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The Role of The Greenhouse Gas Emissions Trading System in the Carbon Regulation of the European Union

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ABSTRACT

The relevance of the study is due to the need to study the features of low-carbon development of the world economy, to understand the mechanisms and tools of decarbonization, including the formation of a comprehensive policy providing for a wide range of measures to transition to a green economy with minimizing negative consequences. **The subject** of the study is the EU quota trading system as an economic instrument for regulating greenhouse gas emissions. **The purpose** of the work is to analyze the stages of development of the European quota trading system, identify the existing advantages and disadvantages of this system. **As a result** of the conducted research, the existing problems of the European quota trading system are identified; measures to improve the functioning of this system are described; the boundary carbon correction mechanism (as part of the development of the system) is investigated, including its impact on exporters to the EU.

Keywords: carbon regulation; carbon pricing; European Union; emission trading system; green economy; carbon charges; greenhouse gases; climate change; boundary carbon correction mechanism

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INTRODUCTION

At the Conferences of the UN Framework Convention on Climate Change, held in Dubai in 2023, the majority of representatives of the world's leading economies confirmed that they aim to reach carbon neutrality by the middle of this century (2050–2070). Nevertheless, geopolitical and economic crises pose risks to this and they could lead to the introduction of more stringent measures. The choice of instruments of climate policy becomes an even more complex and important task in the context of constraints and negative dynamics of most macroeconomic indicators, such as slowing GDP growth, high inflation, volatile prices for fuel and energy commodities, etc.

ECONOMIC INSTRUMENTS FOR CARBON REGULATION

Carbon regulation is a system of measures aimed at reducing emissions of greenhouse gases, primarily carbon dioxide (CO_2) into the atmosphere of the Earth. Carbon regulation may include various instruments (*Table 1*). Its main goal is to reduce the negative impact on the climate and prevent the potential effects of global warming.

The employment of carbon regulation mechanisms usually involves the use of a variety of instruments. In this case, the most effective and universal are economic measures, especially those that establish a price on carbon, in view of the costs of struggling the consequences of greenhouse gas emissions during the formation of the cost of products.[1]

There are two main approaches to carbon pricing [1]:

1. *Direct* carbon tax *approach* establishing a fixed rate per ton of carbon emissions. It can be set up at a level sufficient to stimulate emission reductions up to a desired level.

2. *Market-based approach* involves an emissions trading system which sets limits on the total amount of emissions that can be produced by a particular sector of the economy. These limits are distributed among market participants who are allowed to trade emission allowances to optimise their emission abatement costs.

ENERGY TRANSITION IN THE EU COUNTRIES

According to Eurostat, the EU's energy mix is predominantly made up of oil and oil products, with a 37% share. This is followed by natural gas with 21% and renewable energy with 18%.

[1] URL: https://www.economy.gov.ru/material/file/c13068c695b51eb60ba8cb2006dd81c1/13777562.pdf?ysclid=le30toz4me704691704

Table 1

Regulation instruments of greenhouse gas (GHG) emissions

Administrative and technical instruments (direct limitation of harmful anthropogenic impact on an ecosystem)	Economic instruments (creating economic incentives)
Technical regulation Resource consumption norms (energy efficiency standards for buildings, fuel consumption norms, etc.). The best available technologies. Quantitative limitation of emission (fixing emission "ceilings" for enterprises and industries)	Regarding emissions: Carbon taxes. Emission trading systems. Subsidies for emission reduction (including subsidies for RES and other clean energy sources). Regarding production or consumption of carbon-containing products: Tax on carbon-containing products. Subsidies for non-carbon-compound products

Source: URL: https://www.economy.gov.ru/material/file/c13068c695b51eb60ba8cb2006dd81c1/137–77562.pdf

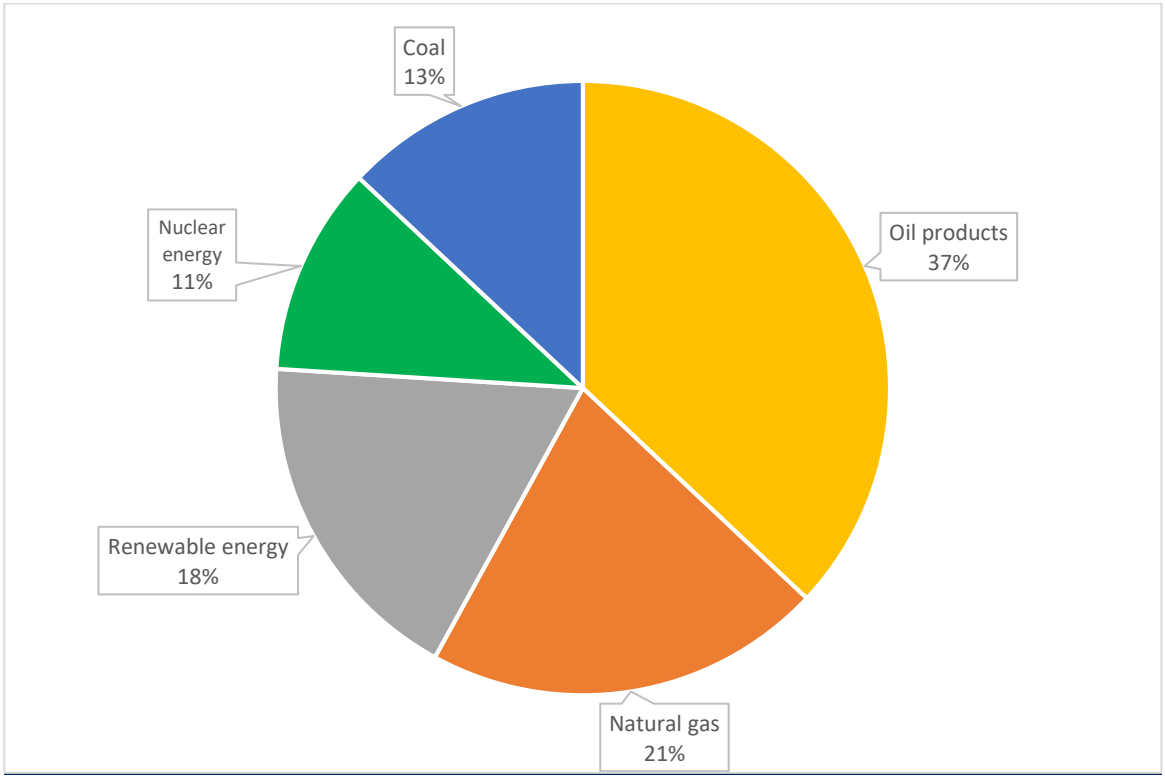

Fig. 1. **Share of energy products in total energy available in the EU, 2022**
Source: URL: https://ec.europa.eu/eurostat/web/interactive-publications/energy-2024

Coal and nuclear power account for 13% and 11% respectively. *Figure 1* shows the structure of the EU energy mix, according to which fossil fuels account for almost ¾ of the total. However, due to the EU targets, this ratio may change significantly by 2050.[2]

However, the shares of different sources in the energy mix are not equal among the member countries. In 2022, the share of oil and oil products was 87% in Cyprus, 86% in Malta and 61% in Luxembourg. Natural gas played a key role in the energy mix of such countries as Italy (37%), Hungary (31%), Ireland and the Netherlands (30% each). The leaders in renewables were Sweden (50 per cent) and Latvia (42%). In France and Sweden, nuclear power plants were a significant part of the energy mix, 35 and 26 per cent respectively. Solid fossil fuels were most widely used in Estonia (58%) and Poland (41%)[3].

Lack of efficiency in the use of natural resources contributes to deteriorated climate situation. The EU is consistently running a policy aimed at making Europe a climate-neutral continent by 2050, when greenhouse gas emissions in the EU countries will be compensated by their absorption [2].

In 2019, "The European Green Deal" Programme was approved as part of the EU's development strategy for the years 2019–2024. It aims to change the way goods and services are produced and consumed, which accounts for 75% of greenhouse gas emissions [3].

The main objectives of the programme include improving resource efficiency, transitioning to a circular economy, restoring biological diversity and reducing emissions. Such initiative is expected to have an impact not only on the economy of the European Union, but also on its partners due to possible changes in energy markets and reduced purchases of high-carbon products[4].

[2] URL: https://ec.europa.eu/eurostat/web/interactive-publications/energy-2024

[3] [3] Ibid.

[4] URL: https://eec.eaeunion.org/upload/medialibrary/b34/Doklad-

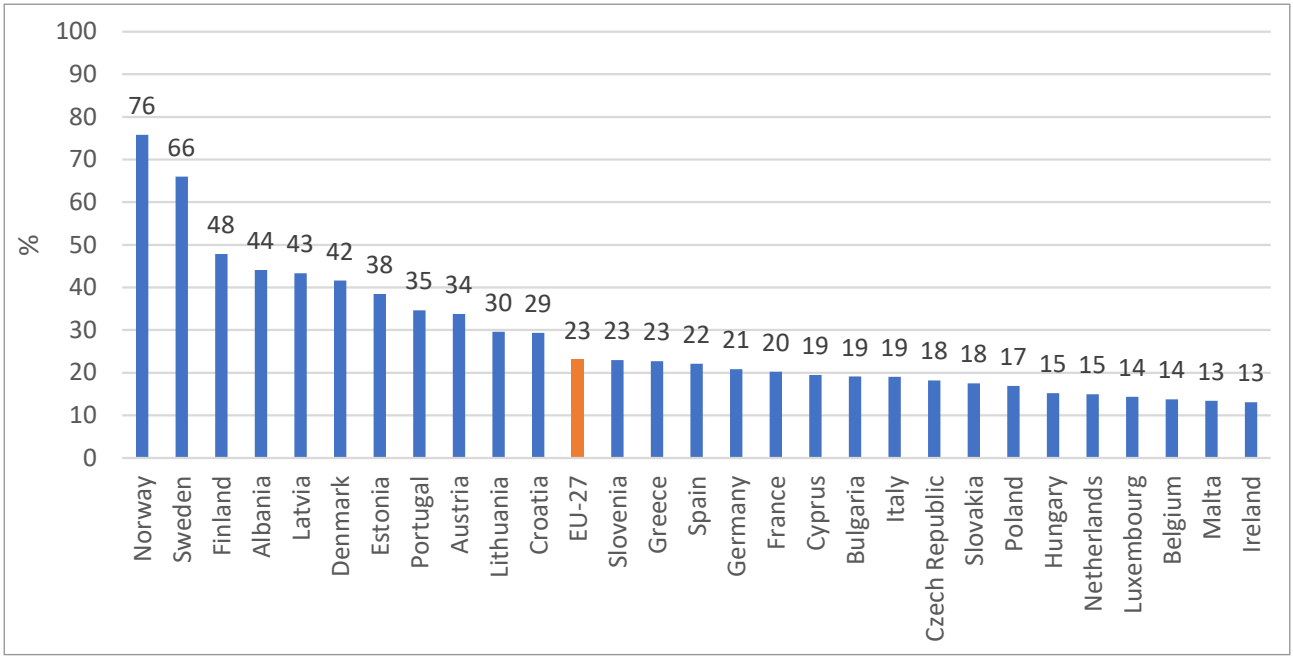

Fig. 2. **Overall share of energy from renewable resources in the EU, 2022**

Source: URL: https://ec.europa.eu/eurostat/web/products-eurostat-news/w/ddn-20231222–2

According to the prognosis of the European Commission, fossil fuels will continue to cover about half of the EU's energy needs by the year 2030. At the same time, fossil fuels are characterised by different degrees of intensity of emissions into the atmosphere [3].

Thus, the use of coal, one of the most high-carbon elements of the EU energy system, is expected to decrease significantly by 2030. By 2050, it is planned to almost completely avoid the use oil from the energy mix, and natural gas will provide only 10% of the EU's energy needs [4].

The active use of renewable energy in electricity, industry, construction and transport could boost the EU's independence in energy, kick-start the transition to green energy and, later on, reduce energy prices. The European Commission proposes to increase the renewable energy target by 2030: from 40 to 45 per cent within the framework of the Fit for 55 package. According to the latest Eurostat data, the share of RES in 2022 consumption at the EU level has already reached 23% (*Fig. 2*).

Such fundamental changes in the EU energy system will inevitably lead to geopolitical and economic consequences, including for oil and gas exporting countries, as well as for global energy markets and European energy security, etc. [5].

At the same time, despite the start of process of energy transition, there exist a number of difficulties:

- endemic problems of energy supply, which are related to the increasing share of RES in generation;
- the probability of another energy crisis, characterised by a sharp increase in the cost of fuel and energy commodities, which brings into question perspectives of success and forethought of the European decarbonisation strategy and it gives a new direction to discussions on the role and place of fossil fuels in the EU energy mix;
- the increasing share of coal in electricity generation due to the energy crisis, which has a negative impact on emissions.

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All these problems require an integrated approach and joint efforts of all EU member states. They become drivers for regular reformatting of energy policy.

GREENHOUSE GAS EMISSIONS TRADING SYSTEM IN THE EUROPEAN UNION

Currently, decarbonisation issues are under particular attention, among other things, due to deterioration of climate situation. As a consequence of extensive economic growth, increased greenhouse gas emissions pose serious threats to national security: more frequent droughts, water shortages, shrinking forest territories, reduced air quality, etc.). How to reduce greenhouse gas emissions and achieve carbon neutrality? This can be done through carbon pricing. Currently, there are 73 carbon pricing initiatives in the world, including cap-and-trade systems and carbon taxes and costs (11 Ht CO_2-eq.)[5].

One of the most well-developed and important initiatives is the European Emissions Trading System (hereinafter EU ETS) [6]. This system started to operate in 2005 and continues to be the main instrument of the EU policy towards carbon neutrality. The EU ETS is the largest one of its kind. It regulates about 40 per cent of emissions from more than 10,000 industrial sources[6].

The basis aspect of the EU ETS is the traditional approach to addressing environmental protection issues, providing economic incentives for businesses to reduce emissions [7]. Initially, the effectiveness of this system was limited, however, after some changes in the third phase of its implementation, the pressure on enterprises with high emission levels has increased significantly, as was evidenced by the increase in the cost of allowances (*Table 2*) [8].

Initially, the European Commission determines the annual total indicator for emissions from all sources and each type of greenhouse gas. Based on this data, the maximum permitted emissions are set for each emitter in the current year. This becomes its annual quota. Then these allowances are determined as individual emission permits to be sold to the relevant regulated entities.

Within the framework of this mechanism, emitting enterprises must first of all purchase the required number of emission allowances from the central authority. If an enterprise exceeds its quota, it can buy additional permits from those that have reduced their emissions. If its emissions are below the quota, it can sell the remaining permits to other enterprises, or to the central authority. This mechanism stimulates enterprises to reduce emissions in order to reduce the cost of buying additional permits [9].

Thus, the European Commission has made it clear, that the number of allowances granted for each emission source must not exceed the CO_2 emission level set by its pre-determined production plan. Establishing the upper limit of CO_2 emissions allows to create the necessary deficit of allowances for stimulating trade and maintaining an adequate (high) cost of permits [10].

Emission prices in emissions trading systems, including the EU ETS, depend on the balance of supply and demand. They are also determined by the free exchange of allowances. A cap-and-trade mechanism ensures leveling up automatically of distribution for emissions and their gradual reduction. It involves the free and voluntary re-allocation of emission allowances from sources, which do not need them to those which need them, because of the higher carbon trace of their products. It should be noted, that the EU ETS has the potential to be a very effective means of managing CO_2 emissions into the atmosphere. However, over the long term, no country has been able to successfully implement a climate strategy and achieve significant results (*Fig. 3 — in kilotonnes CO_2 eq*).

To achieve cost-effective emission reductions, the EU ETS has been reinforced. Specifically,

[5] URL: https://carbonpricingdashboard.worldbank.org/

[6] URL: https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets/what-eu-ets_en

Table 2

EU ETS Developmental Stages

Characteristics of the stages	Phase 1 (2005–2007)	Stage 2 (2008–2012)	Stage 3 (2013–2020)	Stage 4 (2021–2030)
Objective of the stage	Pilot project	Reduction of emissions by 8% compared to the level of 1990	Reduction of emissions by 21% compared to the level of 1990	Reduction of emissions by 62% compared to the level of 2005
Territories	EU	EU & Norway	EU with Norway, Iceland, Liechtenstein	EU + Norway, Iceland, Liechtenstein. UK withdrawn from EU ETS
Types of greenhouse gases	Carbon dioxide CO^2	Carbon dioxide CO^2 Nitrous oxide N_2O with voluntary agreement of participating countries	Carbon dioxide CO^2. Nitrous oxide N_2O. Perfluorocarbons (PFC) from production of aluminium	Carbon dioxide CO^2. Nitrous oxide N_2O. Perfluorocarbons (PFC) from production of aluminium
Application sectors	Energy. Energy-intensive sectors	Energy. Energy- intensive sectors incl. aviation within the EEA	Energy. Energy intensive industries. Aviation in the EEA and aluminium, oil, chemicals.	Energy. Energy intensive industries. Aviation in the EEA, aluminium, oil, chemicals + maritime transport
Types of quotas	Free allocation of almost all quotas. Penalty for non-compliance € 40/ tonne CO^2	Free quota allocation reduced by 90 per cent. Auctions introduced in some member states. Penalty for non-compliance up to € 100/tonne of CO^2	Auctions. Free quota allocation allowed for green policy companies. Introduction of Market Stability Reserve and Reserve for new entrants. Penalty for non-compliance up to € 100/tonne of CO^2	Retention of free quotas for green companies. Gradual reduction of remaining free quotas. Penalty for non-compliance up to € 100/tonne of CO^2
Specialties	Over-supply of allowances, low emission prices	Supply and demand imbalance	Introduction of market correction mechanisms for imbalances of supply and demand	Expanded coverage of industries — introduction of a separate emissions trading system for construction and transport

Source: URL: https://www.ecb.europa.eu/pub/economic-bulletin/focus/2021/html/ecb.ebbox202106_05~ef8ce0bc70.en.html

free allowances are significantly reduced on an annual basis and its territory is expanded with itineraries of maritime transportation (*Fig. 4*). Overall, restrictions have been expanded to reduce emissions by 62% by 2030 compared to 2005 level.

Simultaneously, the operational parameters of a special Market Stability Reserve (MSR) were adjusted to organise a balanced EU carbon market. This mechanism allows for automatic changes in the number of permits auctioned under predetermined conditions.

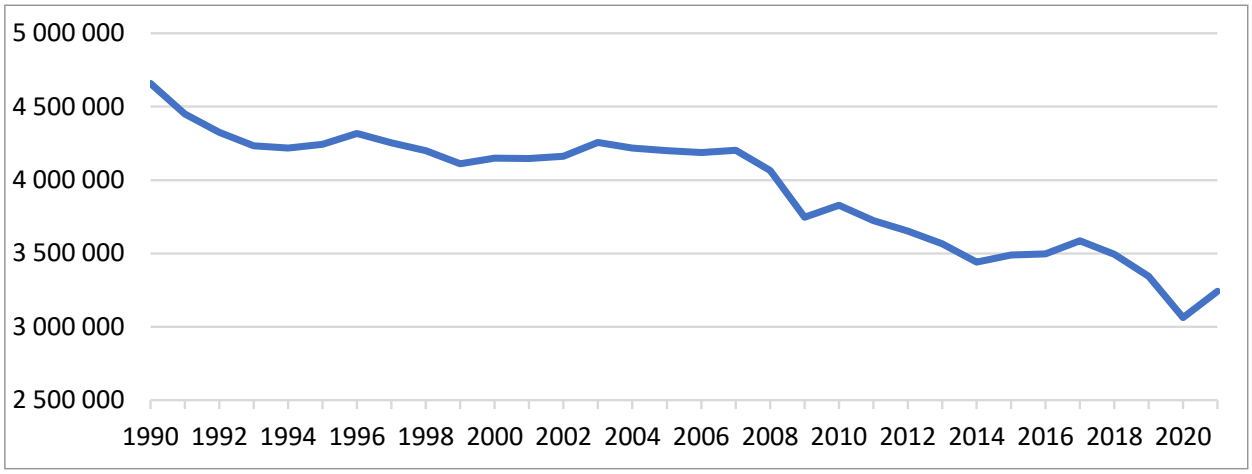

Fig. 3. **GHG emissions in the EU in 1990–2020, ktonnes CO_2 eq.**

Source: URL: https://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer.

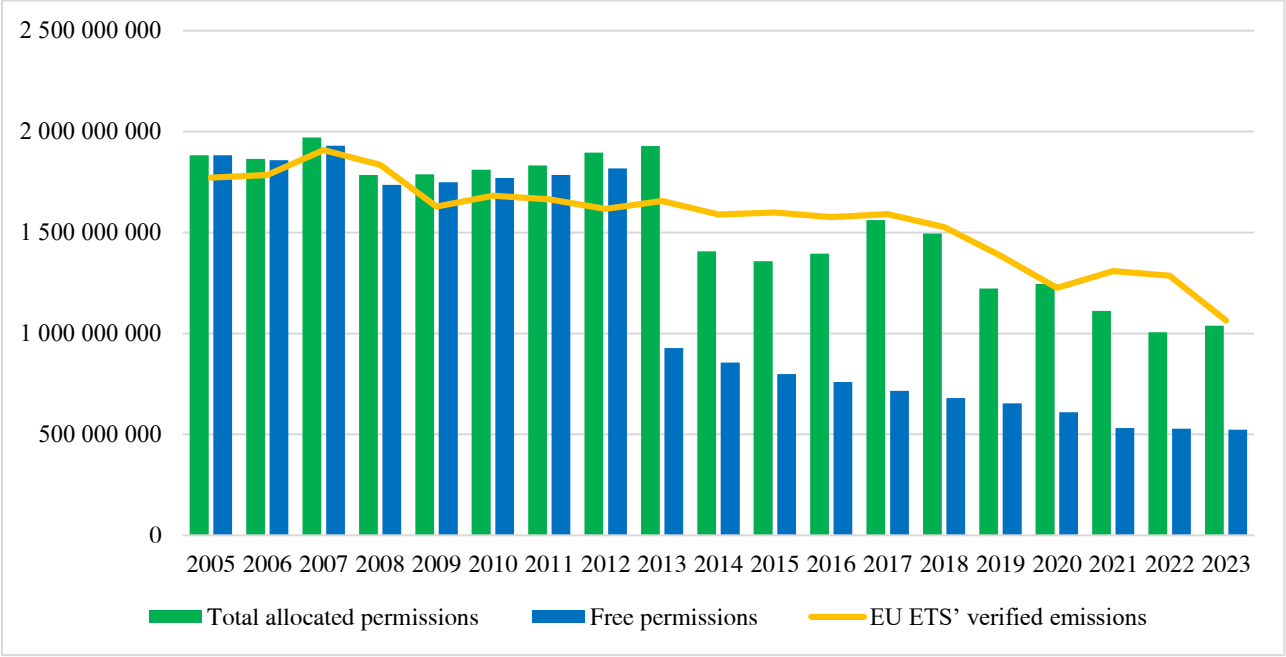

Fig. 4. **EU ETS reduction in 2005–2023, in ktonnes CO_2 eq.**

Source: URL: https://www.eea.europa.eu/data-and-maps/dashboards/emissions-trading-viewer-1

For example, if the total volume of unsold permits in the carbon market exceeds a certain limit, they are automatically transferred in the MSR. Conversely, if the total volume of unused permits is insufficient, they can be removed from the Reserve and positioned for the market.

To improve the EU ETS system the following measures should be taken, including:

- More effective reporting transparency. Requirements for reporting procedure of enterprises, as well as monitoring and control system for emissions should be more effective. This will help to inspire a better confidence

about the system and reduce the chances for manipulation.

• More efficient market monitoring. To prevent manipulation and ensure market stability a set of special measures should be introduced. For example, to limit the amount of allowances that can be sold for, or bought by a single market participant.

• The cost of quotas should be economically justified — high enough, but not exceedingly high that turns out unprofitable for enterprises [3].

INTRODUCTION OF THE EU BORDER ADJUSTMENT CARBON MECHANISM

To avoid the transfer of high-carbon emission industries outside the EU territory to other countries with no (or low) carbon charges and to keep European businesses competitive qualities, the EU has developed the Carbon Border Adjustment Mechanism (CBAM).

The point is, that some enterprises move their high-carbon production outside the EU borders to gain an advantage over other European companies which comply with the climate agenda in good faith. In order to prevent such cases, a step-by-step monitoring system of emissions is introduced, followed by payments to the EU budget for greenhouse gases contaminating the atmosphere [11].

However, it should be noted, that a few decades ago, many large companies made a wide-scale re-location of their production facilities to other countries from the EU territory. The leaders of Russia, India, Brazil, South Africa, as well as BASIC and BRICS groups have repeatedly drawn attention of international community to the fact, that this phenomenon contradicts the norms of international law, including the articles of the WTO charter and the Paris Agreement.[7] Besides, it should be emphasized, this

[7] URL: https://greenfiscalpolicy.org/brics-summit-is-likely-to-strongly-oppose-carbon-tax-proposed-by-eu/

Table 3

Top 10 CBAM exposure countries

No.	Country	Product exports to the EU (% of total product exports)	Gross relative index of CBAM impact	Most vulnerable products
1	Zimbabwe	87	0.087	Iron and steel
2	Ukraine	37	0.053	Cement
3	Georgia	35	0.046	Fertilisers
4	Mozambique	74	0.045	Aluminium
5	India	19	0.031	Iron and steel
6	Belarus	50	0.030	Cement
7	Egypt	38	0.022	Fertilisers
8	Russia	31	0.020	Energy resources
9	Kazakhstan	14	0.016	Aluminium
10	Venezuela	45	0.015	Iron and steel

Source: URL: https://www.worldbank.org/en/data/interactive/2023/06/15/relative-cbam-exposure-index#1

makes a large-scale menace to economies of export industries for a number of developing countries.

Until the mechanism is fully and effectively operational, business in the EU has to purchase permits for rising prices, which affects the final cost of European products and services. Therefore, the European authorities intend to launch the Carbon Border Adjustment Mechanism aiming to increase competitive capabilities of producers of goods and services within the European Union (*Table 3*). Such measures force EU partners to introduce their own carbon trading systems in order to shift the payment of carbon emissions to their territory [10]. Currently, 24 national and subnational markets operate with CO_2 emission allowances trade. Nearly 20 such marketplaces are still in development. In 2021, border carbon adjustment mechanisms started to operate in China, the UK and New Zealand.

The CBAM Regulation associated with higher carbon emissions and assessed by the EU as high risk carbon-leakage products. These include aluminium, cement, fertilisers, iron and steel. Importing goods into the EU territories will require authorisation from a competent authority of the entered into force in May 2023. The carbon levy is expected to come into force on the January 1, 2026 and will initially deal with import of certain products EU member state. The cost per tonne of emissions is influenced by the weekly average final price of a tonne of emissions auctioned under the EU ETS (as of 10 June 2024, the CO_2 price is € 70.9/t). It is important to emphasise that the amount of the levy for an imported good will depend on the actual amount of emissions at the production site where it was produced. The emission level is calculated either by importers or manufacturers. In any case, the declared emissions must be verified by an independent person accredited by the European Commission [12].

At the same time, goods are exempt from the levy if the country builds up its national cap-and-trade mechanism and agrees with the EU on compatibility with the EU ETS.

If carbon levies are charged, the country has a possibility to reduce the amount of CBAM levies. In this case, the importer may ensure the reduction by providing the proper information: the type of product according to the EU commodity classification; the type of carbon price; the country where the carbon fee was paid; whether there is a rebate or any form of compensation available in the country where the fee was paid; the amount of direct or indirect emissions covered, etc.). Switzerland, Norway, Iceland and Liechtenstein are exempt from this system.

CONCLUSIONS

To summarise, it can be said that currently, economic incentives for the benefit of global climate prevail in carbon regulation. The implementation of some of the above mentioned initiatives should contribute to improving the global climate situation, increasing the efficiency of the system of emissions trading within the framework of the majority of countries and regions, including the EU member states [9].

Overall, the EU ETS has demonstrated its potential to create tangible incentives for businesses to reduce greenhouse gas emissions. Reforms and adaptations took place over three consecutive phases, which culminated in the introduction of a mechanism to stimulate reduction of carbon dioxide in various industrial sectors.

The third phase (2013–2020) introduced meaningful changes which significantly increased the pressure on emitting industries. This shift is indicated by a notable increase in allowance prices, which showcases more growing economic signals used to substantially reduce emissions.

Fulfilment of such key conditions as development of reliable means of verification procedure to ensure accurate reporting of greenhouse gas

emissions at industrial enterprises, establishment of economically justified prices for allowances, creation of clear and transparent conditions for trading in allowances, etc., will ensure improved efficiency of the system adopted by the European Union. It is also worth mentioning once again the Carbon Border Adjustment Mechanism (CBAM), which makes a contribution to the regulation of emissions. Although, some countries consider some CBAM regulations fail to meet basic principles of the WTO: most-favoured-nation treatment, EU tariff commitments, principles of uniform administration of measures, etc. It will be possible to draw final conclusions only after the full implementation of the CBAM.

To sum up, the EU ETS is the cornerstone of the EU's decarbonisation policy. It demonstrates both the potential and the challenges of market-based approaches to carbon regulation. If it is successful to encourage reductions of emissions while balancing economic performance, it may influence global efforts to combat climate change. The system is constantly upgraded with supplementary measures (such as the CBAM) which reflects the dynamic nature of the EU's decarbonisation policy in view of changing economic and climate realities.

As the world faces the need to reduce carbon emissions, the European cap-and-trade system gives a practical example of decarbonisation of the economy. The ability of countries to effectively combine economic goals with reductions of greenhouse gas emission will be of paramount importance for shaping the global response to climate change.

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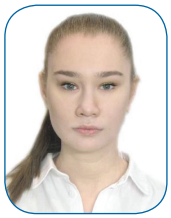

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