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THE IMPACT OF THE WAR IN UKRAINE ON CLIMATE CHANGE IN THE EU

Russia's aggression in Ukraine has a significant impact on the environment and climate change not only for our country, but also for EU countries, especially those that share a common border with Ukraine. This impact cannot be fully assessed today, as the war continues, the volume of pollutant emissions into the atmosphere, soil, and water resources is growing and accumulating, and the volume of waste from destroyed military and civilian infrastructure is increasing. It is also not possible to fully assess the extent of the damage caused in the temporarily occupied territories.

Confirmation that the impact of Russia's war against Ukraine on climate change is not limited to the territory of our country is provided by UN data, which indicates that a war on the territory of Ukraine could disrupt the achievement of slowdown climate change goals. First of all, the possibility of limiting the temperature increase to 1.5°C by 2100 is at risk. Greenhouse gases formed on the territory of Ukraine will affect global warming. In addition, the military industry is growing, not only in Ukraine but also in the EU, which is very energy-intensive and additionally emits greenhouse gases. A significant amount of greenhouse gas emissions comes from the production of ammunition, the volume of which has increased significantly since the beginning of Russia's full-scale invasion of Ukraine. There are already reports showing that the production of military equipment is growing, and industrial enterprises are reorienting to military production [1]. Emissions from these types of production will have significant climate effects, as they can affect the whole regions in the period from several months to several years. Damage to the «Nord Stream» gas pipelines lead a climate catastrophe. In particular, gas leaks created a 700-meter-long pool of boiling water in the Baltic Sea. German experts estimate that the emissions resulted in about 300 thousand metric tons of methane was entering to the atmosphere, one of the most powerful greenhouse gases. According to the German Federal Environment Agency, this amount of gas will have approximately the same impact on the climate over 20 years as the annual emissions of more than 5 million cars in the United States [3]. During the first 20 years of being in the atmosphere, methane has 84 times more heat capacity than carbon dioxide. When assessing the impact of methane emissions on the climate, scientists typically convert methane to CO2 equivalents using either a 20-year global warming potential coefficient or multiplying the potential impact of emissions by the increase in global warming over 100 years. Germany, using a 100-year conversion coefficient, announced that leaks from «Nord Stream» were approximately equivalent to 1% of the country's total annual emissions. According to the Danish Energy Agency, methane emissions will account for approximately 32% of the country's annual greenhouse gas emissions [3].

It is also necessary to pay attention to the energy sector and the impact of military operations on the territory of Ukraine. The total consumption of natural gas in the European Union has decreased significantly — by 55 billion m3 (or 13%) in 2022 compared to 2021. In the buildings sector, which experienced a 28 billion m3 decline in consumption, 18 billion m3 were due to mild weather, a factor that is certainly not related to the war. The other 10 billion м3 were reduced by a combination of energy efficiency measures and behavioral changes, such as lowering the room temperature or taking a shower faster [4]. In the industrial sector, the rise in gas prices caused a reduction in production (12.5 billion m3) and led to the implementation of energy efficiency measures (5 billion m3), which is fully related to the impact of the war. Some industries have managed to switch to other fuels, replacing 7.5 billion m3 of gas, mostly with oil products [4]. Since oil products are more carbon-intensive, this change has led to an increase in greenhouse gas emissions. In view of the reduction in

gas consumption and the increase in emissions from oil products, the reduction in emissions caused by the war can be estimated at about 40 million tons of CO2 [5]. The gas crisis forced European countries to look for alternative suppliers. Gas producers connected to the European pipeline network (e.g., Norway, Algeria) could not replace all Russian gas, so the only way was to increase imports of liquefied natural gas. In 2022, Europe imported an additional 55 million м3 of liquefied natural gas, which is 70% more than in 2021 [9]. The increase in demand for liquefied natural gas has led to an increase in emissions at the production and transportation stages, which is estimated to be about 20 million tons of CO2 [5].

Another important factor in the impact of the war in Ukraine on EU countries is the significant number of refugees. The number of refugees who have left their homes at some point is 13.5 million, or about 30% of the total population of Ukraine [5]. Of these, as of April 2022, 8.172 million people were registered in the EU [5]. A few months after the war began, many refugees decided to return to their homes, but there is no clear data on how many refugees are abroad and how many have returned, but a rough estimate can be made by dividing the total number of registered refugees in the EU by the total number of refugees currently covered by national protection programs. The percentage is approximately 60%, i.e. 40% of refugees returned to Ukraine [5]. Therefore, the outflow of refugees to the EU has led to an increase in greenhouse gas emissions, as the main vehicles used by these refugees are private cars and buses. In addition, it is worth noting that the outflow of people from Ukraine due to the war has led to an increase in the volume of solid waste in the EU. In turn, their utilization or recycling requires an increase in financing. Due to the closure of Ukraine's airspace to commercial flights and the air traffic barriers against Russia imposed by Western countries, important east-west air routes between Europe and Asia were blocked for many Western companies, making almost 18 million km2 unavailable for flights [5]. Carriers were forced to take detours on routes to East and Southeast Asia, so flight times increased, as did additional fuel costs and greenhouse gas emissions. As a result, air traffic was redistributed, and a significant number of flights from Russia to Europe were taken over by such countries as Armenia, Turkey, and Serbia. However, the changes caused by Russia's war in Ukraine had only a minor impact on the total emissions in the Eurocontrol zone. At the same time, between 2021 and 2022, due to the resumption of flights after the pandemic, they increased by 62 million tons of CO2 (56.9%) [5].

Therefore, the impact of the war in Ukraine on the EU countries is indisputable. This research has analyzed only some aspects of this impact. And the estimates given in the various sources witch have been researched are approximate, since the war is ongoing and it will be possible to fully assess all its consequences for Ukraine and Europe, both those with a short-term effect and long-term impact, only after the complete cessation of hostilities and the resumption of full control of the Armed Forces of Ukraine over the whole occupied territory.

References:

1) Russia Struggles to Maintain Munition Stocks (Part One). *Jamestown*. URL: https://jamestown.org/program/russia-struggles-to-maintain-munition-stocks-part-one/ (date of access: 10.11.2023).

2) Climate Change 2023: Increase in emissions due to war and forecasts / Journal ECOBUSINESS. *Ecology of the enterprise / ecolog-ua.com*. URL: https://ecolog-ua.com/news/zmina-klimatu-2023-zbilshennya-vykydiv-vnaslidok-viyny-ta-prognozy (date of access: 10.11.2023).

3) The impact of Russian military aggression on climate change. National Institute for Strategic Research. URL: https://niss.gov.ua/doslidzhennya/natsionalna-bezpeka/vplyv-rosiyskoyi-zbroynoyi-ahresiyi-na-zminu-klimatu (date of access: 10.11.2023).

4) Europe’s energy crisis: What factors drove the record fall in natural gas demand in 2022? URL: https://www.iea.org/commentaries/ europe-s-energy-crisis-what-factors-drove-the-record-fall-in-natural-gas-demand-in-2022 (date of access: 10.11.2023).

5) The impact of the Russian war in Ukraine on the climate. URL: https://ecoaction.org.ua/wp-content/uploads/2023/07/vplyv-ros-viyny-na-klimat-2023.pdf (date of access: 10.11.2023)