RENEWABLE ENERGY AND ADAPTATION TO CLIMATE CHANGE

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Abstract

Climate change is an unprecedented challenge in human history. It requires further immediate and concerted action. Understanding the stage of development of each energy resource, as the impact on the energy system to make informed decisions and prescribe a healthy energy future has thus become a priority. Decisions such as the phasing out of fossil fuels and the transition to an efficient and 100% renewable energy system, as well as increasing the storage capacity of greenhouse gases using environmentally sustainable approaches, maintaining natural ecosystems that generate environmental services, and restoring the degraded ones are now a top issue. Therefore, the relationship between energy and environmental policy is becoming essential. Accordingly, this paper will focus on the transition to renewable energy, the adaptation to climate change and the energy transition at EU level being strenuously debated, in order to build a holistic context of the actual situation.

Adaptation to climate change requests a complex scientific study, given the diversity of uncertainties involved, and the interconnections between different areas, such as agriculture, sustainable development or energy industry. Therefore, the aim of research is to provide holistic understanding of the current climate issues, according to the mentioned fields. In this context, it is emphasized the benefits of clean energy by investigating the methods for achieving a prolific energy transition, from a conventional to a sustainable one. Carefully analysing the commitments and the transition to a low-carbon electricity system looking behind the causes and studying closely the underlying elements of all these topics, using the qualitative research method as a basis to indulge in further analysis and research, it was outlined a detailed analysis of the current climate context.

In conclusion, the effect of the pressure brought into play by human exploitation of goods and services on the ecosystems was associated with the ongoing concerns of environmental degradation, climatic variations, natural and ecological distortions, and financial setbacks. Taking into account the drive toward accomplishing sustainable development and environmental quality, powerful policies are being implemented, but given the variety of investment conditions in each country and

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including the different characteristics of the financial markets, there is no unique solution that works for everybody. Therefore, the transition to a more sustainable energy system has a verity of implications but it is an essential condition for sustainable development.

Key words: renewable energy, climate change, intervention measures, energy transition, environmental protection.

JEL[2]: Q1, Q2, Q42

Introduction

The effect of the pressure brought into play by human exploitation of goods and services on the ecosystems was associated with growing concerns regarding environmental degradation, climate change, natural and ecological distortions, and financial setbacks. Considering the European Union's (EU) drive towards accomplishing sustainable development and environmental quality, strong guiding policies are to be set and implemented by the EU for its member nations hereinto meeting the Sustainable Development Goals (SDGs). Consequently, the increase in the share of renewables is essential to reach a more sustainable environment.

With respect to climate change, the focus will be on the new circumstances and possibilities concerning the current worrying context in the EU, but it have to be emphasized that this topic can be extended to the rest of the world due to the different dimensions it highlights and portrays (Paska et al., 2020).

The EU can learn different strategies in terms of managing climate issues and combating the negative and long-term effects it is currently facing. In line to natural limits of bioenergy or geothermal energy, renewable electricity has emerged as a privileged path. Due to technological development and lower costs, new production methods (wind and solar energy), quickly gained important shares in electricity balances. Undoubtedly, the issue of financing the energy transition to a low-carbon economy will have the deepest macroeconomic implications but this process is a major opportunity for both financiers and creditors. Accordingly, the energy transition will necessarily involve a technological revolution and will include long-term investments in infrastructure.

Therefore, the main paper goal is to find adequate and comprehensive answers for the following fundamental research questions: What are the commitments to sustainability in order to reconsider the EU's attitude toward climate change?, What are the technological measures and what are the costs?, and at the same time, What

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sort of solutions could be implemented to overcome the environmental problems of the 21st century?

In order to find adequate answers and to offer a holistic understanding of the subject, this paper focuses on different literature sources (articles, reports and books). Writings such as „Renewable energy communities under the 2019 European Clean Energy Package: Governance model for the energy clusters of the future?", or „Regulatory challenges and opportunities for collective renewable energy prosumers in the EU", were among the most useful readings. Through these well-structured reports and articles, it was laid the foundation of this research and later, using various other articles from the last couple of years, there were debated some of the most important aspects of the discussed topic.

Methodology and data used

Meeting the requirements of sustainable development through the efficient use of natural resources, without affecting future generations, as well as ensuring the necessary energy in conditions of safety, security, and availability, requires the development of a set of public policies that respect strategic objectives set in line with regional objectives, principles, and demands. To achieve this goal, this paper proposes an integrated and complex approach to renewable energy sources in both a macro and micro-socioeconomic context by creating optimized multidisciplinary strategies at the local level. These strategies need to be constantly analysed by recording the impact of changes in society at all levels and in all areas (mentalities, concepts, relationships, technologies). Thus, instead of dispersed strategies, a unitary and long-term strategic thinking system can be created, having also the flexibility to respond to any type of international rescheduling or global change.

In this context, an integrated approach to the whole socio-economic issue can ensure the full fulfilment of all requirements of sustainable development, especially by offering strategies focused on smaller geographical areas, having as central pawn locally optimized renewable energy resources, and functioning as engine of local development. Consequently, the information was collected from online crowdfunding platforms and different projects which were selected based on a range of criteria (Maehle et al., 2021). Starting with a strong analysis of renewable energy sector and climate change aspects, it was subsequently reported the research strategies to be implemented at EU level. The specialized literature abounds in papers, studies, and statistics on the topic of this article, as well as factors that influence the bilateral relationship between them. Analysing the relation between climate change and renewable energy is broad because it involves correlating data from several areas. The

understanding of such materials can be fully realized only from a serious reflection and by a major involvement in different research activities.

In order to offer a holistic understanding of the topic that addresses an exploratory issue, specific research methods are involved (methodology being in accordance with the project's objectives). Research is therefore based on a comprehensive analysis of the known environmental context, using current data provided by the European Commission, data that helped outlining and completing the current climatic situation. Previously created research tools, such as "Drivers of renewable energy deployment in the EU: An analysis of past trends and projections" and "Environmental and climate policy integration: Targeted strategies for overcoming barriers to nature-based solutions and climate change adaptation", served as a vital tool for strengthening the importance of implementing a coordinated and creative socio-economic action for the improvement of the current circumstances.

Therefore, recent scientific reports and articles were closely analysed and extensive comparisons were made in order to highlight the current situation, emphasizing future scenarios and highlighting the real consequences and disproportions at the EU level. In conclusion, empirical research will be used, carefully observing reality and contributing to the enrichment of the theory, so the article is offering useful information to other related fields through the complexity of the results provided.

Results and discussion

Commitments to sustainability and the new clean energy market

Ecology and responsibility for climate change have become a priority on the global agenda. Nowadays, it has become impossible to talk about the worldwide energy sector without referring to climate change and related commitments. As part of what is known as corporate social responsibility (CSR), large energy companies must implement environmental protection standards. According to social responsibility considerations and growing environmental knowledge, organic production could be excellent business alternative for producers. Meanwhile, positive effects of organic production to nature and environment have to be also reconsidered (Vasile et al., 2015).

Since 2008, the International Energy Agency (IEA) has expanded its mandate's focus on specific elements of sustainability and environmental protection, emphasizing the "triple E": energy security, economic development and environmental protection. Even if the renewables sector is the one with the largest investment in research and development, as well as with an increase in employees and rapid change in revenues during the last years, recent studies suggest that the

sustainability issue it may be too difficult to solve. The World Bank shows how new wind and solar technologies will put huge pressure on the exploitation of different ores such as copper, iron, zinc, or aluminium, but also on rare metals such are iridium, lithium, titanium, or silver (IEA, 2019a).

The stake in the new energy paradigm is to accelerate the transition to a clean energy economy and to reduce the negative impact that energy has on the environment, as was the approach presented in the Energy Strategy 2021-2030 that lacks ambition in this regard (Komusanac et al., 2020).

Intelligent technologies based on solar energy and storage, for example, are advancing at accelerated pace. At the same time, the growing popularity of solar energy has led to lower prices and turned the solar industry into the one of the fastest-growing sectors. However, to encourage the large-scale transition to the use of sustainable energy sources, the support of policymakers is needed (Zuk, Zuk, 2021). With sustained government support, energy storage technologies can continue to develop and expand. Globally, among the largest energy companies active in the field of renewable energy, eight of them are from North America, six from Europe (four from Germany - CropEnergies, Global PVQ SE, SolarWorld Industries şi VERBIO Vereinigte BioEnergie, and one from Spain - Siemens Gamesa Renewable Energy and Denmark - Vestas), while 11 are from Asia (Volintiru, 2019).

In the EU, greater use of renewable energies is stimulated by the mandatory renewable energy targets for 2030, as well as the implementation of country-level policies and improvement of energy efficiency. The IEA's forecast scenarios suggest a significant increase in the share of renewables in covering electricity consumption in the EU, and under current commitments, polluting sources such as coal are expected to decrease considerably (IEA, 2019b).

If we look globally, the competitive development of advanced batteries is fierce, and the largest share of investments, innovations and implicit profits belong to the companies from USA and China. Up to a point, however, the USA seems to have been overtaken by concerted efforts throughout the production chain of Chinese developers to integrate energy storage solutions. In 2019, the leading lithium-ion batteries producer was Tesla Giga Factory with 23 GWh, while the Chinese company Contemporary Amperex Technology (CATL) has been ranked second with a capacity of 12 GWh. On the other hand, the increased adoption of solar energy systems and electric bicycles in the UK, Germany, and the Netherlands will stimulate industry growth. The growing demand for lithium-ion batteries in Germany, Spain, Italy, France, and the UK is expected to have a positive impact in the coming period as well (Wamsler et al., 2020).

Europe's chance to consolidate its dominance in the renewable energy industry: trends in energy consumption

Countries face unprecedented challenges in their efforts to develop policies that address energy needs. From the perspective of international organizations, it is clear that the level of uncertainty regarding the future evolution of the energy sector is very high. Adapting to radical technological and political changes, as well as meeting pressing goals that require not only short-term results but also long-term efforts, commitments, investments and visions are intimidating tasks. There is, however, one certainty: the need for change. An economic system based on fossil fuels, intensive agriculture and the exploitation of global natural resources is simply not sustainable (Dobre, 2015). Climate change, air and ocean pollution, and ecological decline are already damaging the lives and livelihoods of million people globally. There is a real risk of catastrophic damage to economies and societies over the next few decades if the current dominant production and consumption forms are not radically changed.

Globally, the European Union was among the first areas that recognized the climate change issues, as well as the transition possibilities to a clean energy. The Investment Plan for Europe (the Juncker Plan) mobilizes investments in renewables, energy efficiency and energy infrastructure (NEA, 2019). Its aim is to provide all EU consumers with secure and affordable energy after reforming the European energy and climate policies.

Several countries have already started this energy transition, confidently choosing the path to create a sustainable future energy based on renewables. In line to certain renewables limitations, there are emerged some new production methods, as are the transformation of wind and solar energy. The perpetuation of this orientation has pushed European states with maritime areas, to exploit their potential. Attracted by the expectation of sizeable market, and driven by authorities eager to show a new way of clean energy consumption, some large industrial companies have already made gradually researches regarding the floating offshore wind energy possibilities. For example, SAIPEM from Italy intends to launch its Hexafloat up to 2022 located along the Ireland's seashore (Goodess et al., 2019). Consequently, in a world driven by the desire to speed up the decarbonisation of its economic and energy sectors, in order to follow a road that overlaps the Paris agreement, the previously mentioned technology is probably among the most suitable one - it provides entrance to huge well allocated resources globally, resources that can be used for longer periods of time, meanwhile having a mild impact on the environment (Volintiru et al., 2019).

Accordingly, a unique approach to fulfil all sustainable development demands has to be set. In particular, strategies oriented to limited geo-areas have to be developed,

and the central role has to be given to locally optimize renewable energy resources. Trying to fit all demands of sustainable development, in line to competent utilization of natural resources that will avoid negative effects to future generations, there have to be implemented some policies that complies both EUs objectives and the national interests. But even within the EU, the situation is extremely different among the Member States. For example, even if the Fukushima accident initiated broad processes in Germany to restructure the energy mix, shutting down its nuclear facilities and betting everything on clean energy, the dependence on the Russian gas remains high. Contrarily, the situation in France is completely different. It supplies about 75% of its electricity from nuclear energy, based on a long-term energy security policy. France is thus the largest net exporter of electricity in the world due to its very low cost of generation, earning over three billion euros per year within this sector (Bagdadee, Zhang, 2020).

Currently, international trade with energy is more relaxed, according to directives on electricity and gas markets, or ensuring compliance with antitrust rules (Volintiru et al., 2019).

Ultimately, a much larger transition must be accessed, as the changes of attitude and mind-set. The age of blind consumerism must end in order to ensure the success of the energy transition. The global energy sector is undergoing a major change of roles. The leading position of today's big energy companies is being questioned in the perspective of the coming decades. Fortunately, Europe's dependence on energy imports, especially for oil and gas, will decrease from the current 55% to 20% in 2050, due to a primary energy supply which would come largely from renewables (IEA, 2019c).

The transition to a low-carbon electricity system: the energy union and the climate changes

One of the EU's key instruments for ensuring energy security is its regulatory framework. National Energy and climate Plans (NECPs) have the potential to become the most powerful instruments for strengthening the Energy Union. They are the keys to synchronize energy reform steps, both at national and EU level. Although significant progress has been made in recent years, Central and Eastern Europe still suffer from a lack of energy connectivity, depending on Russian gas to meet at least 75% of their needs. Therefore, the EU aims to liberalize, connect, and diversify the internal market. This strategy might lead to the strengthening of the Energy Union and the harmonization of energy capacities between the member states of the EU (Shivakumar et al., 2019).

When it comes to the current context, the World Energy Council (WEC) argues that it is a "robust energy transition which must meet the challenge of striking a balance between energy security, energy equity and environmental sustainability" (Bagdadee, Zhang, 2020). The ability to formulate and strike a balance between all the objectives will be crucial for any country that seeks to maintain both a strong competitiveness and a sustainable development. The WEC describes this issue as the "energy trilemma" and allows it to serve as a framework not only for guiding policymakers but also for helping the industry, so that it can turn energy sustainability from a concept into reality, through their joint effort (Campos et al., 2020).

The equity initiatives, which aim to offer universal sustainable access to modern and affordable energy services (as provided for in SDG 7.1) address both the benefits and potential challenges of moving towards a more complex and diverse energy system. First of all, they can support progress towards universal access to energy, but at the same time, they are likely to cause cost increases, especially in terms of system costs, which could ultimately compromise equity.

Cities can be strong supporters of the energy union goals, considering that 70% of Europeans live in the urban area. Urban areas play a key role in many spheres, such as: construction, mobility, overcoming the negative effects of climate change, public heating, and renewables (Volintiru et al., 2019).

Undoubtedly, the issue of financing the energy transition to a low-carbon economy will have the deepest macroeconomic implications. This process is a major opportunity for both financiers and creditors. The energy transition will necessarily involve a technological revolution and will include long-term investments in infrastructure. Estimates show that in order to achieve the proposed objectives, the rate of investment in infrastructure has to be in average four times higher than the current one. The road to energy transition is by no means an easy task. Putting resources and best practices together, consulting with global experts and exchanging relevant data will contribute to the success of this effort (NEA, 2019).

Regarding climate change, which is closely related to renewable resources, as high-temperature makes more and more problems, the temperature is soon expected to grow from 0.3-4.8°C degrees by the end of the XXI century, compared to 1986-2005 (IEA, 2019a). In addition, agriculture strengthens the climate change effects by GHGs emission and it is primarily affected by deforestation, methane emission, but also emissions from nitrogen-based fertilisers (Ion, 2017). In April 2020, the European Commission has published "The 2021-2030 Integrated National Energy and Climate Plan", paper through which the EC issues a series of targets such as increasing the level of ambition regarding the use of renewable resources until 2030, up to a share of at least 34% (IEA, 2019c).

For sustainable and efficient development, there are many complex interactions, many types of policies and legislation that can't be addressed without discussing the impact of the energy system in the context of some very ambitious decarbonisation targets at the EU level. But the environmental protection strategy should not be driven only by numerical objectives, especially in the current context in which the internal energy market in the EU is still fragmented, and the geopolitical context is volatile. Competitiveness, security of supply, and climate change mitigation goals are (or should be seen as such) long-term goals, closely linked to the strategic development (Lowitzsch et al., 2020). Consequently, the common approach to complete the socio-economic system is ensuring the covering of all concerns related to sustainable development, providing the strategic perspective for smaller but well-determined geographic units that have a central role in optimizing the renewables (Campos et al., 2020).

Conclusions

The responsibility for climate change is a vital priority of the global agenda. Today, it is impossible to talk about the global energy sector without referring to climate change and its related issues. While the decentralization and diversification of energy resources will contribute to a greater flexibility of the system, there will still be some future challenges.

While the purpose of this paper was to remove the difficulties in understanding the benefits of renewable energy both regionally and globally, it also highlighted the solutions it can bring in order to overcome the global problem of climate change. It is essential to understand what renewable energy actually represents, which the main sources are and what tools are needed in order to reach a smart and a sustainable development. Going through development-related limitations, companies will be capable to finance in larger extent the developing technologies that will optimize the use of renewables. Further, considering that the climate change has serious impact on the agriculture, the reconsideration of production structure is critical, while using a clean, sustainable and innovative development perspective.

The transition to a sustainable energy system has a variety of relevant implications for the EU, such as: guaranteeing the supply of electricity to growing population, offering an economical/industrial development, as well as providing the rapid technological advances towards profitable solutions. This transition based on the production of renewable energy with low impact on nature, is an essential condition for a sustainable development. EU's climate challenges and set targets for eliminating GHGs emission by 2050 should stimulate research procedures and should provide

a favourable context for investment opportunities. Development of financing instruments alleviates the pressure on competitiveness and opens competition between member states, where the winners will be rewarded with a sustainable welfare. Finally, environmental sustainability raises the question of how can we protect or even improve the environment in a sustainable way while achieving our goals of equity and energy security. Understanding the stage of development of each energy resource, as well as their impact on the energy system, in order to make informed decisions, has become a priority.

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