





**IMPLEMENTATION OF THE EUROPEAN GREEN STRATEGY.
SYNERGY OF EDUCATIONAL, SCIENTIFIC, MANAGERIAL AND INDUSTRIAL
COMPONENTS FOR CLIMATE MANAGEMENT AND CLIMATE CHANGE
PREVENTION / CLIMAN ERASMUS+ KA2**

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Abstract. The urgent problems related to environmental and climate factors, the solution of which requires the involvement of highly qualified and narrow-profile specialists capable of solving and developing effective measures to minimize the negative effects of global warming, were analyzed. The analysis demonstrates that today in Ukraine, there is an urgent need to train climate management specialists due to the global nature of this problem. The main aspects and advantages of the participation of Ukrainian universities in the joint project Erasmus+ KA2 “Synergy of educational, scientific, managerial and industrial components for climate management and climate change prevention” (Climan), which promotes the implementation of multi-level education and professional training on climate services, climate change adaptation and mitigation at the local, national and regional levels are presented. The important particularities and innovative results of the project implementation in higher education institutions in Ukraine, which involve creating climate management centres based on educational institutions, developing interdisciplinary training modules Climate Management, and training qualified climate managers, were described.

Keywords: education, Climan project, climate change, adaptation, mitigation.

1. Introduction

Climate change caused by human activities is defined in current conditions as one of the most significant challenges for countries, governments, businesses and individuals, with large-scale consequences for the humanitarian system and the natural ecosystem. At the 21st session of the Conference of the UNO on Climate Change on 12.12.2015, the Paris Agreement was adopted, which is aimed at implementing the resolution of the UN General Assembly “Transformation of our world: Agenda for Sustainable Development till 2030” and support of ecological integrity, renewable energy, green economy, transfer of high-performance technologies, climate change mitigation, and adaptation to the the climate change. In response to this global trend, initiatives are being developed and implemented to limit the concentration of greenhouse gas (GHG) in the atmosphere of Earth. Such initiatives rely on the assessment, monitoring, notification and verification of GHG emissions and/or elimination of emissions. Therefore, there is no doubt

in the relevance of the provision on the need to consolidate professionally oriented activities in the prevention, adaptation and mitigation of consequences, including training of highly qualified specialists in the field of climate control, climate initiatives and climate management.

An analysis of climate control legislation, state and private initiatives in the field of GHG emissions reduction, carried out by the UNESCO Chair of “Environmentally Friendly Technologies” (409), made it possible to establish the following prerequisites.

Training of climate management specialists in Ukraine as an element of establishing a national system of carbon management and trade in accordance with the legislation and their adaptation to the requirements of the European Union environmental legislation within the framework of the Association Agreement between Ukraine and the European Union is an important step towards implementation in the country of the Directive No 2003/87 / EU “On the establishment of a scheme to reduce greenhouse gas emissions by trading within Community and amending Council Directive 96/61/ EU” in the part of the establishment of an Exploring Humanitarian Law (EHL) system, as well as the provisions of Regulations 600 and 601, which will allow introducing effective mechanisms proven by European experience for the functioning of the EHL system, in line with international commitments and the generally recognized European vector of Ukraine's development. In addition, in 2018, a “Draft Law on the Principles of Monitoring, Reporting and Verification of Greenhouse Gas Emissions” was developed in Ukraine, which aimed to legislate and approve the need for professional activity to reduce greenhouse gas emissions.

Based on this, excellent education is one of the main factors in the modern world that enables society to develop rapidly, create new technologies and implement our aspirations to create comfortable living conditions and improve living standards. It is hard to imagine the world today without communication, vehicles, equipment and technologies that allow us to organize and optimize our time and work. To achieve that, every day, a lot of pollutants harmful to our environment are released into the air, water and soil. Most pollutants cause dangerous and difficult-to-control changes that, in one way or another, lead to the destruction of the ozone layer or the intensification of the greenhouse effect, to the destruction or changes in ecosystems, to the occurrence of smog or a decrease in air quality, which is harmful to human health and

causes various diseases or even genetic mutations in newborn children.

All existing environmental risks can be local, regional or global. While the solution to local or regional environmental problems can be implemented and localized in a particular territory, which thereby reduces the negative impact on the environment and human life and health, global environmental problems are extremely dangerous and, in most cases, may cause consequences that require urgent solutions at the level of all countries of the world and of each country in particular.

Climate change, caused by the emission of excessive amounts of substances that cause the greenhouse effect, is one of the consequences of environmental pollution. It occupies a special place among the global consequences of environmental pollution. Every year, the problem of the increasing greenhouse effect and, as a result, climate change is becoming increasingly acute on the agenda of all ecologists and climate scientists around the world. The conducted researches (Ivanyuta et al., 2020; Order Cabinet of Ministers of Ukraine, 2021) show that this problem is becoming increasingly threatening today. Melting glaciers, changes in climate zones, increased frequency of natural disasters, rising world ocean levels, extinction of certain species and entire ecosystems, desertification of territories, forced migration of the population and increased morbidity as a result of climate change, and many other consequences, which development and impact on the environment are problematic and sometimes impossible to predict.

Thus, today, solving environmental problems is tightly related to dealing with climate change on our planet. Most of the environmental risks that threaten human life and health are formed under the influence of emissions that increase the greenhouse effect and thus cause a series of chain reactions in response.

That is why it is a very important and urgent task to train, first of all, highly qualified climate-oriented environmental specialists who will be ready to solve complex problems related to climate change, identify priority ways to adapt all spheres of our life and develop effective methods of climate change mitigation to preserve future generations and the quality of the environment.

2. Theoretical part

Today, environmental education and professionals face the challenge of having sufficient knowledge of global climate change and its impact on the environment.

The concepts of environmental monitoring, control, and management have become tightly linked to climate management. Both environmental and climate management is a prerequisite for the sustainable development of society and all sectors of the economy.

Why is it so important? First of all, this is due to the global nature of climate change, as all spheres of human life are affected by its consequences. Almost all global consequences impact each country and Ukraine in particular. They influence and make adjustments to agriculture and forestry in Ukraine, the energy system, water management, biodiversity, human life, etc.

The average annual temperature in Ukraine is increasing every decade, which is due to the impact of global climate change (Fig. 1). Their consequences are the occurrence of dangerous weather disasters, which are expressed by extreme changes and temperature fluctuations, abnormal and extreme temperatures throughout the year, strong winds, rainstorms and heavy prolonged rains, droughts in particular regions of the country, as well as floods, degradation of our valuable soils and reduction of crops, the disappearance of valuable species of animals and plants (Ministry of Ecology and Natural Resources of Ukraine, 2020.; Didukh, 2009).

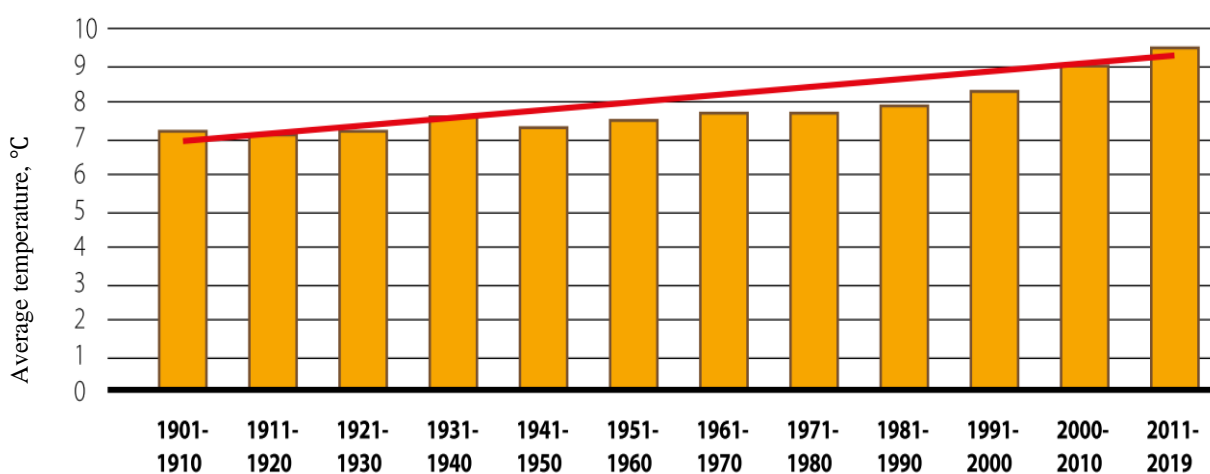


Fig. 1. Dynamics of changes in the average annual temperature in Ukraine (Ministry of Ecology and Natural Resources of Ukraine, n.d.)

Ukraine is an agrarian country, and agriculture remains a key sector of the economy, supplying food to many countries of the world. The food security of the population depends on the quality of agriculture. However, agriculture is closely related and directly depends on environmental factors and the effects of climate change, as well as the choice of optimal solutions to adapt it to these changes (National Academy of Agrarian Sciences of Ukraine, 2020).

Today, due to the increase in the average annual temperature (Fig. 2), there is a reallocation of crop cultivation areas. An increase in the average annual temperature leads to partial desertification of the southern regions, a shortage of water resources and, consequently, a reduction in crop yields (Ecodia, n. d., Order Cabinet of Ministers of Ukraine, 2019). In the context of climate change, moisture conditions and the availability of sufficient water resources are crucial

factors in farming, along with the choice of optimal crop-growing regions with appropriate soil and climatic conditions.

Climate change has equally negative consequences for forestry because changes in environmental conditions, an increase in the number of days with abnormal and extreme temperatures, etc., can lead to the disappearance of some valuable tree species and/or their replacement with other species that are more resistant to temperature fluctuations and changes in external conditions. This may lead to a change in the species composition of forests, as well as a reduction in their area.

Among all European countries, Ukraine is the least provided with water resources. The problems associated with climate change are expressed in the reduction of usable groundwater and surface water resources. Taking into account that the ecological condition of surface water reservoirs is unsatisfactory

and they are contaminated with various substances, the shallowing of rivers suitable for water intake and a decrease in precipitation create critical conditions for water supply in some regions of Ukraine. In addition,

the decrease in the infiltration of groundwater aquifers causes a reduction in the use of groundwater resources and, as a result, a decrease in drinking water reserves (Loboda, 2018).

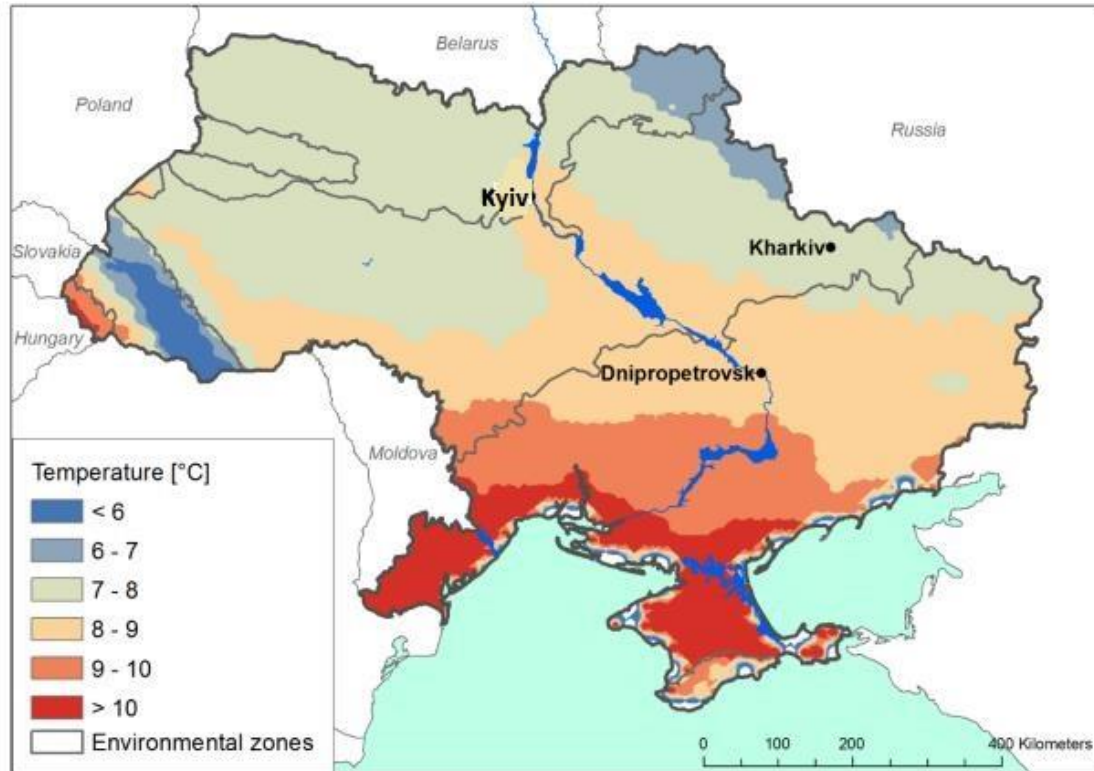


Fig. 2. Average annual temperature in 2012 (Müller et al., 2016)

Ukraine's energy sector is no less vulnerable to climate change. On the one hand, Ukraine's energy system contributes to greenhouse gas emissions by burning fossil fuels. On the other hand, the increase in average annual temperature leads to a decrease in the overall thermal efficiency of thermal power plants, and there is a problem of overheating cooling ponds and drying up nearby water reservoirs used for cooling. This raises the issue of finding alternative fuels and creating conditions for the development of renewable energy. This will partially decarbonize the energy system and reduce the environmental impact of energy (International Atomic Energy Agency, 2019).

The increase in the average annual temperature, as well as the number of abnormal and extreme temperatures during the year, also negatively affect human health. The number of people suffering from cardiovascular diseases is increasing. Due to the extended period of flowering of trees and flowers, the number of people suffering from allergic and pulmonary diseases also increases annually (World Health Organization, 2021).

Overheating of urban areas leads to the evaporation of harmful substances from road surfaces and buildings. A long dry period leads to overheating of the air. This raises the problem of cooling residential buildings and supporting the optimal temperature. So it is very important to develop energy-saving technologies considering the possible impacts of climate change, using all the opportunities and benefits that can be gained from it.

Given the above, there is an urgent need in Ukraine to increase the number of specialists who will be able to solve problems related to climate change.

In 2017–2019, the UNESCO Green Technologies Department (409) analyzed the labour market demand for specialists in reducing greenhouse gas emissions and optimizing the consumption of fossil fuels in the industrial and transport sectors of Ukraine and Georgia. The analysis showed a trend towards an increase in labour market demand for such highly specialized specialists in the field of climate change prevention, mitigation and adaptation by an average of

7 % annually, with a peak in 2030, with the full implementation of legislative initiatives in partner countries to reduce GHG emissions.

Therefore, the need to train specialists in climate management in Ukraine and Georgia is due to the global nature of this problem, the legislative norms of the European Union and partner countries and also to the medium-term and long-term analysis of labour market demand for such specialists in the above countries. Projects that aim to work together to train and improve skills and curricula in this direction are very important. The Climant project is an ambitious educational project in which more than ten partner organizations participate. Three universities in Ukraine are also involved in this project.

Problems and needs identified at the level of Partners from Ukraine:

Partner institution [Kharkiv National Automobile and Highway University, Kharkiv]: 1. Updating the existing Master's program in ecology in accordance with current European requirements and best practices (development of the training module Climate Management) (priority is given to the industrial, transport and energy sectors); 2. Creation of the Climate Control Center (CCM) for the practical implementation of students' knowledge and updating the opportunities for "self-employment" of graduates of the updated Master's program.

Partner institution [KROK University, Kyiv]: 1. Updating the existing Master's programs in management, marketing, logistics and economics in accordance with modern European requirements and best practices (development of the training module Climate Management) (priority is the implementation of managerial and economic activities in the field of climate change regulation); 2. Creation of modules for the practical implementation of students' knowledge and updating the opportunities for "self-employment" of the graduates of the updated Master's program.

Partner Institution [Lviv Polytechnic National University]: 1. Updating the existing Master's programs in the field of ecology in accordance with modern European requirements and best practices (development of the training module Climate Management) (focus on the agricultural, tourism and industrial sectors); 2. Creation of modules for the practical implementation of students' knowledge and updating the opportunities for "self-employment" of the graduates of the updated Master's program.

3. Results and Discussion

In accordance with the above, it becomes clear that it is very important to train qualified specialists who will specialize not only in environmental issues but also in the possibilities of adaptation of all sectors of the economy to climate change. Fundamentally, adaptation to global climate change is the adaptation of all spheres of human life to environmental changes by reorienting activities considering possible risks and benefits.

The whole world has been working for decades to find ways to mitigate the impact of climate change on the environment. Various studies are conducted, and all the necessary conditions are created to prepare climate-oriented areas of economic development.

At this stage, it is very important to provide quality education and broaden people's outlook on what is happening to our environment.

It is not enough to work to reduce pollutant emissions, as the environmental situation is changing every year, and a comprehensive approach to solving a range of problems is needed.

Ukraine is one of the countries that is actively involved in solving environmental problems related to climate change and adaptation to its consequences. Much is being done to solve this problem at the national level. The Concept of Implementation of the State Policy in the Field of Climate Change for the Period up to 2030, approved by the Cabinet of Ministers of Ukraine in December 2016 (Order Cabinet of Ministers of Ukraine, 2016), was the first comprehensive regulatory document in Ukraine in this area. Following the adoption of the Paris Agreement in 2015, a framework document on joint actions by all countries of the world aimed at reducing greenhouse gas emissions. Ukraine signed and ratified this agreement in 2016. In addition, our country became the 9th country in the Paris Agreement, adopting the Low Carbon Development Strategy of Ukraine until 2050 (United Nations Climate Change, 2022). Ukraine has also committed itself to implementing various projects aimed at mitigating the impact of climate change and adapting all spheres of our life and activities to climate change.

However, Ukraine currently lacks specialists who can efficiently implement projects to mitigate climate change by introducing new advanced technologies, finding ways to decarbonize both

industry and energy, and improving and adjusting agriculture to maximize the benefits of the changes in the environment, etc. Today, we can no longer rely on old methods of dealing with environmental pollution and outdated methods of adapting to climate change. Technologies are evolving, and thus there is a need to train highly qualified specialists ready to work and perform their tasks efficiently.

According to the “Analytical Report on Vocational Qualification Forecasting in Ukraine”, developed by the European Foundation for Education, National Academy of Sciences of Ukraine and the State Statistics Service of Ukraine, the medium-term forecast (up to 2025) of the need for professionals in the field of engineering and natural sciences indicates a constant trend growth through an increase in the share of eco-friendly public and private commitments and initiatives.

Therefore, the need for training climate management specialists in Ukraine is stipulated not only by the global nature of this problem, by the European Union and Partner countries' legislative regulations, but also by the medium and long-term analysis of the labour market demand for such specialists in the abovementioned countries.

In order to improve the quality of education and training of specialists in overcoming climate change issues, Ukrainian higher education institutions are participating in the implementation of the joint project Erasmus+ KA2 “Synergy of educational, scientific, managerial and industrial components for climate management and climate change prevention” (Climan). It is coordinated by the Netherlands Business Academy and co-coordinated in Ukraine by KROK University. Other Ukrainian universities involved in the project are Lviv Polytechnic National University and Kharkiv National Automobile and Highway University. The Climan project promotes multi-level education and professional training on climate services, climate change adaptation and mitigation at the local, national, and regional scales.

The aim of the project is to help the universities of Ukraine and Georgia to become centres for the development of research of climate management to accelerate integration into the global climate market and to meet global climate regulation requirements by acquiring best European practices in the field of climate change prevention, adaptation and mitigation.

This project and its results will contribute to the creation of a platform for training specialists of a wide

profile in the sphere of mitigation of climate change and adaptation. Such specialists will be ready to carry out not only practical activities aimed at reducing greenhouse gas emissions in various sectors of the economy, developing comprehensive measures to minimize the effects of global warming, etc. Students trained in the updated (through the creation of an interdisciplinary training module Climate Management) Master's degree program will also gain competencies in climate-oriented management of enterprises and organizations, climate business and consulting, etc. This will help to create an educational product unique for Ukraine and Georgia based on the interdisciplinary training module Climate Management.

Exchange of experience with universities of partner countries that are not involved in the project, with representatives of business structures, state and local authorities, and involvement of the public will help to build the potential of higher education of partner countries in updating existing Master's degree programs by creating interdisciplinary study modules of various kinds. This will help graduates of universities of partner countries to be more adapted to the current conditions of the national and international labour market by expanding the list of acquired professional competencies and greater flexibility of educational plans.

This approach corresponds to the modern world and European trends in training specialists in various fields of knowledge. The project is consistent with both, the development strategy and the internationalization of higher education in Ukraine and Georgia, as well as the development strategies of each partner university.

Improving the quality of education by updating student training programs, including the development of interdisciplinary training modules, is the main development priority of each university. Implementing activities to improve the quality of education, including creating specialized consulting centres, that support feedback from external stakeholders and are a testing basis for the development of practice-oriented competencies of students by supporting their educational and business projects, as well as a centre for communication with society, is generally recognized a good European practice, which is planned to be extended to partner universities. In addition, international cooperation, initiated by the project, will help students to adapt not only to the national labour

market but also to the international one, including also through internships in European partner universities.

The project envisaged the training of qualified climate managers. For this purpose, project teams will study best EU practices, select and train staff, and update existing Master's degree programs in environmental protection and management by developing an interdisciplinary training module in climate change prevention, adaptation and mitigation. The quality of training and competencies of climate managers will be thoroughly evaluated by all stakeholders, aiming to ensure their professionalism. Project activities will be organized in partner countries and the EU. Climate Management Centres will be set up to ensure the interaction of industrial and transport sectors, power industry, local authorities and partner universities towards implementing the plan to decarbonize the various sectors of the economy of partner countries, promoting climate innovations by supporting the implementation of "climate-innovative start-ups" at all stages of implementation from generating a business model to entering sales transactions.

4. Conclusions

Adherence of Ukraine to European integration requires the adoption of successful experience of the European Union in sustainable development, including efficient environmental protection. This poses new challenges for higher education and policy-makers' awareness in Ukraine. Being geographically part of Europe, Ukraine still has a burden of unsolved economic and environmental problems from the soviet times, which are now complicated by military aggression and ongoing hostilities on the territory of Ukraine. Over 40% of our country's territory is mined and contaminated with explosives. The challenge of the current moment is to change this situation radically. It is important to note that Ukraine plays an important role in ensuring environmental sustainability in Europe. The Chernobyl catastrophe, with its long-term disturbing impacts on ecosystems and public health all over Europe, is one of the examples that environmental issues have no borders.

It is essential today to cooperate to change this situation fundamentally. Ukraine must be ready to face any challenges and have enough highly qualified specialists to solve both environmental and climate change problems successfully. Therefore, the Climan

project will allow us to implement a comprehensive approach to the problems with a key role of higher education, providing innovative elements that will change society.

The main innovative elements of the project are the creation of the interdisciplinary module Climate Management, developed in accordance with the highest EU standards and adapted to the realities of each country, which represents an optimal symbiosis of environmental and managerial competencies, allowing graduates to pursue professional activities for ecologically and economically effective management of climate regulation. Climate management centres will be set up in each partner university based on European practice and will serve as sustainable intermediary structures and environmental and climate student business incubators.

This project will allow us to prepare qualified teaching staff capable of training professional climate managers and climate managers who will implement activities to reduce greenhouse gas emissions and minimize the effects of global warming, as well as provide the cost-effective implementation of climate-oriented business projects.

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