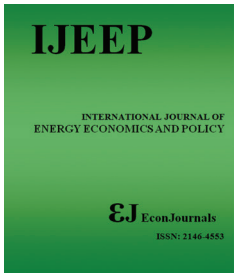

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Net-Zero Emission Industry: Efficiency of EU Regulation in the Context of American Approach

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ABSTRACT

The relevance of the study is due to the aggravation of the global climate crisis, which requires urgent and coordinated action by the leading participants in international relations. The European Union and the United States play a key role in the global economy and have a significant impact on industrial emissions. Given their role, a comparison of their legal approaches to achieving zero emissions is crucial for the development of an effective global policy in this area. The purpose of the article is to identify the optimal legal mechanisms and strategies for the implementation of zero-emission industry. The article provides a detailed analysis of the legal regulation of industrial emissions in the EU and the US. The authors examine the monitoring and reporting mechanisms, the role of case law, and the specifics of economic incentives in both jurisdictions. The article identifies the advantages of a centralized regulatory system in the EU compared to a flexible but fragmented approach in the US. The authors reveal the key challenges of harmonization, including different levels of economic development and regulatory heterogeneity. The author also substantiates legal proposals for improving zero-emissions regulation, including the unification of standards and strengthening international cooperation. The scientific novelty of the paper lies in the development of generalized recommendations that take into account the most successful practices of both regions and offer a model for combining rigorous supranational coordination with market instruments.

Keywords: Industrial Emissions, Legal Regulation, Green Deal, Clean Air Act, Climate Policy
JEL Classifications: K32, Q58, Q56, H23

1. INTRODUCTION

The high dependence of the global economy on carbon-intensive industries has led to a significant increase in greenhouse gas emissions (Hnedina and Soroka, 2023). Such consequences of human activity create global environmental challenges, including climate change. First of all, it concerns the issue of global warming. This phenomenon is caused by the accumulation of greenhouse gases in the atmosphere and can pose a serious threat to ecosystems (Basok and Bazieiev, 2020). The industrial sector is one of the key sources of greenhouse gas emissions. It plays a critical role in shaping climate policy, as the success of global initiatives to reduce emissions and adapt to climate change depends on the degree of its environmental reorientation. Of particular relevance and global importance is the urgent need to address this issue in order to create the preconditions for a climate-neutral future (Sachs et al., 2023).

It is worth noting that today the international community is taking large-scale measures to overcome these challenges in the legal field. Fulfillment of international obligations is impossible without an effective legal framework aimed at a gradual transition to zero emissions (Hu et al., 2024). Relevant legal norms are aimed at limiting the negative impact on the climate and gradual transition to clean technologies. Thus, the relevant legal norms

are intended to lay a stable foundation for a green economy and sustainable development. Notably, climate-related issues are also included in the UN Global Sustainable Development Goals, in particular Goal 13, Climate Action (United Nations, 2015b). Industries are significant contributors to global emissions and often face economic and structural challenges in transitioning to low-carbon alternatives. Addressing these challenges requires innovative solutions, appropriate policies, government regulation, and international cooperation (Hnedina and Soroka, 2023).

Given the global nature of the problem, the approach to solving it should also be supported by all participants in international relations. Nevertheless, the leading actors, such as the EU, the US, and a number of other countries, still play a significant role in this matter, as they are able to set high standards of environmental regulation. Their policies on industrial emissions regulation not only set certain legal guidelines but also encourage other countries to join the process of shaping the global climate security agenda. The global community is increasingly inclined to use legal instruments and coordinated actions of leading economies to create conditions for a gradual and inevitable transition to zero emissions.

In addition, despite a number of international legal acts, national policies and approaches to climate change may still differ. Some states place a strong emphasis on regulating emissions, while others may be more cautious, fearing negative impacts on national industrial sectors or employment (Iacobuta et al., 2018). In the context of such a diversity of views and development models, the search for compromise solutions and the development of flexible legal mechanisms are particularly important. Such mechanisms should ensure environmental safety while promoting economic growth (Duțu-Buzura, 2022). Ultimately, a successful transition to zero emissions is only possible if the interests of various stakeholders in international relations are balanced. With this in mind, it seems appropriate to analyze the relevant legal regulation of the EU and the US in order to summarize common and distinctive features, identify advantages and disadvantages, and prospects for harmonization.

2. LITERATURE REVIEW

The study of the legal regulation of industrial emissions in the context of EU and US climate policy is based on a wide range of scientific sources covering both theoretical aspects and practical experience in this area. Fundamental to understanding the global context are the works devoted to theoretical analysis of climate policy and its legal framework. For example, Powałowski (2023) considers the role of state regulation in ensuring economic stability and achieving social goals, including environmental safety. In turn, Basok ana Bazieiev (2020) analyze the problem of global warming as a key challenge of our time, emphasizing the importance of the transition to low-carbon technologies. These studies emphasize the need to integrate environmental goals into the structure of public administration and legislation.

The EU demonstrates a systematic approach to regulating industrial emissions through initiatives such as the European Green Deal (European Commission, 2019) and the European Climate Law (European Parliament and Council, 2021). Dupont et al. (2023), Kulovesi and Oberthür (2020) analyze the EU's longstanding experience in strengthening climate ambitions and achieving sustainable development goals. They emphasize multilevel governance, which allows member states to adapt European goals to their own conditions. However, as Dubash (2020) notes, the EU needs to further improve mechanisms to fully achieve climate neutrality.

US climate policy is characterized by flexibility, allowing legal mechanisms to be adapted to the needs of individual states. The federal regulation is based on the Clean Air Act (U.S. Environmental Protection Agency, 1990), while the Supreme Court decision in Massachusetts v. EPA (US Supreme Court, 2007) expanded the EPA's authority to regulate greenhouse gases. Bartosiewicz and Miley (2014) emphasize the importance of regional initiatives that create market-based incentives for emissions reductions. These programs demonstrate how decentralization can facilitate local solutions within the framework of overall climate goals.

Meyer and Zahar (2020), Fetting (2020) analyze EU and US climate policies, emphasizing the advantages and disadvantages of each approach. The EU demonstrates effectiveness through a unified regulatory framework and mandatory standards, while the US emphasizes economic incentives and business involvement in the green transition. The authors emphasize that international cooperation and the exchange of best practices are critical to the convergence of legal approaches. Initiatives such as the Net-Zero Industry Act in the EU and the Inflation Reduction Act in the US are important components of modern climate policy. Farber (2023) and Fal (2022) analyze these acts as examples that create favorable conditions for the introduction of innovative technologies and financial instruments. At the same time, the authors emphasize the need to integrate such mechanisms into the global legal system.

Overall, the literature review shows that industrial emissions regulation covers a wide range of legal, economic, and social aspects. The EU and the US offer different but complementary approaches. They can serve as a basis for harmonizing global climate policy. Further research should focus on integrating innovative solutions and strengthening international cooperation to achieve climate neutrality.

3. MATERIALS AND METHODS

In preparing this article, the author used a combination of several methods and approaches to comprehensively consider the specifics of legal regulation of industrial emissions in the EU and the USA, taking into account current environmental challenges. The study is based on a comparative analysis of the climate and industrial legislation of the two leading economic entities - the EU and the USA. In particular, the key regulations, regulatory mechanisms, and the role of relevant institutions are analyzed. The comparison reveals the strengths and weaknesses of each model, as well as possible ways of harmonization.

The legal method of scientific research was also applied by the authors of the article. The research is based on a thorough study of key regulations and court decisions. These documents shape climate policy and regulation of industrial emissions in the EU and the US. Particular attention is paid to the Massachusetts v. EPA precedent as a crucial decision that expanded the powers of the US Environmental Protection Agency in the field of greenhouse gas regulation. This approach makes it possible to assess the legal nature, content and mandatory nature of each act, as well as to determine how legislation and judicial practice interact in forming a unified regulatory policy.

In addition, a systematic approach and structural-functional analysis were used to write the article. The study takes into account the complexity of climate policy, covering economic, environmental and social aspects. In particular, the study examines how legal requirements and economic incentives (tax breaks, grants, subsidies) interact within the framework of industrial policy, as well as the place of scientific and technological progress in this system. This method was also used to formulate specific proposals for improving the legal regulation of climate change issues. The authors also formulated specific proposals for conflicts that may arise in the relevant segment in the future. In general, the relevant research results obtained using this method are reflected in the Discussion and Conclusions of the article.

The method of studying best practices was applied to assess the potential for harmonizing approaches and developing recommendations for improving zero emissions regulation, taking into account the experience of the most successful initiatives in the EU (EU ETS, Net-Zero Industry Act) and the United States (California Cap-and-Trade, RGGI, tax incentives under the Inflation Reduction Act). This allowed us to identify opportunities for cross-fertilization and mutual borrowing of innovative solutions.

This article uses the methods of analysis and synthesis to comprehensively study and summarize the legal mechanisms for regulating industrial emissions in the EU and the USA. The analysis method allowed us to break down the legal framework into separate elements (in particular, directives, regulations, court decisions) and evaluate each of them in terms of its significance, legal force and scope. The synthesis, in turn, helped to combine the results of the analysis into a single holistic picture, identify the relationships between different legal documents and institutions, and formulate conclusions on the consistency of legal norms and their potential for further harmonization. This approach allowed us to identify the most effective regulatory solutions, outline gaps in the existing regulatory framework, and develop proposals for improving the legal regulation of zero emissions.

The combination of these methods made it possible to see the legal regulation of industrial emissions in a broader international context and to form a comprehensive conclusion on the effectiveness of the EU and US mechanisms, outline prospects for harmonizing approaches, and develop targeted recommendations for further improving global climate policy.

4. RESULTS

4.1. Legal Analysis of the EU Climate Policy Framework

Politics is understood as, among other things, the activities of state authorities, especially government. It can also be understood as the ability to exercise public authority, the ability to mobilise members of the collective for social goals and to gain their obedience to the decisions of the authority, as well as the ability to effectively implement the set social goals in a diverse society (Powałowski, 2023). The modern state seems to treat interventionist behaviour not only as a method of achieving market equilibrium, but also, or perhaps above all, as a way of pursuing objectives set by the public interest and defined by the state itself, and falling within the framework of economic policy, e.g. protection of society from environmental threats.

Integral parts of the economic system are, inter alia, those regulations whose content is the ordering of the economy by the state in the name of achieving public objectives (Lange & Banasiński, 1970). Global climate change mitigation measures must constantly take into account the latest scientific knowledge and assessments (Dupont et al., 2023). This requires steadily raising targets and strengthening policies. Although the European Union has regularly updated its climate policy since the 1990s, scholars note that it is still in its infancy (Kulovesi & Oberthür, 2020; Dubasch, 2021).

The EU's climate policy is based on the desire to transform the economy into a low-carbon one and achieve climate neutrality by 2050. An important milestone on this path is the European Green Deal adopted in 2019. It sets strategic benchmarks for reducing greenhouse gas emissions and provides for the modernization of the energy sector. It is also worth noting that the course provides for the development of innovative green technologies. The document defines specific goals for decarbonizing the economy and applies a comprehensive approach. It includes renewable energy and energy efficiency measures (European Commission, 2019).

The EU's goal of achieving climate neutrality by 2050 is aimed at realizing the main objectives of the Paris Agreement: to keep the increase in global average temperature well below 2°C and to make efforts to limit the temperature increase to 1.5°C (Zubko and Koputsia, 2021). This goal also serves as a basis for advancing the achievement of the global adaptation target set out in Article 7 of the Paris Agreement (United Nations, 2015a).

The relevant policy is based on the principles of multi-level governance. This means that each member state has a certain amount of discretion to adapt the European goals to its own conditions. At the same time, the EU legal framework creates a clear institutional framework that encourages member states to move towards climate neutrality. As a result, the EU serves as an example for other countries, demonstrating its ability to combine economic growth with environmental safety. It actively uses international cooperation mechanisms to try to convince global partners to join this ambitious agenda.

In June 2021, the European Council adopted the European Climate Law proposed by the European Commission, which sets a new, more ambitious target of reducing greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels. The law envisages achieving zero greenhouse gas emissions for the EU as a whole, mainly through emission reductions, investments in environmental technologies and environmental protection; it ensures that EU policies contribute to this goal and that all sectors of the economy and society play their part (European Parliament and Council, 2021). Member States also need to develop and implement adaptation strategies to strengthen resilience and reduce vulnerability to climate change. To achieve decarbonization targets, emissions need to be reduced in all sectors, from industry and energy to transport and agriculture. In parallel with mitigation measures, the EU is taking adaptation measures to ensure maximum preparedness for its inevitable consequences (Kulovesi et al., 2024).

One of its elements is the draft regulation on carbon-neutral industry called Net-Zero Industry Act (hereinafter - NZIA). The primary objective of the proposed act is to establish measures for innovation and increasing the production capacity of carbon-neutral technologies in the EU. The aim is to contribute to the achievement of (a) the EU's target of a net reduction in greenhouse gas emissions of at least 55% compared to 1990 levels (by 2030), and (b) the EU's target of achieving climate neutrality (by 2050). An additional objective is to ensure that the Union has access to a secure and sustainable supply of the carbon-neutral technologies necessary to protect the resilience of the EU energy system and to contribute to the creation of high-quality jobs.

The analysis of the New Green Deal should also not overlook the situation of the energy crisis faced by EU Member States as a result of Russia's invasion of Ukraine. Regulatory solutions need to be reviewed, as they can no longer refer only to the design of a zero-carbon economy (of the type - hydrogen as a fuel of the future), but must instead increasingly take into account the negative context and accompanying phenomena such as energy poverty, the financial situation of energy-intensive industries, energy (and especially gas) security, or ways out of the crisis and not necessarily the preferred return to proven technologies. It is indisputable from economic analyses that the implementation of all these (both more and less) necessary tasks requires billions of euros (European Parliament and Council, 2024).

The importance of the NZIA is to create a favorable legal framework and economic preconditions for the development of sustainable infrastructure that helps to combat climate change and guarantees the EU's energy security and independence from external suppliers of traditional resources. By clearly defining the objectives, the act promotes the creation of new jobs in the green sector and attracts investment.

One important regulatory element of the NZIA is the shortening of the permitting process for carbon neutral technologies. The permitting process for production projects of these technologies (unless they have strategic status) is not to exceed 12 months for projects with an annual production capacity of <1GW or 18 months for projects with an annual production capacity of more than 1GW. For upgrades to existing plants, the permitting process is not to exceed 6 and 9 months respectively. The possibility of extending the indicated deadlines is provided for when the project involves risks to the health and safety of workers or the general public.

In addition, for investments for which an environmental impact assessment is required, the national authorities have 30 days to determine the scope and requirements of the impact assessment for the applicant (European Parliament and Council, 2024). An analogous solution is to shorten the permitting procedure for strategic carbon-neutral investments. The NZIA specifies that for such projects, the permitting timeframe should not exceed 9 months (if the annual capacity is to be below 1GW) and 12 months (if the annual capacity is to be above 1GW). For permits for geological underground CO storage sites, the permitting process should not exceed 18 months (European Parliament and Council, 2024).

One of the mechanisms envisaged in the NZIA is the implementation of so-called regulatory sandboxes for investments in carbon-neutral technologies. The project allows EU Member States, at the request of an investor, to waive part of the regulatory requirements and at the same time use a regulatory sandbox tool. A sandbox is a system that allows an entrepreneur to test innovative carbon-neutral technologies in a controlled real-world environment, under a specific plan developed and monitored by the competent authority (Fal, 2022). The NZIA also envisages the establishment of a Carbon Neutral Europe Platform.

The platform is planned to be set up with the aim of supporting EU Member States and the Union itself in working out solutions for the development of carbon-neutral technologies and establishing partnerships between the EU and its Member States. The platform is to be composed of a Commissioner and representatives of the Member States. A cursory review of the solutions shows that they are essentially regulatory in nature, while any incentives of a financial nature are missing. Paradoxically, the main emphasis is on simplifying procedures, the current content of which is mainly determined by derived EU law.

The European Union relies on an extensive system of regulations to regulate industrial emissions. One of the central elements of this system is the Industrial Emissions Directive (hereinafter - IED), 2010, which consolidates requirements for a number of industrial sectors, establishing mandatory Best Available Techniques to minimize harmful emissions to air, water and soil (European Parliament and Council, 2010).

In addition, the EU Emissions Trading System (hereinafter – ETS) plays a significant role. This system creates economic incentives to reduce greenhouse gas emissions. In this context, it is worth mentioning Directive 2003/87/EC of the European Parliament and of the Council of October 13, 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community. This document stipulates establishes the mandatory nature of the system for large industrial facilities and energy companies that must obtain permits for greenhouse gas emissions (European Parliament and Council, 2003).

Decision (EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading scheme introduced a reserve to stabilize the emissions allowance market. The mechanism is designed to respond to an oversupply of allowances that may affect the price of allowances and ensure the efficiency of the system (European Parliament and Council, 2015).

Regulation (EU) 2020/1055 should also be taken into account. This regulation establishes stricter reporting and monitoring rules for ETS participants aimed at increasing the transparency and efficiency of the system (European Parliament and Council, 2020). Among the latest documents, two legal acts adopted in 2023 are worth noting.

The first is Regulation (EU) 2023/857 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030. The Regulation specifies binding annual emission reduction targets for each Member State for the period 2021-2030, taking into account the EU's revised climate ambitions. These targets are calculated on the basis of national GDP per capita, in order to take into account, the socio-economic circumstances of individual countries (European Parliament and Council, 2023b).

The second important document is Directive (EU) 2023/959 establishing a system for greenhouse gas emission allowance trading within the Union, which expands the scope of the ETS to include new industrial sectors. It also aims to increase funding for green initiatives through the mechanism of emissions trading (European Parliament and Council, 2023a).

It should be noted that the list of legal acts in this area is not exhaustive. We have cited only those that seem to us to be of national importance for this study. These regulations provide the legal framework for the ETS to function. They also contribute to improving the efficiency of the emissions market and integrating the system into the broader environmental strategy of the Union. Overall, this approach incentivizes economically feasible emission reductions by encouraging innovation in the industrial sector.

Therefore, the legal regulation of emissions in the EU's industrial sector is a complex and multi-level mechanism based on numerous directives, regulations and decisions adopted in response to ever-growing environmental ambitions. The system is based on the desire to harmonize national efforts of member states with European climate goals. EU regulations and directives in this area set clear technical criteria and requirements. As a result, the current EU regulatory framework for industrial emissions regulation is flexible, adaptable, innovative, and constantly improving based on the latest scientific knowledge. This approach ensures the gradual transformation of the EU economy towards sustainable development.

4.2. The US Regulatory Approach to Industrial Emissions Regulation

The second important actor in international relations is the United States. Accordingly, we are interested in considering this country's approach to regulating industrial emissions. Thus, the US legal approach is based on a combination of federal legislation and regional initiatives. As the United States is one of the world's leading economies and a significant source of industrial emissions, it faces the need to implement effective mechanisms to mitigate the effects of climate change. While the EU focuses on a unified and rigid legal framework, the American approach is characterized by flexibility, significant decentralization, and the widespread use of market mechanisms (Bartosiewicz and Miley, 2014).

One of the central instruments of legal regulation of industrial emissions in the United States is the Clean Air Act (hereinafter – CAA), which was adopted in 1970 and significantly amended in 1977 and 1990. Its provisions cover a number of measures to reduce air pollution from industrial facilities. The CAA introduced the National Ambient Air Quality Standards (hereinafter – NAAQS), which define the maximum permissible concentrations of pollutants that are safe for human health and the environment (U.S. Environmental Protection Agency, 1990).

The law also establishes requirements for emission permits, standards for new and modernized facilities, and greenhouse gas control mechanisms that became more widely used after the 2007 US Supreme Court decision. Thus, in the case Massachusetts v. Environmental Protection Agency, the U.S. Supreme Court made a fundamental decision on the possibility of regulating greenhouse gases as pollutants under the CAA. In this case, the court recognized that the EPA has the authority to regulate emissions of such gases (e.g., carbon dioxide) on an equal footing with traditional air pollutants. This decision was an important turning point in the US climate policy, as it paved the way for the development and implementation of federal rules aimed at reducing greenhouse gas emissions from industry and transportation (US Supreme Court, 2007).

The CAA is implemented by the Environmental Protection Agency (hereinafter - EPA), but states have some freedom to develop their own regulatory programs, which may be more stringent than federal standards. This combination of centralized and decentralized approaches allows for a balance between national environmental priorities and the specific conditions of each state (U.S. Environmental Protection Agency, 1990). As a result, the Clean Air Act retains its status as the basis for legal regulation of industrial emissions in the United States. We can note that this legal act provides a clear system of sanctions necessary to effectively combat air pollution and mitigate the negative effects of climate change. At the same time, the CAA has a flexible approach to sanctions.

The United States does not have a single nationwide emissions trading system, but individual states and regions have introduced their own cap-and-trade and economic incentive mechanisms to encourage the transition to carbon-neutral technologies. The most well-known examples are the California Cap-and-Trade Program and the Regional Greenhouse Gas Initiative in the northeastern United States (Bang et al., 2017; Fell and Maniloff, 2018). Both systems impose a ceiling on aggregate emissions from large industrial and energy facilities and allocate allowances that can be traded among entities.

California's program, introduced in 2013, covers a wide range of emission sources and gradually tightens requirements, reducing the overall cap over time (Lessmann and Kramer, 2024). The RGGI system, launched in 2009, operates among several eastern states and covers fossil fuel power plants (Chan and Morrow, 2019). The proceeds from the sale of allowances under these programs are used to finance energy-efficient solutions that reduce the carbon footprint.

In general, it can be noted that the US federal climate policy remains fragmented. Nevertheless, the existing quota systems and economic incentives create the preconditions for a gradual transition of the industry to a carbon-neutral model. This approach allows each state to adjust climate action to its own economic circumstances. At the same time, it lays the groundwork for attracting investment and technological innovation in the clean energy sector.

In addition to regional mechanisms, tax incentives aimed at encouraging the use of clean technologies are becoming increasingly important at the federal level. In particular, it is worth noting the system of tax incentives for green energy producers (e.g., Production Tax Credit, Investment Tax Credit) and the special 45Q tax credit that encourages carbon capture and storage. In addition, the Inflation Reduction Act of 2022 (hereinafter – IRA) introduces large-scale subsidies and grants for green industry, electric vehicles, and energy infrastructure modernization (U.S. Department of Energy, 2022).

In this context, we cannot fail to pay attention to the IRA. This Act contains dozens of solutions grouped into a dozen different programmes. Each of them specifies a public purpose, the instruments used to achieve it and the budget allocated (Farber, 2023). These programmes can be classified in various ways, if only in terms of their objectives, the instruments used or, finally, the budget allocated to them. From the point of view of this study, the typology of programmes according to the criterion of applied instruments is the most important, as they are the most related to the effectiveness and thus - to the motivational character of the adopted solutions. The following instruments can be distinguished, with the reservation that this is not a logical division, but a typological one:

(a) Tax concessions related to investments preferred by the legislature;
(b) Tax concessions related to the legislator's preferred production;
(c) Grants, subsidies and loans related to other activities favoured by the legislator.

In category (a), tax concessions for investments favored by the legislature appear in initiatives such as the Clean Energy Investment Tax Credit, Clean Energy ITC Technological Neutral, and the Extension of the Advanced Energy Project Credit. These offer a base level relief of 6% of investment costs, potentially increasing to 30% if wage and apprenticeship requirements are met. The total allocated budget for these programmes exceeds USD 70 billion.

Meanwhile, category (b) encompasses tax reliefs for production that lawmakers view as aligned with national objectives. Examples include Clean Energy Production Tax Credit Extension, Clean Energy Production Tax Credit Technology Neutral (for zero CO_2 energy projects from 2025), Zero Emission Nuclear Power Production Credit, and the Advanced Manufacturing Production programme. Collectively, they encourage clean energy generation, nuclear power, critical mineral processing, and alternative fuels, with an overall budget of more than USD 80 billion.

In the third category (c), grants, subsidies, and loans support a wide range of undertakings, from rural electric cooperatives and renewable energy projects to industrial emissions reduction, transmission line development, and low-carbon product labeling. These programmes fund both physical infrastructure – such as new power lines and offshore wind connections – and less tangible objectives like environmental product declarations and technical assistance.

Finally, the loan guarantee initiatives, including the Innovative Clean Energy Loan Guarantee Programme, provide an additional financing layer for projects that avoid or reduce air pollution, demonstrating how federal support can be leveraged to spur clean energy innovation. Taken together, these measures reflect a multi-faceted approach designed to address a broad spectrum of climate and energy priorities through carefully tailored financial and regulatory incentives (U.S. Department of Energy, 2022).

The total budgets of the above-mentioned programmes were estimated at more than USD 60 billion. The above overview makes it clear that the IRA is a set of programmes that are essentially financial in nature. Each of them is targeted at a well-defined element for the implementation of the adopted public (economic) policy, each accompanied by differentiated instruments of financial support, not to say financial incentive. It is also worth highlighting the enormous total budget allocated to the funding of these support instruments.

Thus, the legal regulation of industrial emissions in the United States is based on a combination of a federal framework and flexible regional initiatives. This allows for the diversity of economic and environmental conditions in each state. The Clean Air Act remains the mainstay, setting national air quality standards and mechanisms for monitoring compliance with environmental regulations. However, this legal act is complemented by a system of case law. At the same time, large-scale tax incentives have been introduced in recent years (in particular, as part of the Inflation Reduction Act) aimed at actively engaging businesses in clean technologies and accelerating the energy transition.

Despite the absence of a single national emissions trading system, various states are implementing their own cap-and-trade programs and other economic mechanisms to complement federal initiatives. This combination of centralized and decentralized regulation demonstrates the ability of the United States to adapt its instruments to the specific needs of the regions, while maintaining a general vector for reducing emissions and developing a carbon-neutral industry.

4.3. Comparative Analysis of the Industrial Emissions Regulation in the EU and the USA

Industrial emissions regulations in the EU and the US share a common goal of reducing pollution and stimulating the transition to a low-carbon economy, but their approaches to achieving this goal differ significantly. The European Union focuses on a unified legal framework and clearly defined directives and regulations, setting strict standards and binding targets for all member states (Sikora, 2021). The United States, on the other hand, relies on federal legislation – primarily the Clean Air Act – while allowing broad autonomy for regions to apply their own instruments (Eskander and Fankhauser, 2020).

The submission of the draft NZIA and the adoption of the IRA are unquestionably manifestations of state interventionism (or more broadly, in the first case, of the European Union) as a means of implementing a particular public (economic) policy. In the case under review, I leave aside the question of answering the questions why/why and on what basis/under what rules, focusing solely on the question of how; and even then, only from the perspective of the effectiveness of the acts under review.

Making a revolutionary change to the economic system, and such is what both the NZIA and the IRA are projecting, cannot take place without the participation of business at large. The state is unable to carry it out solely through the use of typical, ordinary legislative instruments. A positive response from business is crucial, if only because the United States, or the European Union, has a market economy system in which private business plays an undeniably important role.

The EU is dominated by a unified approach with a strong vertical governance: European institutions (European Commission, European Parliament, Council of the EU) define cross-cutting obligations and sanctions, which are implemented by member states in their national legal frameworks. One of the key mechanisms is the Emissions Trading System, which covers the main industrial sectors. In addition, there are a number of regulations and directives (in particular, the Industrial Emissions Directive) that detail technical aspects and BAT. This system has a relatively high level of legal certainty, but at the same time requires regular updates to maintain the appropriate level of ambition.

Despite its status as one of the world's largest economies, the United States has not introduced a unified national emissions trading system. At the federal level, the EPA coordinates the implementation of the Clean Air Act. At the same time, regulation is decentralized: a number of states are introducing their own cap-and-trade programs, tax breaks and subsidies, while other states may have minimal regulation (Chan and Morrow, 2019; Lessmann and Kramer, 2024).

Another significant difference is the level of economic incentives and priorities in climate policy. The EU combines a high degree of regulation with strict environmental standards. In contrast, the US makes more use of tax incentives to motivate businesses to develop carbon-neutral technologies (Mayer and Zahar, 2020). Among other things, the IRA has significantly expanded the tools to support green industry (Farber, 2023).

In general, the European Union prefers mandatory harmonization and unified legal acts, while the United States relies on a combination of federal requirements and strong regional initiatives (Fetting, 2020). Both approaches have their advantages and disadvantages. For example, the EU's rigid centralized model guarantees uniform standards and sanctions for violations. However, it can be inert and require lengthy political coordination. The American flexibility, on the other hand, allows for experimentation and testing of different instruments at the local level. However, the lack of a unified strategy can lead to an uneven distribution of environmental efforts. Despite all the differences, both jurisdictions are working to strengthen climate policy and actively engage businesses in the green transition. The results of our research are shown in Table 1 below.

Thus, the effectiveness of EU regulation is largely due to its integrity and the mandatory nature of its rules. American practice demonstrates the importance of incentive economic mechanisms that can complement or even reinforce strict legal requirements. The combination of the best elements of both approaches – unity and rigor on the one hand, and market incentives and flexibility on the other – can serve as a guide for further improvement of international climate policy in the face of growing global environmental challenges.

5. DISCUSSION

In the context of striving for zero industrial emissions, the EU and the US have different priorities in their climate policies. These differences make it difficult to develop universal standards and procedures. For example, the EU demonstrates a systematic approach with strict regulations and unified legal acts. Such regulation is implemented by member states. In addition, it contains direct obligations for business. In contrast, in the US, large-scale legislative initiatives at the federal level are complemented by regional ones (Knox, 2019). This allows for faster testing of new mechanisms, but at the same time creates heterogeneity in the legal framework. Moreover, US climate legislation is much more flexible. This difference in approaches complicates harmonization, as it requires harmonization not only of legal norms but also of a number of other factors that affect the climate priorities of both parties.

We believe that an important challenge in this process is the need to find a common ground for different legal traditions. The US is characterized by a strong role of states and case law (Mayer and Zahar, 2020). The EU relies on supranational institutions and large-scale legislation covering all member states. Harmonization requires flexible mechanisms for mutual recognition of regulatory requirements, as well as the development of common approaches to the verification and certification of green technologies (Kulovesi et al., 2024). An additional complication is the different levels of economic development of individual regions. This requires taking into account the social consequences for communities dependent on traditional industries.

Table 1. Comparative analysis of climate policy frameworks in the EU and the USA

Key aspect	The EU	The USA
Legal and regulatory framework	Unified supranational regulatory system: Directives, regulations, decisions of EU institutions.	A combination of federal laws (primarily the Clean Air Act) and state laws.
The main form of regulation	Strict binding regulations (directives) and centralized goal setting.	Basic federal standards with room for states to impose stricter requirements.
Emissions trading system	A single Emissions Trading System covering major industrial sectors and energy.	There is no national system, only regional programs.
Regional peculiarities	Unification of requirements at the EU level, minor differences in implementation in individual member states.	States have significant autonomy.
Economic incentives	Combine regulation with grant programs, innovation funds, and tax breaks.	Greater emphasis on tax breaks, subsidies and cheap loans.
Main challenges	The necessity to harmonize different economic and social conditions of the EU member states. Continuously increasing climate ambitions, updating directives and regulations.	Lack of a unified national emissions trading system. Polarized attitudes towards climate policy in different states Need for greater coordination between federal and regional initiatives.

However, there are prerequisites for the EU and the US to become the drivers of the global green transition process (De Sadeleer, 2020). They lay the groundwork for further harmonization. In particular, the successful experience of both parties in implementing market mechanisms can serve as an example for creating international standards for emissions trading. In addition, both jurisdictions are already developing systems of tax and financial incentives for clean industry. Such incentives open up space for convergence of preference criteria and reduction of carbon leakage. It is also important to strengthen scientific and technological cooperation to standardize processes in this area on a common platform.

We believe that the introduction of a number of legal measures can strengthen the regulation of zero emissions at the international and national levels. First of all, a single green certification standard should be developed that would unify the criteria for assessing goods and services according to their carbon footprint. In addition, such a standard should include a procedure for mutual recognition of certificates from different countries. At the same time, strengthening the mechanism of carbon adjustment at the border could ensure proper control over imported goods.

Unification of tax and financial incentives would also be an effective step towards harmonization. For example, minimum green standards could be introduced to qualify for subsidies and uniform rules could be developed for issuing green bonds. A common monitoring and reporting system would help to strengthen this approach. In view of possible conflicts and disputes related to compliance with the new environmental standards, it is necessary to modernize judicial mechanisms and provide citizens and organizations with accessible legal remedies. For example, this may include the possibility of class action lawsuits. Such measures are needed to promptly resolve disputes between business and the state or between different business entities. In addition, the social dimension of the green transition can be strengthened through retraining programs. Legislating mechanisms to help employees from high emission industries will allow them to adapt more quickly to the needs of the green economy.

Thus, despite the existing differences, further convergence of legal approaches between the EU and the US in regulating industrial emissions is not only possible but also necessary. This will ensure the formation of effective global mechanisms to combat climate change. A well-established dialog and coordinated implementation of innovative solutions can be the key to progress towards a common goal.

6. CONCLUSION

In general, a comparison of EU and US climate and industrial policies shows that there are different models of legal regulation, each with its own strengths and weaknesses. In the European Union, the effectiveness of regulation is largely due to a unified legal framework, clear goals, and binding rules that prevent significant deviations between member states. This creates a favorable environment for the implementation of systemic solutions. In particular, through mechanisms such as the EU ETS, the Industrial Emissions Directive, or the Net-Zero Industry Act. In contrast, the American approach demonstrates flexibility by combining federal legislation with broad state discretion to implement their own initiatives. Such decentralization can respond quickly to local challenges and facilitate experiments with different emissions reduction mechanisms. At the same time, it can create regulatory heterogeneity on a national scale.

In the context of comparison with the American approach, EU regulation appears to be relatively effective due to uniform standards. In addition, a harmonized system of sanctions and a centralized institutional mechanism are significant advantages. This fundamental strictness helps to avoid gaps in legislation and establishes a level playing field for businesses across the Union. At the same time, the US experience in using market incentives and tax support mechanisms can inspire the EU to further improve its own policy, in particular by expanding investment programs and attracting private capital to green projects.

Thus, the effectiveness of the European model largely depends on the comprehensiveness and binding force of its legal acts. In turn, the American experience vividly illustrates the benefits of economic incentives that can complement or even reinforce strict regulatory norms. The combination of the best aspects of both approaches can serve as a guide for further improvement of

global climate policy in the face of increasingly serious climate change challenges.

Summarizing, it can be concluded that the EU, thanks to its unified and comprehensive legal framework, is achieving tangible efficiency in combating harmful emissions. At the same time, American practice introduces important flexibility and additional incentives. This contributes to wider business involvement in environmental initiatives. Therefore, to develop a truly effective approach at the global level, it is advisable to pay special attention to the combination of coordinated legal obligations and motivating economic instruments. Such a combination strikes a balance between legal certainty and innovative development, creating conditions for the successful implementation of climate goals in different countries and regions of the world.

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