

Article

Mitigating Climate Change and the Development of Green Energy versus a Return to Fossil Fuels Due to the Energy Crisis in 2022

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Abstract: The energy crisis that emerged as a result of the reduction in gas supplies from Russia is very topical and very important. This crisis affects not only Europe but also other world economies. As a result of Russia's attack on Ukraine and the sanctions imposed on Russia, there was a drastic drop in Russian gas supplies, which triggered an increase in fuel prices and an energy crisis. In order to reduce the risk of insufficient gas supplies, European countries have decided to reuse coal and fossil fuels. This is the opposite direction to decarbonization and a zero-carbon economy. The undertaken research is unique, because the issue of slowing down the direction of decarbonization and returning to fossil fuels has not yet been extensively studied. Therefore, the analysis and research results are new in this area. The European project of green energy production from renewable energy sources that has been implemented so far, which aims to accelerate the implementation of a zero-emission economy, may be slowed down. Moreover, the return to fossil fuels will have a negative impact on climate change. The sharp increase in energy prices and the unexpected growth in the profits of energy companies meant that the European Commission introduced a limit on the revenues of enterprises in the energy sector. Surplus income is to be transferred to other entities to offset the drastic increase in energy prices. The conducted analysis showed how the European Union will try to ensure energy security and what the current actions related to climate protection and moving toward an environmentally friendly economy will be.

Keywords: energy crisis; Russia–Ukraine war; coal; fossil fuels; renewable energy; climate change; decarbonization



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1. Introduction

Climate changes are clearly visible on all continents and affect the environment as well as many economic sectors. Therefore, governments of states as well as the global economy and enterprises are taking intensive measures to reduce negative impacts on the climate and environment [1,2]. The activities aimed at eliminating climate change consist of many challenges, such as decarbonization, the protection of water and green areas, and the implementation of innovative solutions involving energy enterprises, transport enterprises, and construction companies [3,4]. At the same time, in 2022, these actions are influenced by the effects of Russia's aggression against Ukraine, consisting of a drastic reduction in gas transmission from Russia to Europe and an increase in energy commodity prices [5].

This is a new, unforeseen situation in the fuel market and therefore requires new, state-of-the-art, and detailed research. Despite the fact that Poland has repeatedly warned for years against the danger of Europe's sole dependence on Russian raw materials, the significant reduction in Russian supplies came as a surprise to Europe. This research showing and analyzing two opposing directions of economic development (decarbonization vs. fossil fuels) is new and will help to understand the situation of the European and global energy sectors. The results and proposed solutions discussed in this article can be a starting point for decision making by managers and people responsible for shaping energy policy.

Russia's intentional actions aimed at destroying energy stability in Europe and around the world have met with many legal and political solutions. The energy crisis caused by the lack of sufficient gas supplies to European countries can be mitigated, *inter alia*, by reverting to fossil fuels. European governments are considering the possibility of producing energy based on coal, increasing the share of fossil fuels in the energy mix, which is the opposite of actions taken so far to decarbonize and implement a zero-emission economy. The problem of climate change mitigation, decarbonization on the one hand and energy security and return to coal on the other hand, is a new approach to the existing situation and is presented schematically in Figure 1. These are two opposing ideas for the development of the energy market.

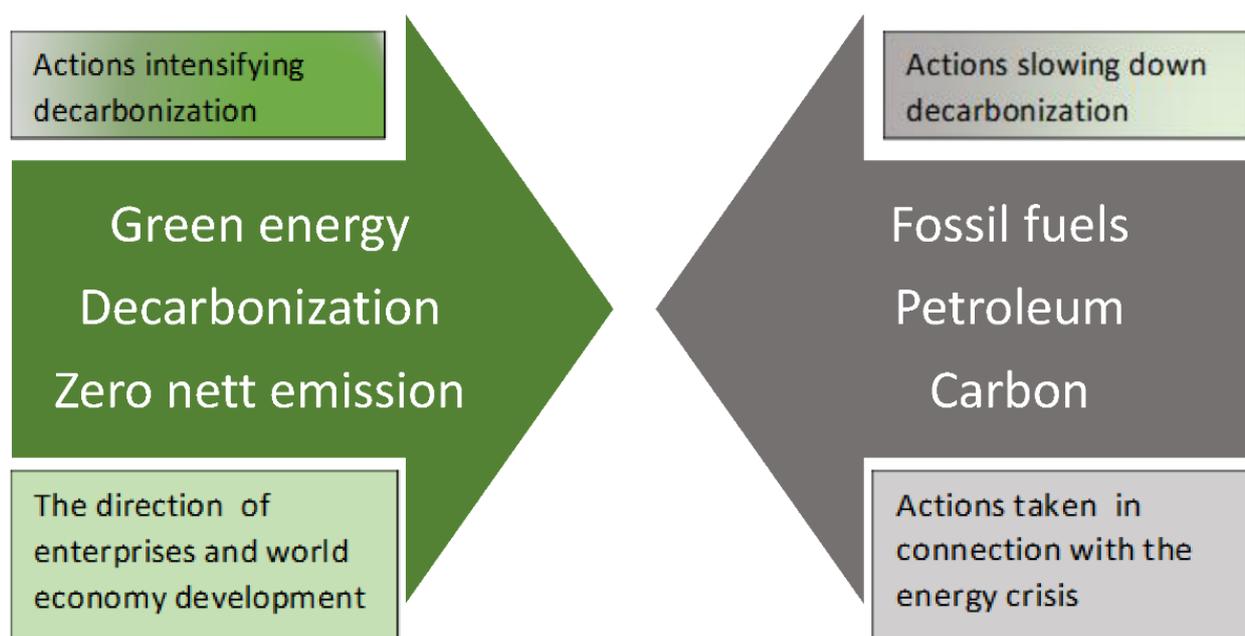


Figure 1. Process of decarbonization vs. energy security in the energy crisis period (own elaboration).

The gas crisis caused the European Union (EU) to pay more attention to energy security than to the decarbonization that has been carried out so far. The sharp increase in energy prices and the worrying shortage of natural gas supplies indicate the limited ability to ensure energy security in the European Union. The European Union must now support its Member States' energy security for as long as it is not provided by national low-carbon energy sources. Due to the energy crisis and the proposal to return to fossil fuels, it is worth considering how much the pace of decarbonization needs to increase in order for the EU to reach its 2050 targets [6]. For companies mining coal and producing electricity based on coal, the direction of decarbonization has already forced the reorganization of their operations and adaptation to new legal and environmental conditions. Thus, for many companies, such a return is no longer possible. However, it should be remembered that the share of coal in the total electricity production in the EU is still high and amounts to around 20%. Coal energy also provides jobs for around 230,000 people in mines and power plants in 31 regions and 11 EU countries [7,8]. European governments are being forced to suspend an ambitious climate policy as a result of the reduction in gas supplies from Russia, which is the result of the geopolitical confrontation related to Russia's aggression toward Ukraine. The world, and especially Europe, is going through a serious energy crisis as a result of Russia's invasion of Ukraine and the sanctions imposed on Russia. Moreover, Russia has radically reduced gas supplies to Europe, which bases its economy on hydrocarbons purchased from Russia [9]. The imposition of new international sanctions on Russia may reduce Russia's capacity and increase its reluctance to export oil and gas, which will cause energy prices to escalate.

The war started by Russia shook the global energy system at local, regional, and global levels, disrupting energy supply chains. In this situation, energy security becomes more urgent than preventing climate change. Germany has delayed the closure of some coal-fired power plants, and the Netherlands has increased the allowable share of coal-based energy in the energy mix. Austria has decided to restart a previously shut-down coal-fired power plant [10].

Government reactions to the energy crisis triggered by Russia may decide whether they enter the next decade of high-carbon development or follow the path toward the decarbonization of their economies to limit global warming to 1.5 °C, as strongly recommended by the Intergovernmental Panel on Climate Change (IPCC).

Issues related to Russia's attack on Ukraine and the resulting energy crisis are very topical and state-of-the-art. There are no scientific studies on this situation yet, and therefore, this analysis will make it possible to get acquainted with the situations of European economies and energy sector enterprises. The research question posed in this paper is as follows: In what direction will energy companies move in the face of an energy crisis with simultaneously imposed climate requirements?

2. Materials and Methods

In scientific research, quantitative or qualitative methods are used. In recent years, there has been more and more research carried out with both quantitative and qualitative methods simultaneously, which, in the scientific community, is called "mix" research. In this study, the author relied on qualitative research, which includes, *inter alia*, the analysis of existing data.

When collecting the data, the author used the potential of internet research, which facilitates the collection of source data. The author is aware that a lot of internet information may be unreliable, so he made every effort to use official sources. Official internet sources contain the name of the person who published it and/or the name of the organization that posted the information on its website. It is often useful to identify and verify the source, especially when using material from the internet.

The specificity of the topic allowed the use of a research method consisting of conducting desk research and making observations. The first stage of the desk research analysis started with finding worthy data sources. The sources found were paper and digital resources from libraries, scientific articles as well as press articles, and opinions of scientists and politicians presented in research communities, such as ResearchGate. In the second stage, the available sources were assessed, first in terms of their credibility and then in terms of their scientific value for further analysis and inference. Records and available data sources were evaluated, including, in particular, their compilation, mutual verification, and processing. In the third stage, information was analyzed, and observations related to the energy situation were made. Therefore, the analysis was the basis for developing conclusions regarding the presented and examined problem and validating the results obtained.

As the energy crisis and the draft directives related to energy security are evolving, and decisions in this regard are made on an ongoing basis by the European Commission, there are not too many studies and scientific articles yet. Therefore, during desk research, the author mainly used press articles and internet articles. On the other hand, for issues related to the subject of a zero-emission economy and climate change, the author used scientific articles published in international journals with Impact Factors (IFs). The scheme of the research methods is shown in Figure 2.

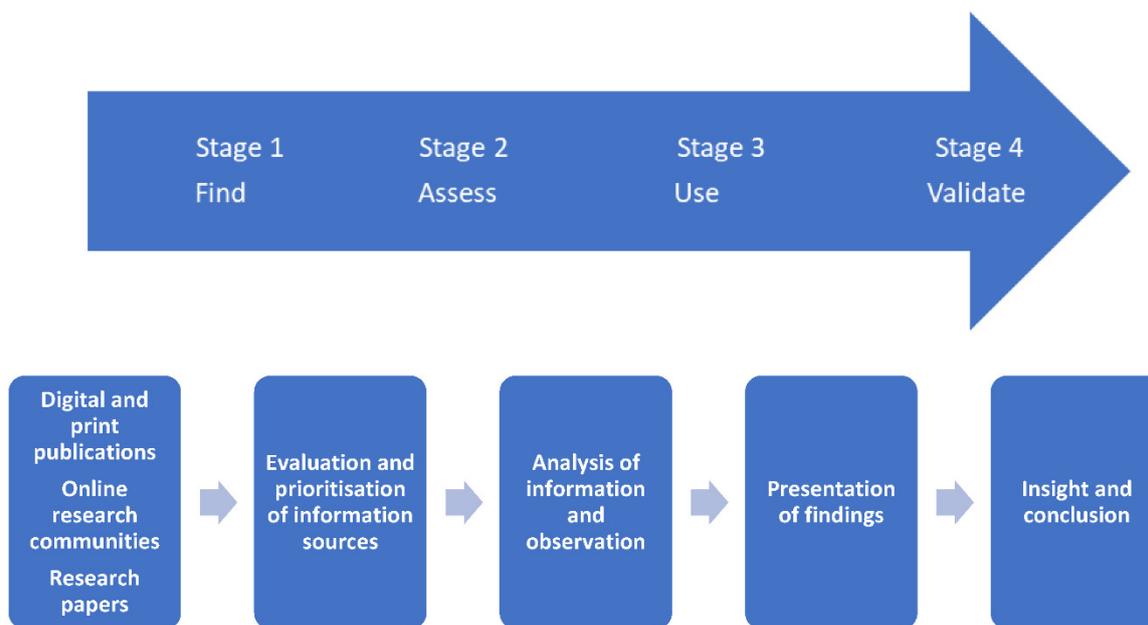


Figure 2. Scheme of the research method.

3. Literature Review

It is difficult to support the current situation regarding the crisis caused by Russia’s attack on Ukraine with scientific articles, as many actions have been taken in the recent few weeks. However, the author has tried to search for available articles discussing the impact of the war on the economic and social situations. The results of that search are presented in Table 1.

Table 1. Papers discussing the impact of the Russian–Ukrainian war on the economy, enterprises, and social situation.

Title of the Paper	Main Issue Discussed in the Paper
Russian-Ukraine 2022 War: A review of the economic impact of Russian-Ukraine crisis on the USA, UK, Canada, and Europe.	Global financial sanctions were imposed on Russia to paralyze the Russian economy, trigger an economic crisis, and prevent further attacks on Ukraine. However, at the same time, alternative suppliers of goods that have so far been imported from Russia should be sought, as Russia decides to react by restricting the export of important world goods [11].
A historical turning point? Early evidence on how the Russia-Ukraine war changes public support for clean energy policies.	The invasion of Ukraine by Russian forces in 2022 may be a turning point for the energy policy of the entire European Union, as the importance of Russian oil and gas for many European countries is very significant [12].
The impact of the Ukraine–Russia war on world stock market returns.	The war had a negative impact on the world economy and stock market indices. Apparently, the decline in indices was noticeable in the countries bordering Ukraine and Russia, as well as among the UN countries that clearly condemned the war and joined the imposition of sanctions [13].
Does oil connect differently with prominent assets during war? Analysis of intra-day data during the Russia-Ukraine saga.	During normal political times, oil prices affect other financial and commodity markets. It is important to check if oil prices are influencing important financial assets during the turmoil caused by war [14].
Pandemic, War, and Global Energy Transitions.	The war in Ukraine has increased energy prices and has become a challenge in terms of energy security. The long-term impact of these crises on a low-carbon energy transition and climate change mitigation is uncertain. In the era of rising energy prices, both society and the economy are paying attention to the production of energy from fossil fuels [15].

Table 1. Cont.

Title of the Paper	Main Issue Discussed in the Paper
European energy politics after Ukraine: The road ahead.	The war in Ukraine and the resulting uncertainty regarding the production, transmission, and distribution of natural gas will play a major role in the development of the future model for the European energy transition [16].
The Ukraine war and threats to food and energy security.	The war in Ukraine and the resulting uncertainty regarding the production, transmission, and distribution of natural gas will play a major role in the development of the future model for the European energy transition. Many EU Member States are dependent on Russian energy imports, which makes it difficult to accept sanctions (especially Germany) [17].
The impact of the Russia-Ukraine conflict on the green energy transition—A capital market perspective.	The Russian–Ukrainian conflict does not seem to have changed investors’ assessment of the possible transition to green energy in the long run. The transformation toward zero emissions in the longer term should be achieved [18].
War and the Politics of Energy and Climate Change.	The European Union began to coordinate efforts to reduce or wipe out Russia’s economic profitability by stopping Russian oil and gas exports. However, such measures could have a negative impact on climate protection, as the lack of Russian gas and oil could affect fossil fuel power generators and bring closed coal-fired power plants back into service. The war in Ukraine is a major complicating factor in global efforts to combat climate change [19].
Long-term implications of reduced gas imports on the decarbonization of the European energy system.	The European energy sector relies on gas as a key source of electricity and heating for domestic and industrial consumers. Due to the Russian invasion of Ukraine, this import may be interrupted, which threatens energy supplies in Europe. Moreover, with the restriction of the import of raw materials from Russia, the withdrawal from the production of energy from hard coal and lignite will be delayed [20].
Global economic consequence of Russian invasion of Ukraine.	As a result of the Russia–Ukraine war that began in February, numerous international sanctions were imposed on Russia to force Russia to de-escalate the crisis it had caused. However, it can be seen that due to supply disruption and trade perturbations, the conflict led to global price increases, which translated into an increase in global inflation [21].
A wider-aperture lens for global strategic management: The multinational enterprise in a bifurcated global economy.	Many companies, when deciding to discontinue cooperation with Russia or withdraw from the Russian market, incurred high costs from these decisions. This translated into an increase in the prices of products such as energy and transport, but also food and everyday products. It is important for scientists and business managers to view this issue from a broader perspective, including relations between China and Russia [22].

4. Results and Discussion

4.1. The Main Directions of Climate Change Mitigation

Mitigating climate change and adapting to emerging climate change are the key challenges that currently face the economies of countries around the world, which also have influence on the functioning of enterprises. Enterprises will have to adapt their activities to new legal, environmental, and political requirements. Many enterprises take up new initiatives to reduce negative impacts on the environment, including by reducing energy consumption, and energy enterprises are increasingly entering markets related to renewable energy sources. Companies are taking up new initiatives to reduce energy consumption, and energy companies are increasingly entering markets related to renewable energy sources. Global warming is one of the most common concepts in the context of climate change. It means a steady rise in the average air temperature in the world over a certain observation period. Warming above 1.5 °C threatens further sea and ocean level rise, extreme weather conditions, the loss of biodiversity, and the extinction of species, as well as food shortages [23,24]. The main cause of the acceleration of these changes is human activity, which has led to the significant warming of land, oceans, and the atmosphere. In order to reduce the negative effects, the world is taking steps to curb climate change. The transition to a low-carbon economy will reduce the negative impacts, have a positive

impact on reducing dependence on imported fossil fuels, contribute to increasing energy security, stimulate the creation of new jobs, and contribute to improvements in air quality and human health. The transition to a zero-emission system in the economy by 2050 or earlier is the goal of many countries [12]. During the Conference of Parties—COP26—in Glasgow in 2021, it was announced that the world is on the path to a low-carbon future, as over 90 countries have committed to reducing greenhouse gas emissions and stopping deforestation by 2030. Countries have declared their carbon neutrality [4].

4.2. The Energy Sector and Climate Change

The energy sector, which is largely responsible for the harmful effects on the environment, including extensive emissions of greenhouse gases, is facing major challenges. The energy sector, which uses fossil fuels to produce energy, therefore has a big impact on climate change. For that reason, it is important to use energy better and more efficiently and, at the same time, to move away from conventional energy sources. Energy companies undertake adaptation measures to adapt their production to ecological requirements. The energy sector should therefore reduce its dependence on coal and oil and move toward renewable sources. However, it should be noted that renewable energy source (RES) installations are very sensitive to weather conditions related to climate change. The changing climate affects the strength and intensity of the wind, while increasing temperatures reduce the efficiency of solar panels [25]. The energy sector is shifting from fossil fuels and reducing its dependence on these types of energy in favor of environmentally friendly renewable energy sources [26]. In addition, it is recommended to start using energy in an economical and rational way while replacing conventional energy sources with clean energy sources. More than 75% of EU greenhouse gas emissions come from energy production and use. It is estimated that coal is the fuel responsible for the rise in average global temperatures between 0.3 °C and 1 °C. This means that coal combustion is the greatest source of the global temperature increase [23]. Decarbonizing the EU's energy system is therefore key to meeting the 2030 climate goals and the EU's long-term strategy to become carbon neutral by 2050 [27].

The European Environment Agency (EEA)'s assessment of climate change, presented in the report "Climate change, its impact and sensitivity to these changes in Europe in 2016" [28], shows that all of Europe is already facing the effects of climate change, such as rising sea levels and increased incidences of extreme weather conditions, floods, droughts, and storms. The phenomena associated with soil tearing and emerging mudslides are more and more frequent. These changes are due to the release of large amounts of greenhouse gases into the atmosphere from human activities around the world—primarily the burning of fossil fuels to generate electricity and heat and for industrial and transport purposes. Burning fossil fuels also leads to emissions of air pollutants that are harmful to the environment and human health. In addition, human activity in the field of large-scale deforestation has a negative impact on climate change. Deforestation is a problem on an increasingly large scale. The amount of warming increases with the rate of the disappearance of forest cover [24]. Cutting down trees releases carbon dioxide stored in vegetation and soil into the atmosphere and reduces the carbon absorption capacity of terrestrial ecosystems.

In recent years, the issue of global warming has become a serious problem and a challenge for the whole world: it means not only higher air temperatures but also the occurrence of many unfavorable phenomena. Table 2 presents the results of the analysis related to the emerging threats resulting from global warming and the problems associated with these threats.

Table 2. Threats related to global as well as European warming and their effects.

Melting of natural ice sheets and glaciers	<p>The Earth's ice resources are formed by snow cover, sea and freshwater ice, and above all, glaciers, in which water has remained frozen for a million years. Monitoring the extent, thickness, and physical properties of ice is of the utmost importance for climate research. If the ice and snow mass losses exceed the ice inflow, the glacier front is retreating. An accompanying phenomenon is also the so-called calving of the glacier, i.e., the removal of ice blocks from it, which drift in the water as icebergs [29]. Europe is also experiencing the rapid retreat of mountain glaciers severely affected by global climate change [30].</p>
Rising water levels in seas and oceans	<p>Since 1993, the levels of seas and oceans have risen by about three millimeters each year. However, this growth does not remain steady but is getting faster every year. Current measurements show that this growth could average ten millimeters per year by the beginning of the next century [31]. In Europe, most coastal regions have experienced an increase in sea levels compared to the mainland. Since the 1970s, anthropogenic factors have been the main cause of accelerating sea level rise both globally and in European regional seas [32].</p>
Greater frequency and intensity of extreme weather events (e.g., long-term heat waves, violent rainfall and storms, and severe hurricanes)	<p>Along with the increasing average temperature of the Earth's surface, some extreme phenomena are becoming more frequent or more intense [33]. Heat waves or milder winters also have consequences for plants and animals. Higher temperatures mean better conditions for the development of, for example, algae or cyanobacteria. High temperatures strongly affect aquatic ecosystems. At high temperatures, there is relatively little dissolved oxygen in the water, which has consequences, e.g., for fish [34]. In Europe, weather disasters are placing an increasing burden on national economies. Extreme weather phenomena also adversely affect agriculture, infrastructure, and the health of the inhabitants [24,35].</p>
Disturbances in the circulation of water in nature (droughts and floods, including flash floods)	<p>Scientific research shows that the hydrological cycle, i.e., the natural water cycle on Earth, has been seriously disturbed over the last dozen years. The hydrological cycle is disrupted by rising temperatures, as manifested by increasingly intense tropical storms and monsoons. The warmer it is, the greater the amount of freshwater released into the atmosphere, where more powerful clouds are formed, carrying more rain [36]. The impact of global changes will first be felt through the disturbance of water-related phenomena. In Europe, water quality changes first, followed by hydrological changes, which have serious consequences for both water availability and other water-related impacts on social activities [37].</p>
Extension of the vegetation period of flora	<p>Global warming has the potential to have some positive effects on agriculture, such as extending the growing season due to an increase in the annual average air temperature. The increased concentration of carbon dioxide in the atmosphere makes it possible to "feed" plants with CO₂, which will translate into their more intensive growth [38]. A longer vegetation period will allow the introduction of new plant species that were previously unfavorable in a given area due to too low a temperature or too short a growing season. However, it can also increase the spread of weeds, pests, and certain diseases [39]. Due to the changing climate, European countries are already struggling with more frequent, severe, and longer-lasting droughts and, at the same time, with longer vegetation periods for plants and higher temperatures [24,40].</p>
Extension of steppe in areas previously covered with regular vegetation and an increase in the frequency and range of forest fires	<p>The expansion of steppes is a dynamic, progressive process of transforming forested areas, shrubs, and meadows into grassy communities characteristic of steppes and prairies or into communities (not necessarily grassy) with lower water requirements. The spread of steppes can be caused by natural and anthropogenic factors leading to periodic or permanent shortages of water available to plants. A steppe is often accompanied by soil drought and increased wind erosion. Under these conditions, forest, scrub, and meadow communities are replaced by less-demanding grassy vegetation communities that tolerate periodic water shortages [41]. Disruptions in forest areas will worsen as the Earth's climate changes. The susceptibility of European forests to fires, winds, and pests is systematically increasing [42].</p>

Table 2. Cont.

Changes in the range of occurrence of flora and fauna species, including pests and vectors of infectious diseases	<p>Animal and plant species have always followed the changing climate. When an area with plants becomes hostile to them—for example, too dry in summer or too cool in winter—they stop growing there. When new areas prove to be suitable for settlement, plants colonize them quite quickly. Animals also follow shifting food sources and are in search of better habitats [43].</p> <p>A warmer climate and a longer growing season will favor the development of many generations of aphids, which will increase their importance, both due to their direct harmfulness and as vectors of viral diseases. A longer growing season and warmer winters will favor the increase in the prevalence of harmful nematodes. Global warming not only changes the biology of pests but also their natural enemies. Their harmfulness should be expected to increase, and a longer vegetation period will allow for 2–3 generations of pests per season instead of 1 generation at present [44]. There is a clear trend in the overall vulnerability of European forests due to warming, which results in the weakening of the plant's defenses against the appearance of pests [42].</p>
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The answer to unfavorable climatic phenomena is the use of green energy. Economies around the world are working to reduce negative impacts on the environment and to become carbon neutral. The aim of the measures taken is to eliminate carbon dioxide emissions, which requires companies to implement innovative solutions and rely on renewable energy sources. To date, most EU countries have already exceeded the target of 20% of green energy, and in some countries, the share of renewable energy is much higher (Norway, Iceland, and Denmark) [45]. According to Eurostat data, in 2020, renewable energy sources accounted for 37% of the gross electricity consumed in the EU. Compared to 2019, in which the share was 34%, there is a visible increase. In a breakdown by individual sources, it was noted that wind energy accounted for 36% and water energy accounted for 33%. This means more than two-thirds of total electricity has been generated from renewable sources. The share of photovoltaics was 14%, that of solid biofuels was 8%, and that of other renewable sources was 8% [46]. The shares of individual sources of green energy are shown in Figure 3.

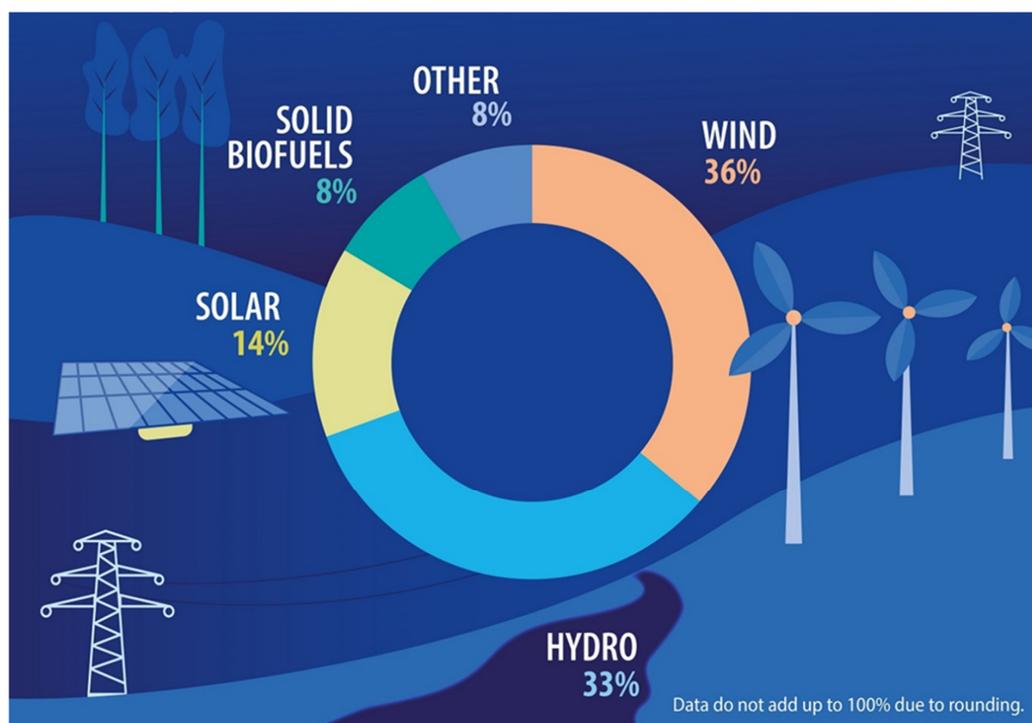


Figure 3. Renewable sources generating electricity in EU in 2020 [46].

The direction of green energy is implemented by many companies in the energy sector. In Europe, oil companies such as BP and Shell are undergoing their own transformations toward cleaner energy production. Royal Dutch Shell committed to clean energy and won a tender to build a wind farm off the coast of the Netherlands. The French oil company Total, which already owns a battery plant, has made several large investments in solar energy in Spain and wind farms off the coast of Scotland [47]. In Poland, energy companies, including Tauron and Polska Grupa Energetyczna (PGE), are increasing their potential in renewable energy sources. PGE Energia Odnawialna has 20 wind farms, 29 hydropower plants, 4 pumped storage power plants, and 5 photovoltaic farms [48]. In the Polish offshore wind energy sector, the total potential of the planned projects is around 10,000 MW. This capacity includes, for example, 1200 MW for the PKN Orlen project, 350 MW for BTI (RWE Polska), 1200 MW for the Equinor (Statoil)/Polenergia project, and 2500 MW for the PGE project. Polska Grupa Energetyczna and Danish Ørsted have signed an investment agreement aimed at the development, construction, and operation of two offshore wind projects in the Baltic Sea with a total capacity of approx. 2.5 GW. These are the projects: Elektrownia Wiatrowa Baltica-3 with a capacity of over 1 GW and Elektrownia Wiatrowa Baltica-2 with a capacity of approx. 1.5 GW [49].

4.3. Zero-Emission Activities and the Energy Crisis

The global energy crisis resulting from the Russian–Ukrainian conflict raises the prospect of returning to some sources of electricity that are far from green and environmentally friendly. The European Union is taking some steps to compensate for the fall in Russian gas and oil imports, which are far from being environmentally friendly. The European Union, which is heavily dependent on Russian hydrocarbons, is considering a return to coal. The reopening of coal and nuclear power plants will help replace Russian gas [50]. The International Energy Agency (IEA), which is campaigning for climate transformation, admits that due to problems with the import of hydrocarbons from Russia, the direction of the return to coal and fossil fuels is justified [51].

The lack of a common external energy security policy to date has made it difficult for the EU to adopt a common energy stance on the Russian invasion of Ukraine. However, after Russia's attack on Ukraine, the European Commission (EC) began to see the threat and began to implement joint actions. It proposed a plan to avert an energy crisis. The main pillar of the plan assumes that the Member States of the European Union will reduce gas consumption, while the next pillar is the solidarity mechanism, according to which countries in a crisis situation will be able to ask Member States for help in replenishing the missing gas. Limiting gas consumption is obligatory for the Community countries, while the said solidarity mechanism is to be voluntary. The EC proposed that the Member States reduce gas consumption by 15%. The proposal is valid from 1 August 2022 to 31 March 2023. Such action is to prevent an energy crisis. This is to be a coordinated reduction in gas use in all Member States. The regulation concerns the issuance of an EU security of supply alert and the possibility of a mandatory reduction in gas demand in all Member States. This mechanism could be triggered if there was a risk of a severe gas shortage or a sharp increase in gas demand. The European Commission proposes so-called solidarity gas for which Member States could apply, provided that they had previously taken measures to reduce gas consumption. In order to limit the negative effects of the energy crisis, the European Commission will propose further solutions to mitigate them. Among the proposed solutions, there will be, among others, an obligatory reduction in electricity consumption during peak hours, price limits for raw materials imported from Russia, and a revenue limit for energy companies. The proposed solutions will be implemented through smart electricity saving, the implementation of the strategy of flattening the peaks during energy demand and the obligatory limitation of electricity consumption during peak hours. Solutions will be proposed to carry out energy-intensive processes in manufacturing companies at night or on weekends, and not during the hours when consumption is greatest. Moreover, the European Commission intends to introduce a revenue limit for companies

that produce electricity at low costs and to introduce a solidarity levy consisting of the transfer of a part of the profits made by companies to weaker players on the market [52]. Oil and gas companies will have to share their excess profits to help European households and industry cope with high energy bills, as demonstrated in mid-September by the European Union's draft plan [53]. The very high profits of energy and fuel companies generated thanks to the political and economic situation will allow them to offer various types of discounts to individual consumers and the energy-intensive industry. For example, oil companies may offer customers discounts on fuel at gas stations. Another planned systemic solution is the introduction of an extraordinary tax. Oil, gas, and coal companies will be required to pay the extraordinary tax if their pre-tax profits in 2022 are higher than the 2019–2021 average by at least 20%. The proposed scheme would raise funds to help governments mitigate the energy crisis in Europe with solutions such as supporting high-bill households and businesses and helping energy-intensive industries [54]. The actions taken by the European Union can be described as short-term, aimed at ensuring energy security and reducing the growing costs of energy. On the other hand, in the long term, the European Union will implement its current plans related to climate protection and the implementation of a zero-emission economy. From the management point of view, in the case of the energy market, short-term actions cover a period of about 5 years, while long-term actions cover an average period of up to 20–30 years. The list of actions undertaken by the EU, split into short-term and long-term ones, is presented in Table 3.

Table 3. Short- and long-term actions of the European Union in the field of energy security and climate protection.

Short-Term Actions	Long-Term Actions
Return to the use of coal for energy production	Developing new innovative technologies, e.g., hydrogen
Reducing demand during peak hours	Sustainable and intelligent mobility
Reduction in overall energy consumption	Investments in renewable energy
Limiting the profits of enterprises producing energy at a low cost	Green deal and ecological buildings and transport
A fair share of the revenue from major oil gas and coal companies as a crisis contribution	Zero-emission economy

Source: own elaboration.

Energy sector companies that have started to implement solutions aimed at limiting negative impacts on the environment, e.g., shifting from the production of energy from coal or other fossil fuels, will now have three possible paths for further development. One possibility is to continue work related to the implementation of innovative solutions based on renewable energy sources and increase production (long-term), the second is to stop or reduce the “green path” and switch back to the use of fossil fuels (short-term), and the third option is to use both solutions at the same time, i.e., green energy production and non-ecological energy production (the mix option).

Russia is the world's largest gas exporter (25% of total exports) and was the third-largest oil exporter in 2020 [55]. The problem with gas supplies to European countries stems from the fact that Russia has reduced gas supplies to Europe. Since the Russian invasion, Russia's imports now account for only 9% of EU imports, compared to the previous 40% [56]. Unfortunately, Russia most likely went further, damaging the gas pipeline in several places on 26 September. All of the press releases available indicate that these leaks are the result of deliberate action [57,58]. The head of the EU's foreign policy announced that there will be an investigation to find out who damaged the transmission line and why. President Biden's national security advisor called the episode “apparent sabotage”. Some US officials have speculated about Russia's possible involvement in the sabotage, while Poland and Ukraine openly blame Russia. Russia, on the other hand, indicates the United States as the perpetrator [59]. The flow of gas from the pipeline is shown in Figure 4.



Figure 4. The Danish military showing gas welling up off the coast of Bornholm island. Source: Armed Forces of Denmark, via Associated Press and [59,60].

Russian Gazprom announced that from 27 July 2022, it will suspend the operation of another turbine in the Nord Stream 1 (NS1) gas pipeline, which will result in limiting gas supplies to Western Europe to 20% of the maximum capacity of NS1 [61]. The threat has become a reality, and the prospect of a cold, dark winter is looming. Russia has announced that it will close its Nord Stream gas pipeline while Western sanctions are in place, which will increase the reference gas prices by another 30%; they currently amount to about USD 400 per barrel of oil.

At current futures prices, annual electricity and gas spending by consumers and businesses across the European Union could rise to a staggering EUR 1.4 trillion, up from EUR 200 billion in recent years [62].

Estimates by the European Commission indicate that Russia has as much as 40% of the market in the EU. According to Eurostat data, gas from Russia accounts for as much as 93% of gas imports [63,64]. Europe should prepare for further disruptions to gas supplies, or even a complete cut-off by Russia. Figure 5 shows the reduction in Russian gas shipments to Europe in 2019–2022. Currently, 12 Member States are directly affected by partial or total gas supply constraints [65]. Russia's actions will have a negative impact on household consumption, increase uncertainty, contribute to unpredictable fluctuations in gas stocks, and disrupt the supply chain [23,66].

Many countries restrict the production of electricity from gas, although gas still constitutes a significant part of the energy mix. Some smaller European countries (North Macedonia, Bosnia and Herzegovina, and Moldova) rely solely on Russian gas. According to the latest data, in Finland and Latvia, dependence on Russia exceeded 90% of gas supplies, and in the case of Serbia, it was 89%. On the other hand, the production of energy from gas in selected countries is as follows: in the case of Greece, electricity from gas in March 2022 accounted for as much as 60% of the energy produced, Moldova obtains 96% of its electricity using gas turbines, and Italy and the Netherlands obtain 48% and 47% of their energy from gas, respectively [64].

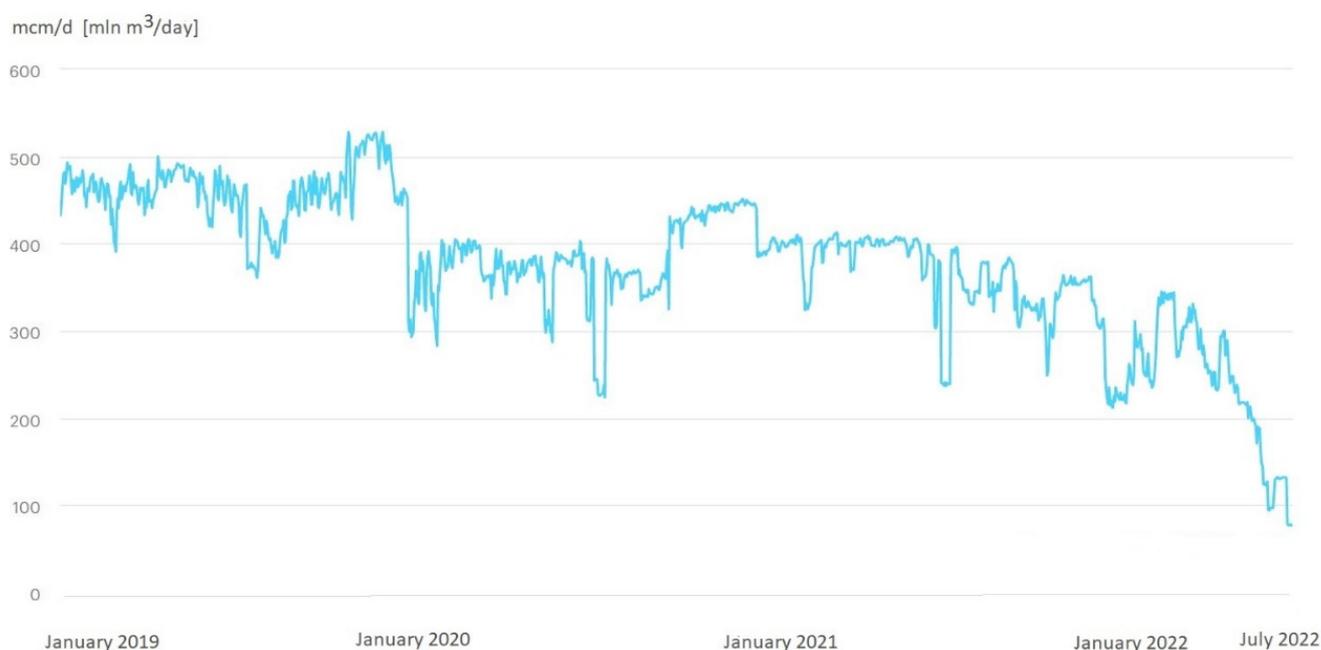


Figure 5. Russian natural gas flow to the European Union, January 2019–July 2022. Source: IEA, *Russian natural gas flow to the European Union, January 2019–July 2022*, IEA, Paris [63].

Governments' responses to the Russian-induced energy crisis may decide whether they enter the next decade of high-carbon development or follow the path toward the decarbonization of their economies to limit global warming to 1.5 °C, as strongly recommended by the Intergovernmental Panel on Climate Change (IPCC) [55].

One way to reduce single-supplier dependency is to diversify energy generation, including through renewable energy sources and generation, which can be decentralized depending on the context (e.g., wind, solar, and small-scale hydropower), and demand-side management (e.g., storage and improving energy efficiency) can reduce the vulnerability to climate change [67]. The European Union is the most exposed of the largest economies not only to rising costs but also to the risk of energy shortages. Almost a quarter of the EU's oil imports are from outside the EU, and almost half of the EU's natural gas imports come from Russia. The EU's energy dependency ratio, measured as the share of net imports (imports minus exports) in gross domestic energy consumption (defined as the sum of energy produced and net imports), shows that the EU relies on imports to meet more than 60% of its energy needs. This means that the response to the increase in energy prices in the EU depends not only on the energy intensity of EU imports but also on the share of imports from Russia. European dependence on Russian gas ranges from zero in Spain to around 40 percent in Germany and Italy, but it is much more in Eastern Europe, such as the Czech Republic and Bulgaria [68]. With the arrival of summer, shortages in gas supplies in 2022 may not disrupt the economy too much, but the most important period of interruptions in gas supplies will be the next winter. The reconstruction of gas in storage during the summer period will keep gas prices high. There will likely be significant investments in green energy in Europe and in Liquefied Petroleum Gas (LPG) import port facilities to reduce dependence on Russia, although the build-up will take some time: this will further increase Gross Domestic Product (GDP) [69].

As a result of Russia's invasion of Ukraine, the price of natural gas has risen sharply, which has a direct impact on the global use of coal. It is predicted that the global demand for coal will be at a record level in 2022. The world's coal consumption will increase, returning to the level from almost a decade ago. According to the IEA report, the governments of EU countries have decided to delay the withdrawal from energy production by coal-fired power plants. In addition, the EU has lifted restrictions on coal to increase the availability of coal-based power generation and thus reduce the life of gas, which is a scarce commodity [69].

Such actions will unfortunately have a negative impact on the natural environment and climate protection. Based on current economic and market trends, global coal consumption is projected to increase by 7% in 2022 to 8 billion tonnes, and a similar trend will continue in 2023 [45]. The continual burning of large amounts of carbon in the world increases concerns about the climate, as burning carbon releases CO₂ into the atmosphere.

The world's carbon consumption increased by about 6% in 2021 as the world economy quickly recovered from the initial shock of the COVID-19 pandemic. This exponential growth has contributed significantly to the highest-ever annual increase in global energy-related CO₂ emissions in absolute terms. In 2022, global coal demand is supported by rising natural gas prices, which have intensified the shift to coal in many countries.

5. Conclusions

In Europe and around the world, climate change is noticed, and national governments and companies make many efforts to minimize negative actions. One of the most important initiatives is the decarbonization of the economy and industry. However, in many countries, coal remains the key fuel in electricity generation and is used in a wide variety of industrial processes. Due to the energy crisis, coal consumption in the European Union is expected to grow by 7% in 2022, in addition to last year's 14% increase. This is driven by demand from the electricity sector, where coal is increasingly used to replace the gas that is lacking and which has experienced huge price spikes following Russia's invasion of Ukraine. The price of gas rose from 2.5 USD/gal before the invasion in February, to 4 USD/gal in June 2022 (1 gal = 3.78 L) [70].

Several EU countries are extending the life of coal-fired power plants that were about to be shut down, reopening shut-down plants, or raising operating-hour limits to reduce gas consumption. However, Europe is only responsible for around 5% of global carbon consumption [53,69]. At the same time, energy companies are investing in innovative solutions to meet climatic requirements. Energy companies will make large investments in renewable energies and in the creation of new smart grid systems using digitization [71] and implement strategic goals based on the created and implemented investment goals [72]. The development of wind energy, hydropower, or solar energy will affect the achievement of goals related to the zero-emission economy. These are actions, at the same time, aimed at slowing down the observed rapid climate change [73].

The European Union has joined forces to counter the effects of the energy crisis caused by Russia. This is extremely important, as so far, the European Union has had problems implementing a single, coherent energy policy.

After analyzing the situation, it is possible to answer the research question: in the short term, it is important to ensure the continuity of energy supplies, even at the expense of returning to fossil fuels, while in the long term, energy companies will rely on renewable energy sources. The direction of the development of the energy sector will be toward decarbonization and the development of innovative solutions aimed at a zero-emission economy.

The presented research shows two directions of the development of the energy market. One, based on renewable energy sources, aims to decarbonize and implement a zero-carbon economy. The second one, activated as a result of the energy crisis caused by the Russian–Ukrainian war, is based on coal and other fossil fuels. Both directions are opposite to each other, as the former reduces the negative impact on the environment and climate, while the latter increases emissivity and increases global warming. Thus, policymakers are currently faced with the dilemma of energy security and climate change.

The issues related to climate change, energy, and the zero-emission direction are quite well documented in scientific studies, while the impact of the Russian–Ukrainian war and the issue related to this conflict and actions taken by the European Union and other countries of the world are not yet widely described in scientific journals. This paper aims to look at these issues from the point of view of scientific considerations (the use of scientific tools and scientific research methods) and will contribute to further scientific discussion.

The contribution to the discipline of management and issues related to the functioning of enterprises in the energy market, resulting from the research carried out, is to show the directions of enterprise development in the aspects of decarbonization, climate change, and the energy crisis.

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