The impact of environmental trade policy on regional greenhouse gas management

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Abstract. The study analyzes the environmental condition of regions to analyze the need to implement changes in environmental trade policy to reduce greenhouse gases and anthropogenic impacts on the regional ecosystem. Identified ways to reduce greenhouse gases, one of which is to change consumer preferences in favor of purchasing eco-friendly products. These have a minimal negative impact on the ecosystem during the life cycle without creating a large number of greenhouse gases during production that can be recycled. The study analyzes the possibilities of reducing the ecological footprint due to changes in energy consumption as the main tool for overcoming the accumulation of negative environmental effects. The environmental damage caused by the war in Ukraine is more than 50 million dollars. The environmental impact of the war in Ukraine is more than $50 million, which can be reduced through a complete reorganisation of the country's production and everyday life. The study substantiates the environmental trade policy aimed at reducing greenhouse gases and introducing the latest technologies and digitalization achievements. Regional management of greenhouse gas emissions is proposed based on the possibility of selling one's emissions quotas to other countries to reduce the negative environmental footprint.

1. Introduction

Since the amount of greenhouse gases in the atmosphere is constantly changing because of the anthropogenic impact, it becomes an indicator of the development of the economic sector in settlements. Greenhouse gas is also a residue of industrial activities and affects heat exchange and the environment. At the same time, the introduction of the circular economy is becoming popular at the macro-level as a concept of reducing anthropogenic impact on the environment through innovations and reducing the amount of residue from production activities. Currently, the circular economy is an economic growth project that limits the demand for continuous irrational consumption while at the same time reducing anthropogenic pressure on the ecosystem. However, in our opinion, the creation of a perfect system with no waste is not possible 100% of the time, but each country can limit the negative impact on the environment using this model and create better conditions for human existence [1].

One of the economic sectors that affects the amount of greenhouse gases is agricultural production, particularly livestock, but other sectors also have residues and ecological footprints that can be reduced by changing approaches to producing a socially useful product and implementing circular economy principles.

An example of the introduction of resource-saving technologies arising from the circular economy is the creation of bioplastics and other environmentally justifiable substances. The basis of new compounds is the fact that carbon-neutral energy is used for production and products are reused or recycled at the end of their useful lives, meaning that residues become minimal. Scientists have noted that the COVID-19 pandemic has exacerbated the plastic problem, creating an acute demand for disposable plastic personal protective equipment such as masks, gloves, and face shields. Besides, the problem of packaging materials and the possibility of their reduction have not been solved, which consequently led to an increase in plastic garbage by 3–10 times [2].

Ukraine is experiencing a situation of ecosystem deterioration and destruction of natural and anthropogenic landscapes as a result of the war, which requires immediate solution and restoration, while the restoration of territories will prioritize the creation of systems with a minimum ecological footprint and maximum use of environmentally friendly materials.

Scientists point to concrete as one of the most used materials for the reconstruction of collapsed structures, which can be upgraded given the concept of circular economy. Concrete is upgraded by replacing the material with reinforced fibers, polymers, mixed plastic waste, and rubber, which can be beneficial in terms of the life cycle of the recycled material and improve certain physical properties. The main stages of organizing the circular system in concrete production can be summarized into the following rules: reducing the volume of concrete in structures, reducing the cement content in concrete, reducing the clinker content in cement batter, and replacing materials with high-performance, low-carbon compounds that can be recycled [3].

However, the foundation of a circular economy in Ukraine should be general digitalization and technologization. To improve the performance of any production, it is desirable to follow the next steps: adapting the offer to actual use in accordance with the principles of reducing environmental load, studying the habits of users of goods, adapting the offer, attracting users, improving efficiency, innovating, monitoring, predicting changes, strengthening collection, and evaluating the recovery of products at the end of life. The prediction function can be applied to assess the potential for producing by-products that can be used as materials in other industries and to determine whether the product can be recycled. It is also advisable to use information platforms for industrial symbiosis, intelligent recycling and waste processing plants, and intelligent services that create conditions for the adoption of the circular economy [4].

2. Related works

Understanding success factors and obstacles and automating decision-making systems provides new opportunities for practitioners and researchers in terms of shifting to the circular economy and reducing greenhouse gases as an effect of overall change. The implementation of sustainable production in many countries has positive results, and having an ecological mindset contributes to changing consumer habits towards greening. Scientists note that technological capabilities in resource management increased the adoption of circular economy initiatives, leading to innovative transformation and development of new business models and overcoming barriers such as public misperception of high price and low product quality (value capture), lack of institutional and government support for capacity development, and lack of necessary space in the value chain for reuse [5]. When signing the Kyoto Protocol, which limited the production of greenhouse gases and allowed trading in emission standards, Ukraine became a country that sold part of the potential environmental burden to other countries, but the development of its own emission reduction systems and the introduction of eco-saving systems were quite slow because of corruption.

Therefore, economic problems, which forced a share of large enterprises to stop production or operate below, full capacity, turned out to be a more efficient tool for reducing greenhouse gases. One of the largest producers of greenhouse gases is China, which created its own products and had economic growth by utilizing the natural environment. Fig. 1 shows the significant increase in carbon dioxide emissions as the main component of greenhouse gases after 1995, which is caused by the economic development and the increase in the number of production enterprises in the country, the increase in population, and vehicles, which are the source of CO2.

European practice, where greenhouse gas emissions are constantly monitored, requires payment for emissions by production sectors, which will gradually be introduced in Ukraine to reduce emissions of production waste and subsequent European integration and expansion of markets for Ukrainian products. Since in Europe, as in China, there was economic development and an increase in the number of manufacturing enterprises, we can see a significant increase in emissions by 2019 and after 2021, while between 2019 and 2021, COVID-19 created conditions for a reduction of emissions and anthropogenic load due to reduced economic activities. Since 2015, China has been characterized by a reduction in emissions by introducing environmental regulations, entering international markets, and fighting corruption. However, China's ecosystem has already experienced substantial anthropogenic impact, leading to the establishment of an additional environmental committee in most regions of the country but not leading to significant results due to the growth of economic and production activity. China's policy regarding the use of natural resources is a negative example for Ukraine and undesirable for implementation, so it is advisable to consider developed European countries as an example of industrial waste management.

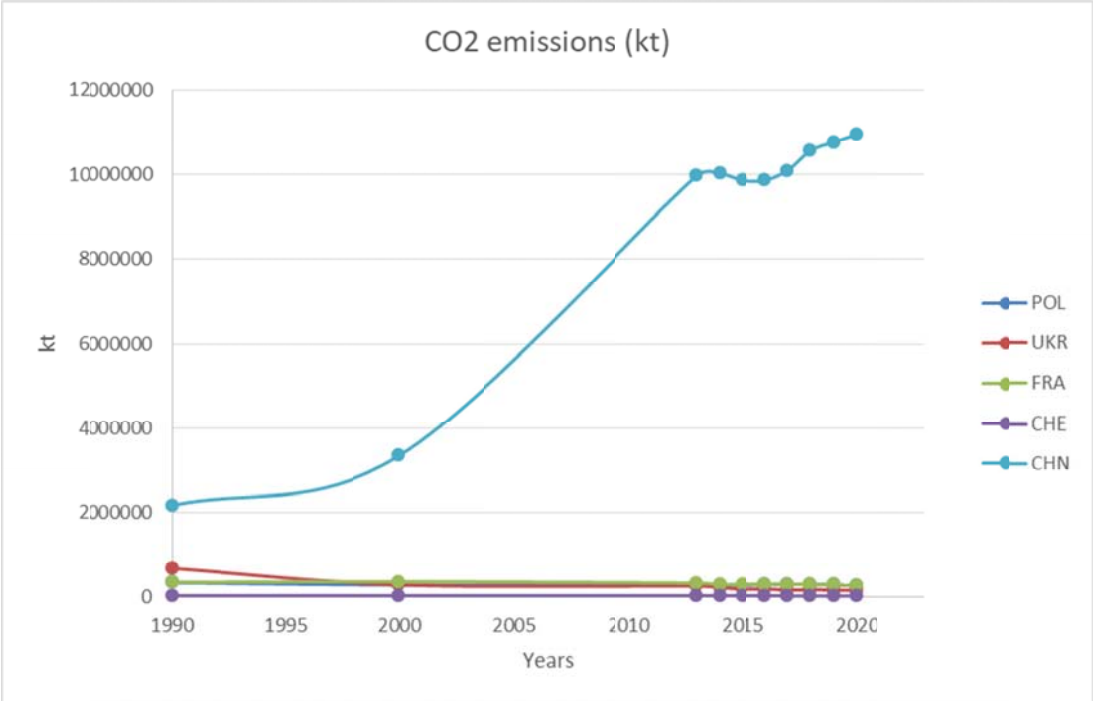

Fig. 1. Climate Watch Historical GHG Emissions [6].

When analyzing greenhouse gas emissions in such countries as Poland, Ukraine, France, and Switzerland, it can be seen that there are no significant fluctuations in most European countries, while

post-Soviet Ukraine has reduced its own emissions by liquidating enterprises or gradually phasing out production facilities. The EU countries feature a common environmental policy forming the Emissions Trading System (ETS) to further reduce emissions by industry and increase investments in environmentally friendly technologies, which can be seen in the emission dynamics in France and Poland since 2014. As of 2023, there has been an abolition of the current royalty-free allowances for industries with high energy demand, which are responsible for creating a large amount of greenhouse gases.

The European environmental policy is characterized by the fact that importers in the EU must report and pay for direct carbon emissions from the production of imported goods, and every enterprise located in the EU must compensate for environmental losses (pay for emissions) or modernize enterprises in order to reduce the environmental burden. The EU ETS stipulates the allocation and trading of greenhouse gas emission allowances throughout the European Union with limits set by each member state, which harmonizes emissions and guides them towards minimization. Any amount of additional allowances that are no longer needed by an enterprise in case of modernization or change of production facilities can be sold on the secondary market through futures or spot markets.

However, quotas are analyzed and reduced every year to minimize the anthropogenic load and to encourage enterprises to innovate in countries where the European monitoring committee, which constantly monitors production activities, is working. For developed countries like Switzerland, greenhouse gas emissions on the time series are relatively stable and do not depend on global trends, which is mainly due to economic stability, constant control over compliance with environmental legislation, timely modernization of enterprises, investments in environmental projects (Fig. 1), and the largest source of greenhouse gases is still transport, which also has better environmental properties with the renewal of the vehicle fleet. Officially, in 2023, the price of one quota (ton CO2) was about 100 EUR, which is a factor in increasing the price of energy from combined heat and power plants, which are mostly obsolete. However, in Ukraine, where non-transparency of information and data and distortion of the real situation are widespread, trading in quotas is not a factor in reducing greenhouse gases, while the moral and ethical principles of production managers and actions of the population to reduce environmental impact have a better result.

3. Results

When signing the Kyoto Protocol, which limited the production of greenhouse gases and allowed trading in emission standards, however, the development of Ukraine's own emission reduction systems and the introduction of eco-saving systems were quite slow. Therefore, economic problems, which forced a share of large enterprises to stop production or operate below full capacity, turned out to be a more efficient tool for reducing greenhouse gases. When analyzing greenhouse gas emissions by the beginning of the war, it can be seen that the Donetsk and Dnipropetrovsk regions were leaders in terms of pollutants (Fig. 2). Significant environmental impacts are observed in the Zaporizhzhia and Ivano-Frankivsk regions. Taking into account the effect of the accumulation of pollutants in the ecosystem and the permanent negative impact on the ecology of these regions by the beginning of the war in 2022, their condition can be assessed as unsatisfactory if we take into account the lack of cutting-edge systems of industrial waste treatment and improper neutralization of toxic substances at many enterprises in these regions, the use of outdated equipment and technologies that remained from the times of the Soviet Union or have reached the end of their useful life.

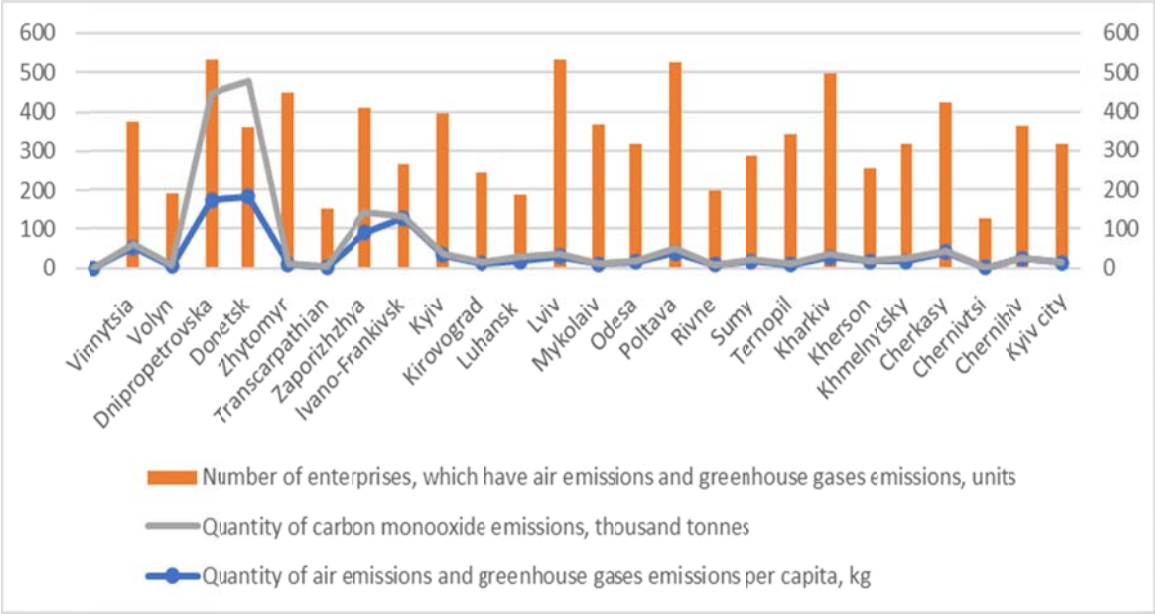

Fig. 2. Emissions of pollutants and greenhouse gases into the atmospheric air from stationary emission sources in 2021 by regions [7].

A characteristic feature of Ukraine before the war was corruption and poor environmental inspection and monitoring, which led to the constant exploitation of natural systems and their negative change. According to saveecobot, these regions are areas of high environmental risk due to the highly developed level of industry and large industrial enterprises that require large energy inputs, which in turn is ensured by the operation of combined heat and power plants that have a large amount of greenhouse gas generation from production activities [8]. Equally important is the assessment of the damage caused by military destruction, totally amounting to 27 billion USD for air pollution, 1.6 billion USD for water pollution, 23 billion USD for pollution due to waste disposal, and 0.3 billion USD for soil pollution for Ukraine as of 2023 [9-10]. However, in our opinion, the metric allowing us to assess the damage from military actions on the state of ecology should be based on finding the maximum value of the flow of useful resources that can be obtained in a certain area, taking into account its natural features or based on the assessment of the utility of the specified area. We will not consider natural phenomena as a way of changing the environment, as we consider it an additional factor in optimising the model and can take it into account in further research. For this purpose, firstly, it is necessary to carry out reclamation and restoration of areas subjected to anthropogenic impact and to observe the sequence of actions (Fig. 3), which will take place taking into account territorial affiliation and the degree of damage.

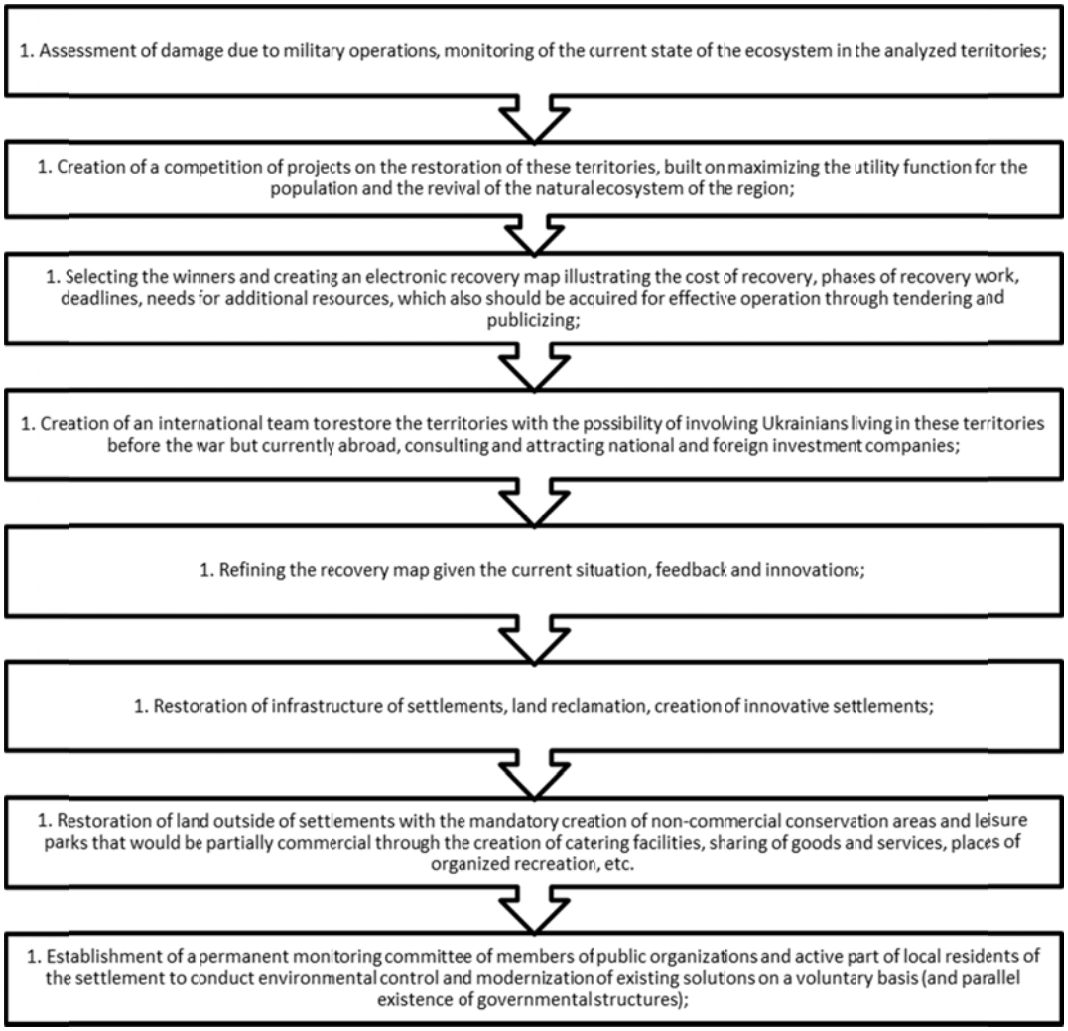

Fig. 3. Sequence of actions to restore destroyed territories and reduce the negative impact on the environment.

If environmental legislation is observed and territories are restored after the necessary measures are taken, the negative environmental impact and greenhouse gas emissions are projected to decrease as a derivative of the overall change function. The costs of territorial restoration will be higher in such regions as Donetsk, Zaporizhzhia, Dnipropetrovsk, Kherson, Luhansk, Kharkiv, Chernihiv, Kyiv, and Ivano-Frankivsk, which are determined not only by the nature and extent of destruction but also by the state of the environmental system before the war.

However, most methodologies for calculating negative environmental anthropogenic impact do not take into account the deterioration of air conditions due to military actions, which also deteriorates the health of local residents and can accumulate in certain territories and landscapes, threatening the existence of the biosystem and having a long-term impact. To assess the impact of anthropogenic factors on the state of the air with regard to the norms of pollutants, it is necessary to take into account the radius of distribution and time of impact, i.e., the assessment of the state of the ecosystem can be carried out taking into account the circumference of impact and, for a clear picture, taking into account the wind rose.

V - concentration of greenhouse gases in the air, mg/m3 (sum of poisonous elements),
T - time (period) of negative effect, min., hour, etc. (can use average value for calculation),
M - maximum permissible concentration norms of poisonous substances (t/y, mg/m3)
R - radius in the vicinity of the impact, m
N - number of fires and explosions occurring in the given territory,

$$E = \sum_{i=1}^{N} \frac{V}{M} * R * T$$

Given the military operations in Ukraine, the amount of greenhouse gases in Ukraine in the Donetsk region increased due to fires and explosions, but the anthropogenic impact due to industrial activities decreased due to the destruction of civil and industrial infrastructure in the region, so this area requires careful monitoring of the current situation after the end of military operations.

Due to permanent stressors on the ecosystem of Ukraine, one should introduce ecological saving systems and promote the use of environmentally friendly goods. This policy will create a market for environmental goods that, according to our hypothesis, should have a positive impact on the amount of greenhouse gases in the country's atmosphere.

Eco-friendly goods have the following characteristics: a natural composition and the absence of compounds in the composition that have a negative impact on living organisms; Resource efficiency and the possibility of recycling (or disposal by biodegradation); Environmental friendliness in the production of goods (lack of technologies in the production that require pollution of the ecosystem or the use of toxic substances); Optimization of production and packaging materials

Thus, the production of environmentally friendly goods implies the control of greenhouse gas emissions at the stage of their creation or distribution. In turn, emissions can be limited using wastewater treatment plants and innovative technologies based on the creation of organic goods that can be easily recycled and reused.

Since one of the sources of increases in greenhouse gases is the energy sector and transport, these parameters can be taken as key parameters for optimizing production at different stages of product creation.

In order to improve energy efficiency in the production of goods, it is necessary to introduce the following regulations:

1. Maximum use of alternative energy sources (installation of solar panels, wind farms, energy generators based on the use of hydrogen, etc.) with minimum use of energy from combined heat and power plants;
2. Minimization of energy consumption in production (installation of lighting sensors, automated machine control systems, use of energy efficient equipment, etc.);
3. Optimization of production time and resource use to improve energy efficiency;
4. Energy efficiency of production facilities and related premises;
5. Creation of energy saving culture among production employees;
6. Automatic control of the temperature regime of production facilities;

Optimal placement of lighting sources, increasing the productivity of light sources and their timely replacement with energy-saving and other technologies depending on the nature of production.

Optimization of the energy sector in the production of eco-friendly goods should create conditions to improve the safety of workers and create a comfortable environment for goods production and human development. There is an increase in labor productivity at enterprises where each employee is provided with a full package of social assistance, where conditions for leisure and free time at the workplace are created, where there is encouragement for the best performance and career development, where interest groups for employees outside working hours are created, and where there is constant access to kitchen and food products during working hours.

According to the anonymous survey, a comfortable environment can improve labor productivity by up to 47% at an environmentally friendly production enterprise (a light industry enterprise specializing in the creation of souvenir products from eco-friendly materials). The second source of greenhouse gas generation when producing eco-friendly goods can be emissions during production and transportation of goods to the final consumer or point of sale. The following steps are suggested to reduce greenhouse gases in the production or transportation (logistics):

1. Minimization (optimization) of logistical routes;
2. Use of sharing transportation facilities and use of postal services;
3. Minimizing the use of packaging materials. If packaging is available, one should use only natural materials with a reduction in the number of additional production facilities;
4. Use of environmentally friendly vehicles if there is a need to create one's own vehicle fleet;
5. Use of innovative technologies and equipment for production;
6. Possibility of using raw materials, secondary raw materials available at or near the enterprise;
7. Creation of an eco-industrial park in the territory of production or functioning within an eco-industrial park.

Obtaining additional certifications and continuous monitoring of the enterprise is desirable for environmentally oriented companies, which implies open documentation of the business model and information about activities, structure and various work processes, as well as consideration of potential public complaints and possible visits to the enterprise. Consumer, widely used goods that can be replaced by eco-friendly products with a reduced carbon footprint include the following products (Fig. 4).

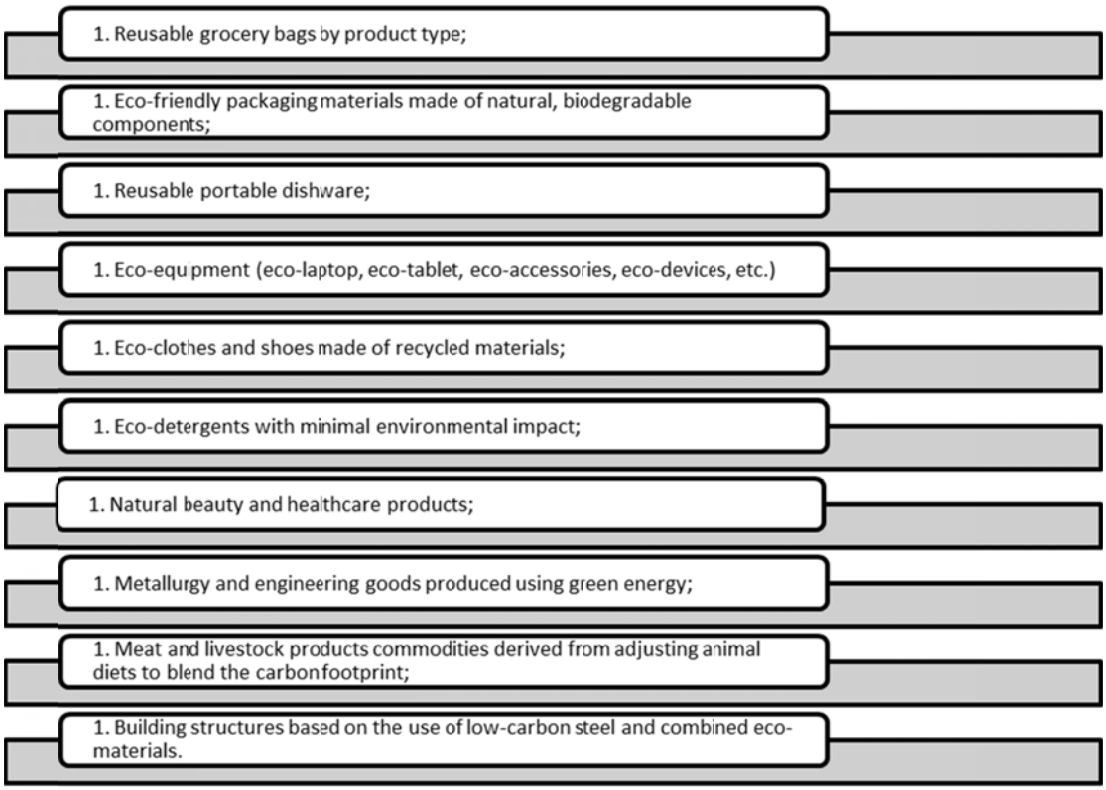

Fig. 4. Widely used products with environmentally friendly substitutes available to the majority of the population.

The trend towards improving the quality of goods and prolonging the life cycle of eco-goods is one of the ways to reduce greenhouse gases due to reduced production and consumption. In this case, goods with longer life cycles and higher consumption characteristics should be favored, which makes markets for used goods up to two times less promising when implementing a green economic system [9-10].

It is suggested to develop independent climate ratings for companies producing greenhouse gases in order to reduce them where it is possible to compare greenhouse gas emissions per unit of area and per unit of produced goods on a 10-point scale, which will allow investors to influence the environmental policy of the enterprise and involve the public in solving pressing problems of the eco-environment. If the value of greenhouse emissions is 0, there will be zero impact on the environment (no negative effect), while when this indicator approaches 10, the impact of the enterprise on the environment is catastrophic and higher than similar enterprises in this industry when analyzing production activities. However, the analysis of this indicator is efficient in cases of environmental transparency and the absence of corruption.

European countries have adopted the 2030 climate plan to reduce greenhouse gas emissions by at least 55% below 1990 levels and decarbonize the European economy.

The climate plan for regions significantly influenced by warfare should be based on cease-fires and reclamation of territories that have suffered climatic losses, which is about 46% of the total area of the country when considering the circumference of the impact of negative sources of influence.

Special attention should be paid to Donetsk, Kharkiv, Kherson, and Luhansk regions, which were in the zone of active combat operations, through full restoration of the regions' infrastructure and restructuring of enterprises in order to increase greening. The presence of illegal mining enterprises in these regions was also one of the reasons for the deterioration of the ecosystem before the war, so after the end of hostilities, it is necessary to create an active public environment and institutions to enforce the existing legislation, which makes illegal and unlicensed activities impossible and contributes to the restoration of the ecosystem.

The best option for the development of these regions would be to modernize industry in accordance with environmental regulations and maximize the redevelopment of enterprises in order to increase the provision of intelligent services and the development of innovative services. It is established that the energy consumption of a production facility for the production of metallurgical products is more energy-intensive than the functioning of an IT product creation office, which proves the reduction of energy consumption due to increased employment in the field of information services. Digitalisation also has a positive effect, as it makes many public and private enterprises more efficient and reduces labour costs. Increased productivity can reduce the number of employees handling paper-based document flows and create conditions for automatic processing of requests, which is also resource efficient.

Since the livestock industry in Ukraine has shrunk significantly in recent years before the war, this greenhouse gas reduction tool is not considered a viable greening method for Ukraine.

Let’s consider replacing household appliances with different types of energy-saving devices as an alternative way to reduce greenhouse gases.

Today, there are seven main energy efficiency classes for appliances: A, B, C, D, E, F, and G. As a rule, appliances with higher energy efficiency have better quality indicators and shorter processing times.

Let us consider the main household items and compare their characteristics in terms of energy efficiency and price, using the example of popular models of appliances currently sold in Ukraine [11]. If there is an electricity rate of 2.64 UAH (as of July 2023), it can be calculated as an indicator of the cost of appliance use. Table 1 shows that the energy consumption of different models of household appliances depends on the technical characteristics of the device and decreases when the model range is updated, which confirms the hypothesis that the environmental load decreases when new types of appliances and equipment are used.

Table 1. Comparison of energy consumption for common household appliances as of July 2023.

Device name	Example model	Energy efficiency class	Average price per unit of the device, USD	Energy efficiency indicator	Average cost of energy in use, USD/year.
Lighting device	Emergency LED bulb	A	5	7 W	3.65
	Iskra incandescent lamp	G	0.4	60 W	31.28
Air conditioner	Cooper&hunter ch-s12ftxla2-ng	A++	725	0.8 kW	83.41
	Hisense AS-13UW4SVETG157	A	400	3.5 kW	364.90
Refrigerator	Whirlpool WHC20T593	A+++	960	177 kW*year	33.37
	Grifon NFN-180W	F	590	273 kW*year	51.47
Washing machine	WHIRLPOOL WRBSB 6228 B UA	A+++	330	153 kW*year	28.84
	Midea MFE06W60/ W-UA	A+	240	196 kW*year	36.95
Microwave	Panasonic NN-SD38HSZPE	A	132	0.6 kW*hour	7.82
	Elektronika SP-23	G	40	1.25 kW*hour	16.29
Vacuum cleaner	BOSCH BWD41740	A	250	1.7 kW*hour	22.15
	Raketa	G	57	3 kW*hour	39.10
Electric cooking stove	Gorenje GEIT5C61XPG	A	763	0.98 kW*hour	25.54
	Atlanta	G	43	2 kW*hour	52.13

When the household has the devices described above, the cost of energy consumption decreases by 387 dollars per year, while the total cost of purchasing appliances increases by 1795 dollars per year.

There is a situation where the costs related to energy optimization will be paid off after 5 years from the beginning of the use of appliances. Taking into account the average lifetime of household appliances of about 10 years, these savings can be considered an effective way for households to save money and an efficient tool for adjusting energy consumption due to the reduction of negative impacts on the energy system and carbon footprint. Besides, Ukrainians widely use such goods as packing polyethylene bags, which have been replaced by reusable bags made of natural materials in developed countries. However, with cotton packaging bags costing 0.4 USD per unit and the possibility to use them about 20 times, there is a trend toward increasing the cost of purchasing an eco-product. While the cost of a polyethylene bag of the specified volume is about 0.07 USD, which is cheaper when used by the consumer, it has a higher ecological footprint and a longer decomposition period of the material, as the production of polyethylene bags is an energy-intensive industry with higher energy inputs than creating a cotton bag (which can be produced by hand) or recycling textile waste.

In this case, the driving force for the consumer's environmental choice should be his or her own desire to improve the environmental situation of the region and awareness of issues of anthropogenic impact on the ecosystem.

Within the last century, there has been an increase in the average annual temperature in the territory of Ukraine, which can be seen in the graphs of temperature regimes in major cities of Ukraine, experiencing constant anthropogenic impact (Fig. 5) [12].

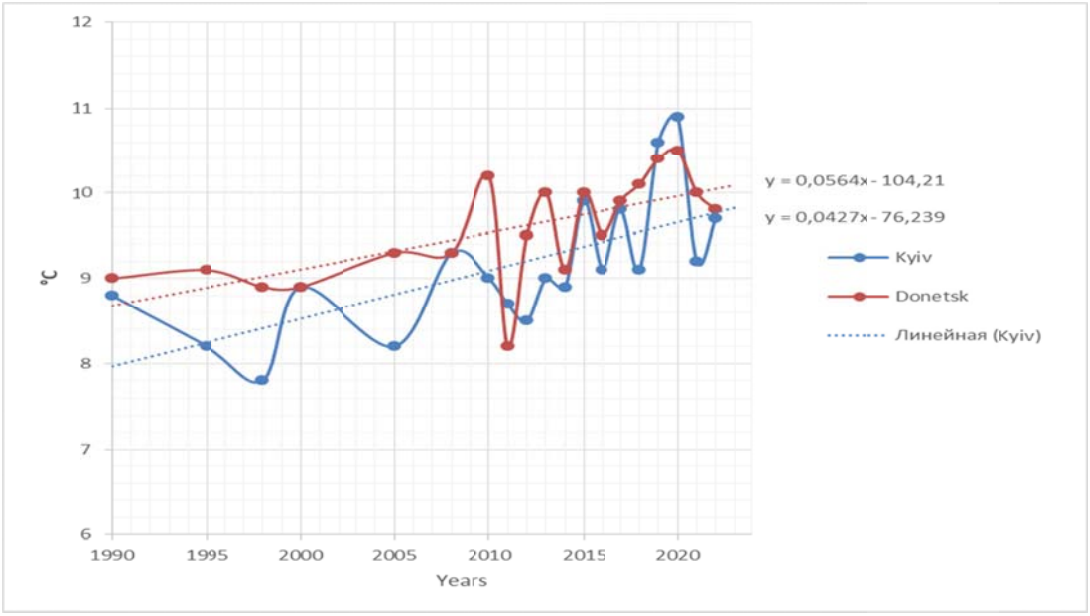

Fig. 5. Average annual temperature changes over the time interval in Kyiv and Donetsk [11].

Fig. 5 shows the increase in the average annual temperature during the study period, which can be caused by increased environmental load, the increasing amount of greenhouse gas emissions, and changes in the ecosystem as a whole around the world. Since the amount of greenhouse gases on the planet as a whole and the average air temperature have increased, this phenomenon is systemic and can be observed in most major population areas on the continent. In Ukraine, the amount of greenhouse gases in 2021, according to official data, was 341.5 million tons of CO2 equivalent, which is 62.5% less than in 1990 but 7.5% more in relation to 2020 [13-14]. The analysis shows that the increase in air temperature in large Ukrainian cities is a planetary phenomenon, not a phenomenon of a specific region. Temperature peaks in 2019 and 2020 were observed in all cities studied, while the level of greenhouse gases in 2020 became lower in Ukraine, which was caused by the COVID-19 pandemic and the change in the operation of enterprises and their partial adaptation to remote management. But, at the same time, energy consumption increased, which is also a source of greenhouse gas generation through the active operation of combined heat and power plants. There was an increase in private cars and a decrease in the popularity of public transportation. Kyiv features a greater angle of slope of the direct change of temperature regime than Donetsk (Fig. 2), which is caused by the increase in temperature in the capital during the past 5 years due to the war and the growth of population, vehicles, and production processes in the Kyiv region, while Donetsk featured a slowdown in economic development, emigration, and curtailment of large production enterprises after 2014. No full-fledged environmental audit was conducted in the entire region. When studying the dependence of the average annual temperature in Ukraine on the amount of greenhouse gases generated during this period, no direct close relationship is observed, but we can see the influence of other negative anthropogenic effects on the ecosystem that change the temperature regime of territories, in particular by reducing the number of perennial green areas, increasing the number of infrastructure facilities (including buildings, paved roads, other structures, etc.), constructing new production facilities, and increasing the number of vehicles and fires.

At the same time about 8.9 million tons of carbon dioxide were generated as a result of military operations; about 1 million tons of CO2eq were generated from the movement of internally displaced persons; and more than 23.4 million tons of CO2eq were generated from fires, highlighting the increased environmental negative effects in places of active hostilities [13].

The cumulative number of negative environmental impacts in the territory of Ukraine is increasing, which emphasizes the need to introduce eco-friendly products and trends, but the main challenge now is to create a peaceful situation where the number of fires, explosions, and destruction would be minimized due to technological development and peace and directed towards zero [14-17].

Considering that when the combined heat and power plant creates 2100 kWh of energy, Ukraine produces about a ton of greenhouse gases, which costs about 100 EUR (the price of a certificate for quotas), the creation of non-energy-intensive and environmentally friendly products that have innovative energy consumption and minimal impact on the environment is desirable not only from the perspective of creating a comfortable environment for life but also in the context of higher economic efficiency.

Since the creation of greenhouse gases increases the cost of goods due to the use of CO2 quotas, it is reasonable to upgrade enterprises, taking into account innovations that have a smaller ecological footprint. Therefore, the production of environmentally friendly products is economically feasible over a long horizon [19, 20].

4. Conclusions

Changes in the environmental state caused by anthropogenic load caused an increase in the amount of greenhouse gases in the atmosphere and other undesirable consequences affecting Ukrainian settlements as well. Emissions trading as an appropriate mechanism for controlling the amount of greenhouse gases proved to be a weak mechanism for upgrading existing enterprises, and large post-Soviet factories and private enterprises continued to generate profits by degrading the ecosystem and using available resources. At the same time, there was an accumulation of negative factors, which created a threatening situation for the existence of living organisms with the outbreak of hostilities.

One of the ways to improve the ecosystem in Ukraine was to reduce energy consumption by modernizing existing automated appliances. The operation of energy production systems based on the process of burning minerals leaves a significant ecological footprint and pollutes the ecosystem, and combined with the constant fires and explosions resulting from war, the amount of greenhouse gases is increasing significantly throughout Ukraine.

It is found that household energy consumption is also a significant source of greenhouse gas creation, so it is appropriate to create conditions for the use of energy-saving devices and promote a change in consumer psychology towards adjusting one's own ecological footprint.

When reconstructing Ukrainian infrastructure, it is desirable to attract companies and investors that would create new buildings equipped with energy-saving technologies and materials. Currently, there is an increase in energy consumption standards in new-generation technological household appliances, and the potential payback period for their costs is up to 5 years, which illustrates the feasibility of purchasing new appliances with an energy consumption level of class A and above as well as being economically and environmentally sound.

Replacing diesel and gasoline vehicles with electric cars given the absence of Ukraine’s own production plants is also an environmentally justified step, and optimizing logistical routes using digitalization and the use of online services will reduce the amount of greenhouse gases in the country. Although the production and consumption of eco-goods can substantially improve the environmental situation in Ukraine, one should create conditions for the formation of a sustainable, environmentally oriented consciousness among the population and a change in the consumer’s psychology towards greening, which will allow eco-friendly goods to enter the market more easily and have objective competitive reasons for their consumption.

In the presence of roads that generate energy for charging electric vehicles, the use of electric vehicles is appropriate, as energy from the outlet is not used or used minimally, while the alternative way of obtaining energy from the roadway is environmentally friendly. The availability of maps and navigators as a form of digitalization speeds up traffic and reduces fuel consumption, which is also positive.

The creation of optimal logistics routes minimizes mistakes for the driver, therefore increasing his efficiency and the delivery of goods, so the development of the latest technologies is a positive change that should be implemented in Ukraine, and the reconstruction of territories should take place only with the consideration of technological maps and the responsibility of international companies for a certain area of the territory, as the private sector of economic development is more efficient than the public sector during the reconstruction period, has less corruption and is interested in creating a long-term project that could be an example for other enterprises.

Trade policy in the allocation of greenhouse gas production between countries adhering to the EU contributes to the reduction of harmful emissions into the ecosystem, but for implementation in Ukraine, it should be based on the values of citizens to preserve the environment and reduce energy consumption because corruption and the desire of entrepreneurs to profit from the use of natural resources will be dominant for most citizens, which can lead to continued degradation of the ecosystem.

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