

INNOVATIVE ENTERPRISES IN THE FACE OF CONTEMPORARY ENVIRONMENTAL CHALLENGES

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Purpose: The paper aims to highlight contemporary environmental challenges and to present innovative ways of their mitigation. The study is based on the activities of the Grupa Azoty Capital Group, one of the leaders among European fertilizer and chemical companies. The methods used by the Company are compared with the most important regulations introduced at the national and international levels, allowing for both the problems and their potential solutions to be presented. Simultaneously, the paper emphasizes the importance of undertaking various activities in the interest of the common good.

Design/methodology/approach: To prepare this article, the document analysis method and the comparative method were used. The study is a review in nature.

Findings: The article identifies the most important environmental problems and innovative ways to limit them.

Social implications: Highlighting the most important environmental challenges should increase the awareness of recipients about the importance of taking responsible actions. In turn, the solutions implemented in the Grupa Azoty Capital Group can serve as inspiration for introducing new, innovative ideas.

Originality/value: The article presents the growing environmental problems and attempts to counteract them. The discussion of the latest findings and implemented actions is significant not only from the point of view of entrepreneurs but also consumers, who thus gain a more complete picture of reality.

Keywords: environmental challenges, European Green Deal, Grupa Azoty Capital Group, Green Nitrogen.

Category of the paper: General review.

1. Introduction

As technology advances, humans have an increasing impact on the environment. According to some scientists, the influence of human activity on climate change reaches even 90% (Malucha, 2010). As a result, an observed increase in Earth's surface temperature is accompanied by the extinction of many plant and animal species and changes in surface waters.

Such factors have a direct impact on the quality of life, including access to drinking water and food. The emerging weather extremes and diseases, previously occurring only in selected areas, pose a direct threat to humans (Stochaj 2022). Therefore, it is essential to constantly shape the awareness of both consumers and entrepreneurs.

In response to the strong need for increased environmental protection, numerous legal regulations appear. An appropriate provision is even found in the Constitution of the Republic of Poland, according to which environmental protection should be closely linked to the principle of sustainable development. Various activities, responding to emerging environmental challenges, should inspire the search for innovative solutions and the development of technology, rather than becoming a barrier to further progress (Pilarczyk A., Pilarczyk E., 2022).

The responsibility for introducing and enforcing appropriate regulations lies with public administration bodies (Walas, 2009). The creation of climate protection strategies and counteracting growing environmental problems can be implemented at the national level, as exemplified by the Polish Energy Policy until 2040. However, it should be remembered that local actions are insufficient in this case, which is why a coherent effort to improve the current situation is necessary. In response to this need, numerous regulations, such as the European Green Deal, are created by the European Union (Olech, 2022). Moreover, there significant initiatives are also undertaken by the United Nations and other institutions, both intergovernmental and non-governmental (Prandecki, 2013).

There is no doubt that the way large companies operate has a huge impact on the environment. In their case, meeting the assumptions contained in various regulations often requires the development of an internal strategy. A prime example may be the actions of one of the European leaders in the fertilizer and chemical industry - Grupa Azoty Capital Group. The Grupa Azoty plan for 2021-2030 fits perfectly into the objectives of the European Green Deal and is an idea for meeting contemporary environmental challenges. The company places particular emphasis on issues such as reducing emissions and decarbonization (Grupa Azoty with a strategy..., 2021).

2. Contemporary Environmental Challenges

One of the most important environmental challenges in today's world is the rising temperature of our planet. Climate change is a natural process, dependent on solar activity and the Earth's position in orbit. However, it turns out that human activity also has a significant impact on climate change (Malucha, 2010). This problem is inextricably linked to the industrial revolution that began in the 20th century. Since that time, there has been a constant development of human economic activity in a broad sense, which is reflected in the so-called global warming.

Scientists predict that without taking appropriate action, the average temperature of the Earth will rise by as much as 6°C over a century (Mikhaylov et al., 2020).

This type of threat is largely a consequence of the increase in greenhouse gas concentrations. Their increased content in the Earth's atmosphere is related to the combustion of fossil energy resources, deforestation, and industrial activities, among others. The result of the accumulation of greenhouse gases is the increase in the temperature of the lower layers of the atmosphere, and consequently, the increase in the Earth's surface temperature (Mikhaylov et al., 2020; Stochaj, 2022).

One of the main greenhouse gases is carbon dioxide, which is why reducing its emissions is among the basic methods to counteract climate change (Malucha, 2010). The formation of this gas is largely the result of natural processes, such as volcanic eruptions. However, we cannot eliminate such incidents. Therefore, it is particularly important to focus on human activity that contributes to the release of significant amounts of CO₂ into the atmosphere, so as not to exacerbate an already serious problem. Highly harmful processes include the extraction of energy from the combustion of brown and hard coal, oil, and natural gas. Deforestation and intensive agriculture are also of great importance (Prandecki, 2013; Gierlotka, 2020).

The presence of certain substances, both gaseous and solid, in the air contributes to climate change on the one hand, and has a negative impact on human health on the other. In the case of Poland, the situation changes depending on the season. In winter, we mainly deal with high concentrations of suspended dust and benzo(a)pyrene. In summer, there is a high content of tropospheric ozone in the air. Occasionally, there is also an exceedance of the standard for permissible nitrogen dioxide concentration, which results directly from the use of internal combustion engine vehicles (Frańczuk, 2022).

Another significant factor with a negative impact on the environment is pollution from solid waste. Improper storage and disposal of waste leads to contamination of water and soil, through the infiltration of heavy metals, and also to the emission of gases such as carbon, sulphur, and nitrogen oxides into the atmosphere. In this regard, there is a strong emphasis on reducing waste generation and finding ways to reuse or process waste. It is also essential to raise public awareness of the importance of this issue (Ferronato, Torretta, 2019).

Both climate change and human activity also contribute to significant changes in access to drinking water. The consequence of irrational management of such valuable resources may be their depletion. The problem is exacerbated by rising temperatures and resulting droughts. This situation poses a direct threat to human health and life. In addition, the lack of water significantly limits or even prevents the procurement of food. The problem of wasting both water and food also adds to the issue. These accumulating threats can lead to a serious crisis, so it is necessary to take appropriate action. Among them, we can distinguish the change in crop models, as well as responsible political decisions, such as regulations governing food export and import (Hashemi et al., 2019; Cattaneo et al., 2021).

All these factors affect not only the climate but also the safety of people. The high probability of exposure to various pollutants does not remain indifferent to health. The presence of undesirable substances in both air and water increases the risk of developing many ailments (Lenzen et al., 2020). There are also many diseases whose occurrence is strongly related to weather conditions, and thus to selected locations. An increase in temperature in one area and a decrease in another can cause infections to spread to an area where this type of threat did not previously exist. This means exposing a large group of people without developed immunity. The changing climate also means an increased risk of extreme weather events. Depending on the region, the frequency and scale of phenomena such as droughts, floods, or hurricanes may increase. Such factors, combined with problems in obtaining clean water, also have a negative impact on crop yields, and consequently, on access to food (Stochaj, 2022).

3. Climate change mitigation strategies

In response to the growing environmental issues and related threats, a variety of strategies are being developed to counteract these factors. As mentioned earlier, in Poland, the Constitution itself imposes the obligation to undertake such measures. According to Article 5 thereof, environmental protection should be ensured in accordance with the principle of sustainable development. This means that any adverse impacts on the environment should be minimized, and the benefits resulting from such activities should be greater than the associated damages. The initiatives undertaken must therefore be balanced, ensuring environmental protection on the one hand and serving the social interest on the other. At the same time, they should not conflict with economic freedom (Pilarczyk A., Pilarczyk E., 2022; Frańczuk, 2022).

Environmental protection is, however, such a broad issue that it cannot be considered only at the local level. The consequences of neglecting or even exacerbating the problems discussed earlier are felt on a global scale. There is no doubt that counteracting these adverse changes must also be carried out on a large scale. With this awareness, the European Commission has developed an innovative strategy to help European Union countries meet contemporary environmental challenges. This document, called the European Green Deal, places great emphasis on implementing initiatives such as striving for climate neutrality and ecology. This does not mean that previous environmental objectives have been omitted. On the contrary, they have been not only organized but also expanded (Grzegorzczuk, 2022).

The main assumption of the European Green Deal is to create an economy whose development and functioning will be as independent as possible from the use of natural resources. The result of the actions taken is to achieve zero greenhouse gas emissions by 2050. In this way, not only the environment but also human health and well-being are to be protected.

An essential element is also putting people first. The pursuit of the set goals should unite citizens rather than be at their expense. In addition, the European Union should inspire and encourage its neighbours and partners to take action to protect the environment. The global character of the undertaking is also confirmed by the fact that the discussed plan is one of the six key elements of the UN agenda for sustainable development 2030 (European Commission, 2019).

Limiting greenhouse gas emissions is, for obvious reasons, a gradual process. The initial stage of this task is to reduce emissions by 55% compared to 1990. This goal is to be achieved by 2030 as a result of a series of actions described in the Fit for 55 package. The first of these is changes in the emissions trading system, mainly affecting maritime transport and aviation, as well as the construction sector. At the same time, the introduction of a carbon border tax is planned to prevent the undermining of efforts by transferring high-emission productions outside the EU. This approach should also mobilize other countries to undertake pro-environmental actions and, as a result, affect a much larger area. The changes gathered in the discussed document are also to concern land use and forestry, specifically the goal related to carbon dioxide absorption. Emission standards for this gas are also to affect passenger and delivery vehicle drivers. From 2035, the introduction of internal combustion engine vehicles to the market is to be suspended. There is a strong emphasis on the use of alternative fuels. This solution aims to reduce emissions for all types of transport. An important aspect of the actions is also to provide support for companies and citizens who find themselves in particularly difficult situations due to the introduced regulations. This mainly concerns households, micro-enterprises, and transport users. The Fit for 55 package also includes a number of proposals related to energy. Above all, it is about increasing the share of renewable energy sources in the total energy consumption. By 2030, this share should reach at least 40%. Efforts should also be undertaken to increase energy efficiency, as well as to reform the taxation of energy products and electricity (Olech, 2022; Ready for 55..., 2023).

As mentioned earlier, environmental protection requires taking appropriate steps on a large scale. However, the significant diversity of situations in individual countries requires the development of local plans as well. In the case of Poland, the Energy Policy of Poland until 2040 was created to bring about the country's energy transformation. The strategy is based on three main pillars. The first pillar - just transformation - focuses on regions and communities that will find themselves in a difficult situation as a result of the measures taken. To counteract the negative effects of pro-environmental regulations, new development opportunities must be created, such as new jobs and even new industries. The program is primarily aimed at coal regions, but it also foresees benefits for individual energy consumers. The second pillar is a zero-emission energy system. Its main idea is based on the use of nuclear and wind power. However, distributed and citizen energy systems are also an essential element. The third pillar - good air quality - is primarily a strategy to move away from fossil fuels. The implementation of such an extensive plan has been divided into eight specific objectives. The first is the optimal use of domestic resources, the essence of which is to reduce the environmental burden

associated with resource management. The implementation of this task should be carried out without jeopardizing energy security and taking into account the needs and problems of all social groups. The second objective includes the expansion of electricity generation and network infrastructure. This is not only to ensure the stability and security of energy supply but also to fulfil various types of international commitments. According to the assumptions, the planned actions will lead to a reduction in coal's share while simultaneously developing technologies that use renewable energy sources. The next goal concerns the construction of new connections that will enable the supply of natural gas from more than one direction. The measures taken are also intended to improve the reception and storage of crude oil and liquid fuels. Energy markets are also the subject of the fourth specific objective. In the case of electricity, the emphasis was placed on striving to increase the active participation of consumers. The development of the natural gas market is to be related to the establishment of a regional gas transmission and trading centre (hub). In turn, limiting emissions and ensuring fuel security in the crude oil market is to be based on replacing petroleum products with bio-components and alternative fuels, as well as on the development of electromobility. Investment activities related to hydrogen technology are particularly important. Energy production itself is also the subject of two subsequent specific objectives. The first focuses on nuclear power, while the second concerns renewable energy sources, with particular emphasis on offshore wind farms. Additionally, the development of photovoltaics and onshore wind farms is planned, as well as heat pumps and the use of biogas, biomass, and geothermal energy in the heating industry. Meeting heating needs is also the topic of the next specific objective, within which the aim is to use systems with the highest energy efficiency and the lowest possible emissions. The last specific objective, on the other hand, concerns actions aimed at improving energy efficiency, taking into account the entire economy (Ministry of Climate and Environment..., 2021; Olech, 2022).

4. Innovative solutions in the industry

Creating new goals and related legal regulations implies the necessity for individual companies to develop detailed plans. The choice of the right strategy depends on the actual situation of a given company and the most significant problems it faces. A huge part of pro-environmental assumptions concerns reducing carbon dioxide emissions, which is closely related to energy production. A great example of consistent pursuit of their implementation is the Grupa Azoty Capital Group, which in response to such expectations prepared an innovative strategy for 2021-2030. This example is not accidental, as one of the leaders in the fertilizer and chemical industry in Europe, it has a significant impact on the energy and raw material situation of our country (Drozdowicz-Tomaszek, 2022; Goranczewski, Kądziałowski, 2022).

The planned actions are primarily aimed at minimizing the emissions of individual installations and implementing modern solutions in the field of renewable energy sources. Focusing on low- or even zero-emission products is a response not only to emerging legal regulations but also to changing customer expectations, who also attach increasing importance to ecology. Another manifestation of concern for the environment is supporting agriculture by striving to increase the efficiency of fertilization and producing the highest quality food (Kwiek, 2021a).

As already mentioned, the key element in combating climate change is minimizing greenhouse gas emissions, the result of which is to achieve climate neutrality. Such an assumption requires modernizing a company's internal energy production. In the case of Grupa Azoty, there is a strong emphasis on replacing coal with renewable energy sources. Implemented projects are to reduce carbon dioxide emissions by over 800,000 tons by 2030 compared to 2020. In addition, as much as 40% of the generated electricity is to come from renewable sources (Kwiek, 2021a).

The basis for the decarbonization process is the production of "green hydrogen" and its use in fuel cells. In connection with this, as part of the "Green Nitrogen" project, work is underway in the Kędzierzyn-based subsidiary of Grupa Azoty to create an Alternative Fuels Laboratory. The main task of its employees will be to assess the purity of the mentioned gas. This parameter is extremely important, especially from the point of view of fuel cells. Hydrogen use is expected to revolutionize transport, primarily rail (Kwiek, 2022a; Świda, 2022). As the largest hydrogen producer in Poland, Grupa Azoty Capital Group is also involved in initiatives aimed at creating Hydrogen Valleys in the country (Kwiek, 2022b; 2022c).

Obtaining energy from renewable sources is essential both from the point of view of environmental protection and for financial reasons. Therefore, one of the solutions used by Grupa Azoty Capital Group are photovoltaic power plants. The benefits of their use include not only reducing the carbon footprint but also the absence of waste resulting from current exploitation and the lack of water consumption. An additional advantage is that such power plants do not generate annoying noise (Kwiek, 2022d; 2022e; 2023). A great example can be a 1 MW installation located in Kędzierzyn-Koźle. On an annual scale, it provides additional energy production of 970 MWh while simultaneously reducing carbon dioxide emissions by as much as 793 tons (Kwiek, 2022f).

Carbon dioxide production is a problem not only in the process of generating electricity but also during the production of chemicals. Also in this area, Grupa Azoty Capital Group shows great commitment and focuses on innovative solutions. The company has been awarded several times in the Decarbonization Initiatives Ranking for its actions. In 2021, the modernization of the nitric acid installation was highlighted. Several years of work in 2020 made it possible to achieve as much as an 83% reduction in carbon dioxide emissions compared to 2018 (Kwiek, 2021b). In 2022, the implementation of a specialized control system was awarded, which led to a reduction in carbon dioxide emissions by over 20 kg per tonne of produced ammonia (Kwiek, 2022g).

As part of the Grupa Azoty Capital Group strategy for 2021-2030, there is also a strong emphasis on research on so-called "green products". By definition, these are products with the smallest possible carbon footprint made from natural raw materials. Examples include varieties of natural polyamide and its derivatives, thermoplastic starch, and modern specialty fertilizers (Kwiek, 2021c, 2022h, 2022i).

5. Conclusion

There is no doubt that environmental protection is an extremely important issue. Growing problems such as air and water pollution or climate change pose a direct threat to human health and life. It is no wonder that various organizations around the world have undertaken work to find the best solutions in the fight for the well-being of our planet. As a result, numerous legal regulations have been created that go far beyond the scope of just one country. Such an approach is necessary, as only global actions have a chance to bring about much-needed changes.

In response to the set goals, individual companies have also been forced to develop their own strategies. Grupa Azoty Capital Group is an excellent example of tremendous commitment and the implementation of innovative solutions. The objectives pursued by this company mainly focus on obtaining energy from renewable sources and maximizing the reduction of greenhouse gas emissions, primarily carbon dioxide. An important aspect of Grupa Azoty Capital Group's activities is the modernization of existing production facilities, as well as the search for new biodegradable products with the smallest possible carbon footprint. The efforts described in this study constitute the most significant part of the company's environmental protection activities.

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