (9.7%) and France (9.1%) were close to achieving the target. If the EU aspires to achieve its long-term goal of becoming the first carbon-neutral continent by 2050, it should address the challenge of decarbonizing its transport sector.

Another relevant reason for increasing renewable energy sources can be energy security. Today, Europe’s energy supply is strongly dependent on imported fuels: for gas notably from Russia, Norway, Qatar and North African countries. The reduction of domestic production of fossil fuels has led to an increase of imported

fuels; the share of imported fuels of the EU–28 increased from 44% in 1990 to 56% in 2017. The significant deployment of renewables reduces the import dependency of fossil fuels. The 2050 long-term strategy affirms that “the clean energy transition would result in an energy system where primary energy supply would largely come from renewable energy sources, thereby significantly improving security of supply and fostering domestic jobs. Europe’s energy import dependence, notably as regards imports of oil and gas, standing today at ca. 55% will fall in 2050 to 20%.” Therefore, this situation leads to an annual spending on energy imports amounting to approximately 2% of the total GDP. Therefore, the increase of renewable energy deployment can be beneficial both for economy and energy security.

4. Current developments and challenges of energy transition in some Member States

Each European target represents a priority for the European institutions but the full implementation of each target has often encountered obstacles. One of the key challenges to a successful energy transition is the political commitment and will in Member States. Energy is a “shared competence” between European institutions and national governments. Indeed, Member States were not keen to leave such a strategic topic exclusively to the EU responsibility. Therefore, despite the announcements and declarations, it can be said that there are different speeds of the EU energy transition among Member States and different results. Italy and the UK, for instance, have seen an increased trend towards renewable energy transition with two different approaches (Italy more state-driven through the feed-in schemes, while the UK is more market-driven); while Germany and Poland have failed in the implementation (Germany despite its targets and commitment, Poland expressing its opposition to the European goal of climate-neutrality).

Although *Italy* had a strong dependence on fossil fuels at the beginning of the millennium, it has been able to transform its energy mix during the last 18 years. In 2000, Italy had a peculiar energy system; it is heavily dependent on (imported) fossil fuels, without any nuclear potential following the 1987 and 2011 popular referendum, and low renewable energy sources deployment. The long-term dynamics have led to a significant change in the production mix. In 2000, fossil fuels covered about 88% of the total energy demand (oil accounted for 50%); this share fell to 74% by 2018 (oil falling by 16% and gas holding its leadership position with 35%). Over the period, Italy has been able to boost its renewable deployment; indeed, renewable sources climbed to 20% of the total from 7% in 2000 (CDP et al. 2019). Italy has been able to increase its energy efficiency, while reducing GHG emissions. In its efforts to decarbonize the energy system, Italy announced its decision to phase out coal for electricity generation by 2025. Italy has overreached the 2020 European targets on climate and energy. Nevertheless, oil consumption increased due to its dominant role in the transport sector, which Italy needs to address in order to improve its energy transformation. Also the *UK* has witnessed a great transformation of its energy system, thanks to a rapid growth in the share of low-carbon energy, which accounted for over 50% of the electricity mix in 2017 (natural gas 41%; nuclear 21%; wind 15% up from 3% in 2010; solar 3%; bioenergy and waste 11%; coal 7% down from 29% in 2010; and hydro 2%) (IEA, 2019). This transformation was highlighted by

the fact that the UK energy-related CO₂ emissions have declined by 35% compared to 1990 levels, and total GHG emissions are down by 40%. The decline of coal in the British energy system is particularly important given its historical role in the British energy and economic system. Additionally, the government has declared its strong commitment to phasing out all remaining unabated coal-fired power generation by 2025. One element that positively affected coal reduction is the high carbon price floor of GBP 18.08 per tonne of carbon dioxide, which was able to drive coal- to-gas switching, reducing the share of coal in the power sector. The carbon floor price is an essential part of the Electricity Market Reform (EMR) of 2013, which was conceived as a series of targeted interventions to manage the transition to a decarbonized power supply through free market principles.

Conversely, *Germany's* energy transition represents the mismatch between ambitions and implementation. Indeed, the German energy transition (*Energiewende*) aims to cut GHG emissions by 40% by 2020, by 55% by 2030 and up to 95% in 2050, compared to 1990 levels. *Energiewende* outlines that the share of renewable energy in gross final energy consumption should be increased to 18% in 2020 and 60% in 2050. This target will deeply affect power generation, since in 2020 35% should be RES-based, and at least 80% in 2050. However, along with the increase of renewables use, it was decided to phase out nuclear power generation completely by 2022. In 2000, Germany's nuclear power stations had a 29.5% share of the power generation mix. In 2016, this share dropped to 13%. This decision was taken a few months after the release of *Energiewende*, mainly driven by the shock following the Fukushima incident. Since 2000, governments have successfully promoted the deployment of renewables—especially wind turbines in northern regions, but also solar PV for power generation through the German feed-in tariff. Nevertheless, large-scale deployment has not led to a significant reduction of emissions (Kunze and Lehmann, 2019). Indeed, trends show that emissions increased since 2000, with the exception of 2008/2009 because of the global financial crisis. The reason for this emission trend is due to the high level of coal-fired power generation in the country. Indeed, coal-fired power generation closed the power generation gap caused by nuclear decommission. The reason why coal replaced nuclear is because the cost of generating power from coal has declined over the past decade (due to an oversupply from the US and Asia). Another reason is the reduction of CO₂ prices, as explained above. Germany's efforts to reduce CO₂ have been weakened by the combination of these two trends—low coal costs and prices of CO₂ emissions—mostly because it did not provide an incentive to abandon coal. The strong support for renewables through an expensive feed-in tariff scheme in Germany generated strong criticism over the outcome paid by customers (households and industry). Indeed, this feed-in tariff scheme produced higher electricity costs which consumers have to pay for, which can be particularly harmful for low-income households and small industries. Today, Germany has one of the highest electricity prices in the EU. This can undermine economic growth and the industrial sector has expressed its concerns. Additionally, German industry, which is globally known for its competitiveness, expressed its concerns that the current energy transition could undermine its status in the world and lead to a loss of competitiveness. The quest for full decarbonization will deeply affect European industry, transforming and changing its business model, and undoubtedly will meet resistance.

Poland has numerous socioeconomic and energy reasons to maintain coal at the center of its system. Indeed, in 2018, the electricity production was dominated by coal, which accounted for 78.1%. Simultaneously, the share of renewable energy sources has decreased to 12.7% from 14.1% in 2017, marking the lowest share and production from renewables since 2014. The coal industry employs thousands of Polish citizens and these are the reasons for Poland's strong opposition to EU climate-neutrality goal. A further development in the Polish energy mix is the increasing role of natural gas. In any case, the current condition of the Polish energy system led to an increase of GHG emissions. Despite the European targets, Polish Energy Policy until 2040 (PEP 2040), drafted in 2018, affirms that hard coal will remain the single most important source of electricity production by 2040, although its role will be decreasing. The same text claimed that given the targeted share of RES in EU's final energy consumption (32%), the importance of renewable energy sources will be growing, assessing renewable share in domestic electricity consumption to around 27%. The document affirmed that the achievement of the share of RES in electricity generation will be mainly based on photovoltaics (from 2022) and offshore wind power plant (after 2025) (EPP2040, 2018).

Because of the relevance of coal in Germany and Poland, the next section will be devoted to the role of coal, the need for its phase-out as well as potential socioeconomic challenges related to this objective.

5. Driving away from coal: Climate priority but socioeconomic challenge

The great political commitment has led to a transformation of the European energy mix over the years, generally moving from coal and other fossil fuels to cleaner energy sources. The European energy system is highly diversified, relying on a broad range of energy sources. Although the share of renewable energy sources has grown significantly from 4% in 1990 to 14% in 2017 in the EU-28, fossil fuels still dominate the primary energy supply (74% in 2017). Among fossil fuels, coal plays an important role in the energy mix of some Member States. Yet coal is the energy source which EU institutions had decided to tackle, given it is a main source of GHG emissions. The European climate policies have led to a decrease in the domestic production of coal. A demonstration of this is that the share of coal in the primary energy supply declined from 26% in 1990 to 13% in 2017. Nonetheless, given its energy and economic relevance for countries, some Member States expressed their opposition to abandoning it. Today, it accounts for 16% of gross inland energy consumption in the EU and 24% of the power generation mix. Six countries still rely on coal to meet at least 20% of their energy demand (Alves Dias et al., 2018). Coal represents 80% in Poland's power generation, 50% in the Czech Republic, 46% in Bulgaria, 37% in Germany, and 34% in Greece. Besides energy, coal is also a key feature of economy in those European coal producing countries, such as Poland, Germany, Czech Republic among others, providing thousands of jobs in these countries. Indeed, the coal sector currently employs about 237,000 people (Alves Dias, et al. 2018). Poland employs about half of the coal workforce, followed by Germany, Czech Republic, Romania, Bulgaria, Greece and Spain. It is estimated that the total cumulative job losses in power plants and mines are likely to increase to 77,000 jobs by 2025 and by 2030

to around 160,000 jobs, because of European climate policies. Therefore, those countries will need to address potential negative impacts on employment and their economy. For such reasons, some of the coal producing countries, especially Poland, have expressed resistance to several proposals aimed at reducing the role of coal and achieving emissions' targets. However, it seems that some positive signs are emerging; Germany has announced a timeline for its coal phase-out and its decision to give compensation to utility companies to speed up the phase-out realization by 2038. It announced a €40 billion agreement with coal-producing region states to begin phasing out the use of brown coal in energy production. Additionally, the federal ministries declared that companies operating in western Germany would receive €2.6 billion while those in eastern Germany would receive €1.75 billion as compensation. Such policies seek to soften the potential opposition to a total phase-out from coal, providing financial support to those areas that are dependent on coal activities, for example in Eastern Germany, and that might burden the costs and loss of the transformation.

6. New strong commitment: the European Green Deal of von der Leyen's Commission

The energy transition in Europe has been gaining a new political momentum mostly due to a reinvigorated call for action against climate change, supported by the popularity of public movements such as *Fridays for Future*. In order to respond to citizens' concerns, the new Commission President, Ursula von der Leyen, launched an ambitious and comprehensive policy program called European Green Deal aiming at achieving energy transition in the continent. The main goal of this new strategy is to transform the European society into a resource-efficient and competitive economy, making the EU a net-zero GHG emissions society by 2050 through the decoupling of economic growth from resource use. In doing so, a substantial transformation of the European economy is required. The EU has already made some progress in this sphere; between 1990 and 2018, it reduced GHG emission by 23%, while the economy grew by 61%. Nevertheless, as mentioned before, current policies will only reduce GHG emission by 60% by 2050. For such reason, the new Commission in summer 2020 presented a plan to increase the EU's GHG emission reductions target for 2030 to at least 50% and towards 55% compared with 1990 levels (EC, 2019d).

To reach full decarbonization by 2050, the Green Deal affirms that the EU should decarbonize its industry, which currently accounts for 20% of the EU's greenhouse gas emissions. To achieve this goal, the new Commission expressed its commitment to foster a circular economy, which will create new jobs while reducing waste and emissions. One of the main goals of the European Green Deal is to support and accelerate the EU's industry transition to a more sustainable model and an inclusive growth. The Commission promotes new forms of industry and supports strategic value chains, notably in the field of batteries with the European Battery Alliance. The EU supports research and innovation in the field of renewables because it could create new jobs, maintaining Europe's competitiveness.

Another sector that the Commission seeks to transform is the transport sector. Indeed, as mentioned above, it accounts for a quarter of the EU's greenhouse gas

emissions, with a growing trend. The Green Deal affirms that to achieve climate neutrality, a 90% reduction in transport emissions is needed by 2050. To do so, the Green Deal seeks to foster multimodal transport, and ramp up the production and deployment of sustainable alternative transport fuels.

All these actions and initiatives require a great financial effort; the Commission has estimated that achieving the current 2030 climate and energy targets will require €260 billion of additional annual investment, about 1.5% of 2018 GDP. Therefore, along with the Green Deal, the Commission presented the Sustainable Europe Investment Plan (SEIP) to help meet the additional funding needs. The SEIP is expected to become the investment pillar of the European Green Deal. In March 2020, this Investment Plan aimed to mobilize through the EU budget and the associated instruments at least €1 trillion of private and public sustainable investments over the next 10 years. The final amount is significant and will come from several sources; however, the EU budget will play a key role. Indeed, climate and environmental spending under the EU budget were expected to provide €503 billion over the period 2021–2030, in line with the Commission's proposal of a 25% target for climate mainstreaming across all EU programs. This should activate further national co-financing of €114 billion over the same period. Another important source for financing the Green Deal would be the InvestEU Fund, which will leverage around €279 billion of private and public climate and environmentally-related investments over the period 2021–2030 by providing an EU budget guarantee to reduce the risk in financing and investment operations. Then, there will be the Innovation and Modernization funds, which are not part of the EU budget but are financed through a part of the revenues from the auctioning of carbon allowances under the Emissions Trading Scheme. These funds will provide at least some €25 billion for the EU transition to climate neutrality.

Because of the depth transformation required, the Green Deal could meet strong opposition from the sectors and people that will be most affected by this transition. Social unrest and strong opposition to a more sustainable society could undermine seriously the positive development of the Deal. A strong example of it comes from France, where policies and decisions aimed at achieving energy transition have encountered great obstacles from public opinion, notably the *gilets jaunes* (yellow vests). The poor, as well as the working and middle classes, protest strongly the burden of climate policies falling on them, especially from the increases in fuel prices. For this reason, the Commission provided for an additional source of financing in order to leave no one behind: the Just Transition Mechanism. It will include financing from the EU budget, co-financing from the Member States as well as contributions from InvestEU and the EIB to reach €100 billion of investments to be mobilized over 2021–2027, which, extrapolated over 10 years, will reach €143 billion to ensure a just transition (EC, 2020b).

The need to create and promote an inclusive and fair transition is essential for its success, especially in a more polarized society where a large section of European citizens favors the transition in order to reverse global warming consequences but many other citizens fear losing out its well-being. Additionally, division among Member States might be another factor that could undermine the achievement of European energy transition, due to multiple and divergent interests. As mentioned above, Member States with a coal-producing region, that rely heavily on coal for its power generation and the provision of thousands of jobs, could raise concerns

about the EU's decarbonization. In 2019, some Member States (Poland, Czech Republic, Estonia and Hungary) opposed the EU's adoption of a 2050 climate neutrality target during different summits. However, during the last European Council summit held in December 2019, only one Member State (Poland) disagreed with the goal and the commitment to carbon neutrality by 2050 (European Council, 2019). Warsaw will have to decide on its position.

7. Green Deal in the aftermath of COVID-19

In the aftermath of the COVID-19 outbreak and the economic crisis, the future role of the EU energy and climate policies towards energy transition in the recovery phase has been upheaved. On July 21, 2020, EU leaders agreed on a €1.8 trillion package whose goal is to boost the EU economy after the COVID-19 as well as to advance some key EU goals, such as indeed climate transition. The package combines €1,074.3 billion for the EU budgets for 2021–2027 (called Multiannual Financial Framework) and €750 billion for the new EU Recovery Instrument, named Next Generation EU. Many analysts welcomed the deal, stating that it is the greenest stimulus ever made (although it is noteworthy to mention that it is the first). Indeed, the deal earmarks at least 30% of the total expenditure (long-term budget and recovery fund) for climate objectives, reiterating EU commitment to implement the Paris Agreement and its own energy and climate targets. However, the deal came at some cost, resulting in spending cuts to key climate and environment programs (i.e. Common Agriculture Policy, the Just Transition Mechanism, and Research and Development), which are three essential components to delivering Europe's Green Deal and Digital Agenda. Especially, the Just Transition Mechanism suffered a major budget cut (from €40 billion to €17.5 billion) and it will be hard to digest for the countries that will suffer most from the transition to a climate-neutral Europe (Casier, 2020). In conclusion, the EU institutions have decided to pursue the energy transition in the post-COVID-19 era as a way for Europe's economy to recover; however, Member States will play a key role in the presentation of national recovery plans, which should include the energy transition issue. Moreover, national division might undermine the allocation of these funds and the reduction of key European programs stresses the need to allocate funds to populations that might lose their well-being throughout the energy transition.

8. Conclusions

The EU has decided to take the lead in the current energy transition, aiming to become the first climate-neutral continent by 2050; this is expected to substantially transform the European society and economy. The EU has set important targets on climate and energy over the years, underpinning its strong political commitment to tackle GHG emissions and reverse the effects of climate change. The last significant plan is the European Green Deal, launched by the Commission President. This Green Deal aims to decarbonize and transform European energy, economy and society. Alongside these targets and the proposed financial support, the EU is promoting "climate diplomacy" in order to engage positively with other regions and make its efforts towards climate change more

widespread and successful. Otherwise—if the rest of the world does not follow—the overall impact of European climate efforts will not have a significant global impact, and may even be highly damaging to the European economy due to the higher cost of energy. The European energy transition will also affect its external relations, notably with those countries that are today’s main energy suppliers to Europe. Russia is the first country for European coal, oil and gas supplies. In 2017, Europe imported from Russia 39% of its imports of hard coal, 30% of its crude oil imports and 39% of European natural gas imports (Eurostat, 2019). European climate policies and targets will affect demand for these resources, lowering reliance to fossil fuels consumption—especially of coal. Although natural gas is often identified as a “transition fuel,” current discussions are also about the long-term future of natural gas and the need to decarbonize it in order to meet the European goal of reducing GHG emissions by 2050. Indeed, given Russia’s present economic structure, a potential decrease of European fossil fuel imports would harm the Russian economy and in particular its natural gas industry which relies on European gas markets having almost the entire Russian pipeline system linked to Europe. Russia may also see this as an opportunity to implement a long overdue transformation of its economic structure away from a resource economy more towards a finished products economy. Moreover, Russia could also present itself not as the “source of the problem” by being a major fossil fuel exporter, but as the “solution to the problem,” proposing that Europe support it in its decarbonization efforts by, for example, investigating the serious possibility of exporting hydrogen through its pipelines. A European hydrogen economy may contribute to decarbonization, and the cheapest way to produce hydrogen is not through RES and electrolysis as it is often envisaged in Europe but through Steam Methane Reforming. It is still necessary to get rid of the CO₂ which is obtained as a byproduct by converting CH₄ into H₂, but in Russia there are many depleted gas fields where the CO₂ could be safely stored. Obviously, this will require a high transparency and verification in order to be sure that the CO₂ is safely stored. This should be envisaged by Russia as a long-term solution, enabling it to continue to be an important energy supplier, but a decarbonized energy supplier, to Europe (Hafner and Wochner 2020). In the short to medium term, there are several factors that should in any case preserve Russian natural gas imports to Europe: (i) low gas prices make gas more competitive gas-fired generation; (ii) gas-to-power will be a key driver behind incremental gas demand over the period; (iii) reduction of European domestic gas production will increase the import needs in order to meet current and future demand; (iv) competitiveness of Russia’s gas supplies. However, in the longer term, if Europe is to become carbon neutral, also natural gas will need to be decarbonized. Regardless of these great challenges, the future of Europe, its societies and its external relations will also be defined by the ongoing energy transition.

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