MINISTRY OF ECONOMY, ENVIRONMENT AND AGRICULTURE OF UKRAINE

The Federal Government

IKI INTERNATIONAL CLIMATE INITIATIVE

Implemented by:
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National Center for GHG Emission Inventory

First Biennial Transparency Report of Ukraine under the Paris Agreement

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A.1. Government structure

According to the Constitution, Ukraine is a sovereign and independent, democratic, social and legal state, a unitary, parliamentary-presidential republic. State power in Ukraine is exercised on the basis of its division into legislative, executive and judicial branches.

The only legislative body in Ukraine is the Parliament, the Verkhovna Rada of Ukraine. The powers of the Verkhovna Rada of Ukraine include:

- adoption of laws;
- defining the principles of domestic and foreign policy, implementing the strategic course of the state for Ukraine's full membership in the European Union and the North Atlantic Treaty Organization;
- approving national programs of economic, scientific and technical, social, national and cultural development, and environmental protection.

The right of legislative initiative in the Verkhovna Rada of Ukraine belongs to the President of Ukraine, the People's Deputies of Ukraine and the Cabinet of Ministers of Ukraine.

The President of Ukraine is the head of state and acts on its behalf. The President of Ukraine is the guarantor of state sovereignty, territorial integrity of Ukraine, observance of the Constitution of Ukraine, human and civil rights and freedoms. The President of Ukraine is the guarantor of the implementation of the strategic course of the state aimed at acquiring full membership of Ukraine in the European Union and the North Atlantic Treaty Organization.

The President of Ukraine:

- ensures state independence, national security and state succession;
- represents the state in international relations, manages the state's foreign policy activities, negotiates and concludes international treaties of Ukraine;
- signs laws adopted by the Verkhovna Rada of Ukraine;
- has the right to veto laws adopted by the Verkhovna Rada of Ukraine (except for laws amending the Constitution of Ukraine) with their subsequent return for reconsideration by the Verkhovna Rada of Ukraine;
- appoints and dismisses half of the members of the Board of the National Bank of Ukraine;
- appoints and dismisses the Prosecutor General with the consent of the Verkhovna Rada of Ukraine;
- appoints one third of the Constitutional Court of Ukraine;
- is the Supreme Commander-in-Chief of the Armed Forces of Ukraine; appoints and dismisses the high command of the Armed Forces of Ukraine and other military formations; exercises leadership in the areas of national security and defense of the state;
- is the head of the National Security and Defense Council of Ukraine;
- exercises other powers defined by the Constitution of Ukraine.

The National Security and Defense Council of Ukraine is a coordinating body for national security and defense under the President of Ukraine. The National Security and Defense Council of Ukraine coordinates and controls the activities of executive authorities in the field of national security and defense. The Chairman of the National Security and Defense Council of Ukraine is the President of Ukraine.

The Cabinet of Ministers of Ukraine is the supreme body in the system of executive authorities. The Cabinet of Ministers of Ukraine shall be responsible to the President of Ukraine and the Verkhovna Rada of Ukraine, and shall be under the control and accountable to the Verkhovna Rada of Ukraine within the limits provided for by this Constitution. The Cabinet of Ministers of Ukraine consists of the Prime Minister of Ukraine, the First Vice Prime Minister, Vice Prime Ministers, and Ministers. The Prime Minister of Ukraine is appointed by the Verkhovna Rada of Ukraine upon the proposal of the President of Ukraine. The Minister of Defense of Ukraine, the Minister of Foreign Affairs of Ukraine are appointed by the Verkhovna Rada of Ukraine upon the proposal of the President of Ukraine, other members of the Cabinet of Ministers of Ukraine are appointed by the Verkhovna Rada of Ukraine upon the proposal of the Prime Minister of Ukraine. The Prime Minister of Ukraine manages the work of the Cabinet of Ministers of Ukraine, directs it to implement the Program of Activities of the Cabinet of Ministers of Ukraine approved by the Verkhovna Rada of Ukraine.

The Cabinet of Ministers of Ukraine:

- ensures state sovereignty and economic independence of Ukraine, implementation of domestic and foreign policy of the state, implementation of the Constitution and laws of Ukraine, acts of the President of Ukraine;
- ensures the implementation of the strategic course of the state for Ukraine's full membership in the European Union and the North Atlantic Treaty Organization;
- ensures the implementation of financial, pricing, investment and tax policies; policies in the areas of labor and employment, social protection, education, science and culture, nature protection, environmental safety and nature management;
- develops and implements national programs of economic, scientific, technical, social and cultural development of Ukraine;
- exercises other powers determined by the Constitution and laws of Ukraine.

Executive power in oblasts and districts, as well as in the cities of Kyiv and Sevastopol, is exercised by local state administrations. In exercising their powers, heads of local state administrations are responsible to the President of Ukraine and the Cabinet of Ministers of Ukraine, and are accountable to and controlled by higher-level executive authorities.

Local state administrations in the respective territory ensure:

- implementation of the Constitution and laws of Ukraine, acts of the President of Ukraine, the Cabinet of Ministers of Ukraine, and other executive authorities;
- law and order; observance of the rights and freedoms of citizens;
- implementation of state and regional programs of socio-economic and cultural development, environmental protection programs, and, in areas where indigenous peoples and national minorities live compactly, programs of their national and cultural development;
- preparation and execution of the respective regional and district budgets;
- reporting on the implementation of the respective budgets and programs;
- interaction with local self-government bodies;
- exercise of other powers granted by the state and delegated by the relevant councils.

The judicial system in Ukraine is based on the principles of territoriality and specialization and is determined by law. A court is established, reorganized and liquidated by law, the draft of which is submitted to the Verkhovna Rada of Ukraine by the President of Ukraine after consultations with the High Council of Justice. The Supreme Court is the highest court in the judicial system of Ukraine.

Independence and immunity of judges are guaranteed by the Constitution and laws of Ukraine.

A.2. Population profile

According to official statistics, as of the beginning of 2022, the country's population is 41167.3 thousand people, compared to 51944 thousand in 1991. In general, over 30 years of independence, the population has decreased by more than 10 million people, including losses due to the occupation of the territories, or by 20%. Since 1993, there has been a steady depopulation of the population, and its pace has been increasing in recent years. Thus, in 2019 the population decreased by 250.8 thousand, in 2020 - by 314.1 thousand, and in 2021 - by 421.1 thousand.

The main signs of the demographic crisis in Ukraine are: low birth rate, which does not ensure simple replacement of generations; high mortality rate, especially among men; low life expectancy (as of 2021 - 66.92 years for men and 76.98 years for women, which is lower than the world average); gender imbalance (as of 2021, there are 1158 women per 1000 men in Ukraine, and in the world, this ratio is 0.99, in the EU - 1.052); the long-term migration outflow of young people, which negatively affects both the population and the birth rate.

The protracted demographic crisis in Ukraine is characterized by high mortality, in particular men of working age, a decline in the birth rate and deterioration of reproductive potential, uncontrolled migration flows and regional differentiation of reproduction rates. The demographic situation is deteriorating due to external factors: the unfavorable economic situation, the effects of the COVID-19 pandemic, political instability, and, starting in February 2022, the outbreak of a full-scale war in the country.

As of January 1, 2022, there were 140 districts, 1469 territorial communities, 461 cities, 881 urban-type settlements, and 28,369 rural settlements in Ukraine.

Table II.1. Demographic situation in Ukraine

Indicator	2018	2019	2020	2021	2022
Number of available population, thousand	42 386.4	42 153.2	41 902.4	41 588.4	41 167.3
Urban	*29 370.9*	*29 256.7*	*29 139.3*	*28 959.5*	*28 693.7*
Rural	*13 015.4*	*12 896.5*	*12 763.1*	*12 628.8*	*12 473.6*
% relative to the total population					
Urban	*69.3*	*69.4*	*69.5*	*69.6*	*69.7*
Rural	*30.7*	*30.6*	*30.5*	*30.4*	*30.3*
Number of permanent population, thousand	42 216.8	41 983.6	41 732.8	41 418.7	40 997.7
Men	*19 558.2*	*19 455.3*	*19 343.4*	*19 195.4*	*19 007.0*
Women	*22 658.6*	*22 528.3*	*22 389.3*	*22 223.3*	*21 990.7*
% relative to the total population					
Men	*46.3*	*46.3*	*46.4*	*46.3*	*46.4*
Women	*53.7*	*53.7*	*53.6*	*53.7*	*53.6*
Population density, people. per 1 sq. m. Km	70.2	69.8	69.4	68.9	68.2
Total fertility rate, people. per 1000 available population	8.7	8.1	7.8	7.3	N/A
Urban	*8.5*	*7.9*	*7.5*	*7.0*	*N/A*
Rural	*9.2*	*8.5*	*8.5*	*7.9*	*N/A*
Total mortality rate, people. per 1000 available population	14.8	14.7	15.9	18.5	N/A
Urban	*13.4*	*13.4*	*14.8*	*17.8*	*N/A*
Rural	*17.5*	*17.2*	*18.1*	*19.7*	*N/A*

Source: State Statistics Service of Ukraine

In September 2024, the Cabinet of Ministers approved the Strategy for Demographic Development of Ukraine until 2040 and approved an operational plan for the implementation of the Strategy for Demographic Development of Ukraine until 2040 in 2024-2027. The document states that the armed aggression and temporary occupation of part of the territory of Ukraine has deepened the demographic crisis, which consists of a significant decrease in the birth rate, an increase in mortality among the military and civilian population,

a multi-million internal displacement of residents from dangerous areas, and a five-million forced emigration of mostly women and children, including those with no intention of returning. The demographic crisis is also exacerbated by the de facto separation between two demographic processes - in the territory where the state authorities exercise their powers in full, and in the temporarily occupied territories, which are actually under the influence of external demographic factors. The key manifestations of negative demographic trends are large-scale external migration, low birth rates, high premature mortality, labor market imbalances, massive forced population movements within Ukraine, and other factors of population reproduction.

Ukraine's demographic policy should include the creation of preconditions that indirectly influence citizens' decisions to have children, return to Ukraine or, conversely, move abroad, and overcome the problem of premature mortality.

The document defines strategic goals aimed at overcoming negative demographic trends, ensuring the quantitative and qualitative parameters of population reproduction necessary for society by creating the preconditions for improving the quality of life of Ukrainian citizens.

Strategic goals:

1. Create conditions for migration growth and reduce the outflow of Ukrainians abroad
2. Creating conditions for increasing the birth rate and supporting families
3. Reducing the level of premature mortality
4. Activation of the maximum number of citizens who can work in the labor market
5. Adapting society to demographic aging and creating conditions for active longevity
6. Developing opportunities for a quality life. Ukraine is a country where you want to live

A.3. Geographical profile

Ukraine is located in the southeastern part of Europe (Figure II.1), between 44° and 52° north latitude and 22° and 40° east longitude. The territory stretches for 1316 km from west to east and 893 km from north to south. The extreme points of the territory of Ukraine are: in the west - Chop, Zakarpattia region; in the east - Chervona Zirka village, Luhansk region; in the north - Hremyach village, Chernihiv region; in the south - Cape Sarych in the Autonomous Republic of Crimea. To the south, the country's territory is washed by the Black and Azov Seas. Ukraine's area is 603.7 thousand square kilometers, and by this indicator it is the first in Europe.

The total length of the borders is 6,993.63 km. Ukraine's neighbors: Belarus, Russia, Poland, Slovakia, Hungary, Moldova, Romania; its maritime neighbors are Bulgaria, Romania, Turkey, Georgia, and Russian Federation.

The territory of Ukraine is located within three physical and geographical countries: The Eastern European Plain (95% of the country's territory), the Carpathian Mountains (partially), and the Crimean Mountains. The highest point of the plain part is Mt. Berda (515 m) on the Khotyn Upland. The Ukrainian Carpathians are home to Ukraine's highest mountain, Hoverla (2061 meters).

Ukraine is rich in hydrocarbons, metallic (iron, manganese, uranium, titanium, mercury, etc.) and non-metallic (graphite, kaolin, limestone) minerals. Ukraine has rare minerals, semi-precious stones, and gold ores.

Ukraine has a strong mineral resource base and is one of the world's largest mineral resource countries. More than 20 thousand deposits and ore occurrences have been discovered on its territory, represented by 97 types of minerals. About 8,000 deposits have been explored, of which almost half are being developed. The most important are iron, manganese, uranium, titanium-zirconium ores, coal, gas, oil and condensate, kaolin, graphite, non-metallic raw materials for metallurgy, facing stone, and mineral waters.

Figure II.1. Map of Ukraine

A number of Ukraine's mineral resources are represented by deposits that are unique in terms of raw material quality and are located in favorable conditions for the creation of mining complexes. Ukraine produces significant volumes of kaolin (18% of global production), manganese (10%) and iron (4%) ores, uranium, titanium, zirconium, germanium, graphite (4%), as well as bromine, ocher, and other minerals, non-metallic metallurgical raw materials (quartzite, flux limestone and dolomite), chemical raw materials (native sulfur, rock and potassium salts), facing stone (granite, gabbro, labradorite), and glass sand.

Hydrocarbons, lignite, peat, cement raw materials, refractory and refractory clays, raw materials for the production of building materials, precious stones, piezoelectric quartz, and various mineral waters are extracted from the country's subsoil. Nickel ores, gold, scandium, amber, zeolites, and phosphate raw materials are mined in small quantities.

Deposits of rare minerals in Ukraine, such as beryllium, niobium and tantalum, rare earths, copper, lead, zinc, molybdenum, fluorspar, apatite, oil shale, and bischofite, have been discovered and studied.

In recent years, real opportunities for further growth of hydrocarbon reserves, discovery and development of new mineral deposits for Ukraine - gold, chromium, copper, lead, zinc, molybdenum and rare earth metals - have been confirmed.

The possibility of using technogenic deposits to produce non-ferrous, rare and precious metals, as well as various types of non-metallic raw materials has been proven.

Such a powerful mineral resource potential of Ukraine is not accidental. Recent studies have shown that Ukraine is a unique geological region of the world, which has been formed over 3.7 billion years. Its structure is characterized by a wide variety of geological structures and geodynamic conditions of their

development, as well as a variety of geological and ore formations. Almost all major geological structures of the European continent converge on the territory of Ukraine: The Western and Eastern European and Central Eurasian platforms; the Alpine-Carpathian and Crimean-Caucasian fold systems; large sedimentary troughs (Dnipro-Donetsk) and basins (Azov-Black Sea).

The Ukrainian Shield, the oldest Precambrian geological structure that is part of the East European Platform, occupies a special position in the geological structure of Ukraine. Over the centuries of its evolution, it has undergone more than seven productive metallogenic impulses that led to the formation of a large number of powerful deposits. At the later stages of re-evolution, or activation of the shield, deposits of non-ferrous and rare metals emerged. That is why this region is characterized by a great variety and richness of mineral resources. In particular, these are some of the world's largest iron and manganese ore deposits, which have been developed for more than 100 years, and significant deposits of titanium, zirconium and uranium ores discovered in the modern period, which are also being actively developed. Of particular importance are deposits of rare metals and rare earth elements. The unique Perzhanske beryllium deposit in Zhytomyr region, the large Azov deposit of rare earths in Donetsk region, and the Polokhivske and Stankuvatske lithium deposits in Kirovohrad region have already been discovered.

Ukraine is rich in groundwater. Fresh water used for water supply, almost all types of mineral waters, including unique ones that are not found in any other country in the world (e.g., Naftusia), brines, and thermal waters are widespread.

The topography of Ukraine is dominated by plains (95% of the total area), which are part of the Eastern European Plain, one of the largest in Europe. Mountains border the plains in the southwest and south.

A.4. Economic profile

The Russia's full-scale military invasion of Ukraine is causing devastating losses for the country's economy, but Ukraine is not losing its resilience (Figure II.2a).

Figure II.2a. Historical GDP of Ukraine, %

The economy is expected to grow by near 4% in 2024 (Figure II.2b), supported by defense spending, agricultural exports and recovering metallurgical production. According to the World Bank, poverty in

Ukraine has increased by at least 1.8 million people to reach 9 million since the start of the war. Substantial infrastructure damage and extensive electricity disruptions are likely to slow economic growth to 3.2% in 2024 and 2% in 2025.

Ukraine	2021	2022	2023	2024	2025	2026
	Current prices UAH billion	Percentage changes, volume (2020 prices)				
GDP at market prices	5 450.8	-28.8	5.3	4.0	2.5	2.0
Memorandum items						
Consumer price index	_	20.2	12.9	6.3	9.4	6.9
General government financial balance (% of GDP)	_	-17.5	-20.4	-24.0	-20.0	-20.0
Current account balance (% of GDP)	_	4.9	-5.4	-9.9	-12.7	-13.2

Source: OECD Economic Outlook 116 database.

Figure II.2b. Projection of GDP of Ukraine

Monetary and fiscal policy are supporting macroeconomic stability, despite the ongoing economic disruption and costs of defending Ukraine from Russia's full-scale invasion. The monetary authorities remain committed to the inflation target and halted cuts to the policy interest rate as inflationary pressures increased. Fiscal authorities are increasing taxes, which will help contain the large budget deficit. Mobilizing more revenues domestically and implementing the substantial reform programmers will help finance public spending and encourage greater private financing of the reconstruction.

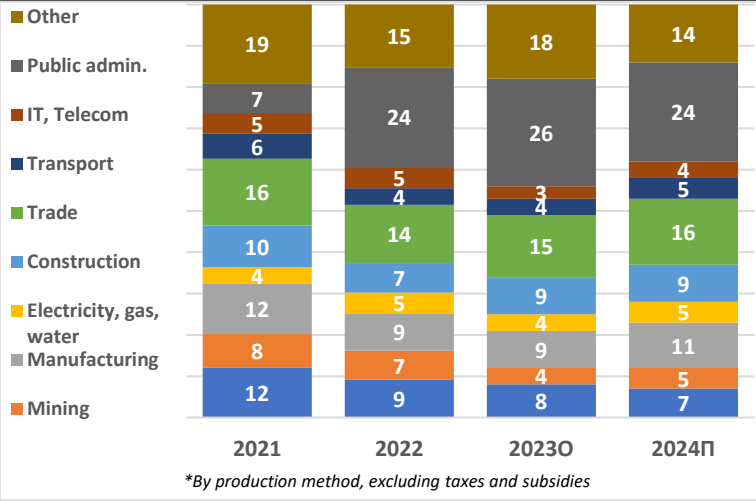


Figure II. 3. Structure of the economy by sector, % of GDP

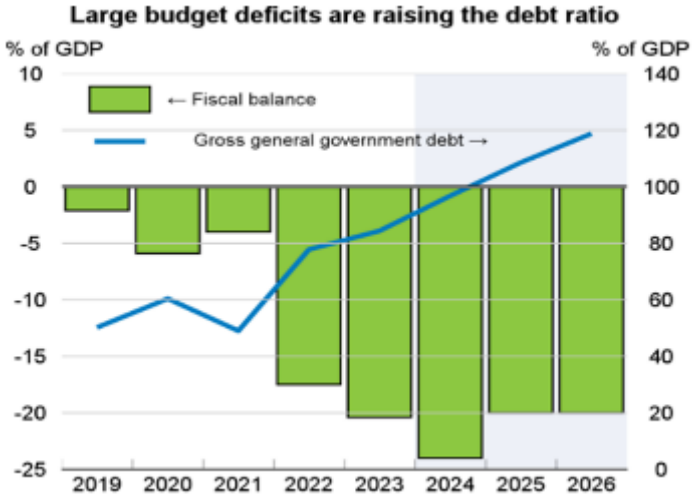
The resource base sharply declined in 2022, due to both a drop-in economic activity and tax breaks temporarily introduced in the first months of the large-scale war. At the same time, the overall decline in tax revenues was moderate (7.6% YoY). The weakness in tax revenues was offset by non-tax revenues, including charitable contributions from Ukrainian and foreign individuals, businesses, organizations, humanitarian aid, and grants. The latter have accounted for about a quarter of revenues since the beginning of the invasion.

Economic recovery was interrupted by Russian terrorist attacks on energy infrastructure. The NBU forecasts that as security risks decline, Ukraine will return to sustainable economic growth in 2025-2026. Limited export opportunities, a large number of forced migrants abroad, and the economy's significant import needs for recovery will result in a high current account deficit in the coming years. International support and cooperation with the IMF will help finance the large fiscal deficit and keep international reserves at a sufficient level. To bring inflation to its target in the coming years, the NBU will keep its key policy rate at 13% and maintain an active presence on the foreign exchange market.

As a result of the war, there is a risk of further decline in economic potential, in particular due to the loss of people, territory, and production facilities. The speed of the economy's return to normal conditions will depend on the nature and duration of the war. In addition, the Russian aggression continues to

generate the following risks: additional budgetary needs, primarily to maintain defense capabilities; possible additional tax increases, which, depending on the parameters, may increase price pressure; further damage to infrastructure, primarily energy and port infrastructure, which will limit economic activity and put pressure on prices from the supply side; deepening of negative migration trends and further increase in labor shortages in the domestic labor market.

According to the Ministry of Finance of Ukraine, in 2022, the share of the public sector in the GDP structure reached a record 24%. This category includes defense spending. In 2023-2024, the share of this category will stabilize at 24-26%. According to the decision of the National Security and Defense Council and the President of Ukraine, at least 21.6% of the total financial resource should be allocated from the budget for 2024. During this period, the share of agriculture decreased due to the occupation of significant agricultural land and the blocking of exports by sea. The role and potential of the extractive industry for Ukraine is declining due to the loss of strategic production facilities in Donbas, logistical constraints (primarily for exports), and the constant missile threat to the Dnipropetrovs'k industrial region. The processing industry has the potential for rapid recovery due to the need to process agricultural raw materials and the government's 5-7-9 soft loan program. In general, regions that produced 10-12% of Ukraine's GDP before the war remain under occupation. The effect of business relocation is estimated at 2-3% of GDP.



Source: OECD Economic Outlook 116 database; Institute of Economic Research and National Bank of Ukraine.

Figure II.4. Budget deficits of Ukraine

The budget deficit is projected to remain large, near 20% of GDP in 2025 and 2026. As the full-scale war is assumed to continue through 2025, the government plans for defense and security spending to rise to 26.3% of GDP, not including in-kind support from Ukraine's external partners. The 2025 budget aims to reduce social, health care and education spending to 8.4% of GDP, approximately 1% of GDP lower than in 2024. The government plans to increase to 57% the share of spending financed by domestic revenues through boosts to revenues from inflation and the depreciating exchange rate, and increases in the corporate income tax, excise tax, and the military levy on labor income. The tax rate increases are valued at 1.6% of GDP. The large deficits will raise public debt towards 110% of GDP in 2025, with three-quarters of new debt raised externally. External grants are expected to provide financing of 1% of GDP. External financial support of USD 27.2 billion in 2024 up to mid-November and military and humanitarian support of USD 32.7 billion in 2024 to 1 September have allowed Ukraine to maintain its foreign exchange reserves and allowed the exchange rate to stabilize against the USD between July and late November 2024. The central bank has maintained its key monetary policy interest rate at 13% since June 2024, but raised banks' reserve requirements at its September meeting.

Moderate growth is expected to continue into 2025, as defense spending continues to support activity and consumer spending rises as labor shortages further propel wage growth. Energy supply and logistical disruptions, especially over the winter, and somewhat less favorable agricultural conditions are likely to weigh on industrial and agricultural output. Growth will ease further in 2026, assuming that the war continues, while few displaced people return. Together, these developments are likely to maintain inflation moderately

above the central bank's 5% target into the medium term. These projections assume that financial and in-kind support continue amid the ongoing war. Exceptional uncertainty surrounds these assumptions. Cuts to financial support would imperil broader macroeconomic stability, and reduced in-kind support risks leading to substantially higher on-budget military spending, weakening public finances. Conversely, an improved security situation could lift growth strongly as reconstruction and recovery activities accelerate, more migrants return, and implementation of the structural reform programme accelerates, boosting private investment and productivity. In either scenario, inflation pressures are likely to remain high.

Ukraine can strengthen its domestic revenue base while limiting the weight of taxes on investment and employment decisions, for example, by raising indirect taxes, easing the compliance burden and reducing evasion. After the urgent supply challenges of the coming winter, reforming the energy market to encourage investments in new generation capacity, including by moving towards market-based pricing for consumers and producers and by addressing legacy issues of unpaid debts, would help tackle one of the more pressing constraints to rebuilding economic activity and well-being. When security conditions improve, more displaced people will return and security forces can demobilize. Supporting their job search, training and reintegration will help them better contribute to Ukraine's reconstruction and recovery.

According to the World Bank, Ukraine will face huge financial needs in the coming years, and private sector investment will be critical. The country will need at least $486 billion over the next decade for repairs and reconstruction, according to the Rapid Damage and Needs Assessment (RDNA3) released in February 2024. The highest estimated needs are in the housing sector (17%), transportation (15%), trade and industry (14%), agriculture (12%), energy (10%), social protection and livelihoods (9%), and explosive ordnance disposal (7%). With timely reforms to improve the investment environment, the private sector could cover about one-third of the reconstruction needs, as well as $280 billion in opportunities in other sectors.

Private investment potential is already substantial in agriculture, commerce, industry, banking, and housing. Policy reforms and deeper integration with the EU could boost private sector participation in the infrastructure sectors and pave the way for green and resilient reconstruction.

A.5. Climate profile

The peculiarities of the physical and geographical location, solar radiation, atmospheric circulation, and the underlying surface cause a significant diversity of climatic conditions in Ukraine (More details?). In the western and northwestern parts of the country, the climate is mild with excessive moisture and moderate temperatures, while in the eastern and southeastern parts there is a lack of precipitation and an elevated temperature background. The diversity of climatic conditions is also related to the heterogeneity of the underlying surface, which varies from plain to mountainous.

Ukraine's climate is predominantly temperate continental, with subtropical features only in the south of Crimea. Ukraine's climate is characterized by frequent weather changes, which is due to the influx of cyclones (45 on average per year) and anticyclones (36). At the same time, days with clear, sunny weather prevail in Ukraine, with an average of 230-235 days per year. The mountain ranges of the Carpathians and Crimea protect Zakarpattia and the Black Sea South Coast of Crimea from cold Arctic air masses coming from the north, respectively.

The average monthly temperature in January ranges from -8°C in the northeast of Ukraine and the highlands of the Carpathians to +4°C on the southern coast of Crimea, and in July from +17°C in the northwest and +19°C in the highlands of the Carpathians to +23°C in the far south. In mountainous areas, temperatures are lower throughout the year compared to the surrounding areas. The duration of the frost-free period ranges from 150-160 days in the north to 200-210 days in the south and 270 days on the southern coast of Crimea.

According to the World Bank, Ukraine's climate has changed significantly over the last 60 years, with accelerating warming since the 1980s resulting in the rates of 0.4-0.6°C per decade that exceed the mean value in Europe and are higher than the global rate by a few times. This causes changes in the precipitation regime: While total annual precipitation has not changed Ukraine significantly in recent decades, greater precipitation was observed in the autumn and less precipitation in other seasons, with the most decreases occuring in summer. Rising air temperatures causing increased evaporative demand with uneven precipitation have resulted in lower accumulations of moisture in the soil, leading to an increase in the frequency and intensity of droughts in the last decade.

The temperature and precipitation trends show greater changes toward the end of the century. The expected increases in average annual temperature and precipitation during this century are presented in Table II.2. Projected average annual temperature change by the end of the century for RCP 4.5 and RCP 8.5 scenarios.

Table II.2. Increases in Average Annual Temperature and Precipitation

	2021-2040 temperature / precipitation	2041-2060 temperature / precipitation	2061-2100 temperature / precipitation
RCP 2.6	0.8±1.4°C / 3%	1.0±1.7°C / 2%	0.9±1.8°C / 6%
RCP 4.5	0.9±1.4°C / 6%	1.5±1.7°C / 5%	2.1±1.8°C / 6%
RCP 8.5	1.1±1.5°C / 4%	2.0±1.7°C / 5%	4.3±2.1°C / 8%

Source: The World Bank, Ukraine building climate resilience in agriculture and forestry, December 2021

Increases in temperature and precipitation changes have a twofold effect depending on the crop type: contributing to increased productivity of certain crops, but also increasing the risk of extreme weather events which can negatively affect crop production. Temperature increase has a positive effect on winter crops during cold periods of vegetation, reduces the risk of frost damage on spring crops and the time to maturity of certain crops. Together with CO2, fertilization, and increased precipitation in vegetation periods, this leads to an increase in productivity of winter wheat, and an increase in the value of agricultural output.

This could potentially increase the competitiveness of Ukraine's agricultural products in the international market. However, extreme temperature increases combined with insufficient precipitation can lead to droughts and a decrease in the productivity of crops and provoke natural disturbances such as pests and diseases.

A.6. General effects of the national circumstances on GHG emissions and removals over time

Since 2014 until early 2022 slightly over 7 % of the territory of Ukraine temporarily remained out of control of the Government of Ukraine[1] as a result of the occupation and attempted annexation of Crimea and armed invasion by the Russian Federation. The temporary occupation by the Russian Federation territory of Ukraine is steadfastly condemned by international community, territorial changes by force are not recognized, sanctions remain in place till full compliance of the Russian Federation with international law. In particular, the UN General Assembly resolution 68/262 of March 27, 2014 «Territorial Integrity of Ukraine» confirmed the internationally recognized borders of Ukraine and the absence of any legal basis to change the status of the Autonomous Republic of Crimea and the city of Sevastopol. The same stance was confirmed by the UN

[1] On 18 January 2018, the Parliament of Ukraine adopted the law "On the peculiarities of State policy on ensuring Ukraine's State sovereignty over temporarily occupied territories in Donetsk and Luhansk regions", which defines the legal status of certain areas of the Donetsk and Luhansk regions as temporarily occupied territories of Ukraine.

General Assembly resolution 71/205 "Situation of human rights in the Autonomous Republic of Crimea and the city of Sevastopol (Ukraine)" of December 19, 2016, which unambiguously defines Russia as an occupying power. Besides that, numerous documents in support of Ukraine's territorial integrity within its internationally recognized borders were approved by the Committee of Ministers of the Council of Europe, Parliamentary Assembly of the Council of Europe, OSCE Parliamentary Assembly and other international organizations. Moreover, full-scale invasion of Ukraine by the Russian Federation increased this share up to around 20 %. Although the Government of Ukraine gained back the control of around 8 % of its territory, this caused a huge impact in every sphere.

The collection of official statistics and other data is not an exclusion. In many places offices and archives were physically destroyed. In other cases, the data is absent due to lack of activity or because it was not possible to collect it. Moreover, the Law of Ukraine № 2115-IX as of 3.03.2022 "On the Protection of the Interests of Entities Submitting Reports and Other Documents During the Period of Martial Law or a State of War"[2] established the obligation of reporting of financial and other data no later than 3 months after the end of martial law. Before that the entities cannot be prosecuted for breaching the obligation to report on data. This includes the data used in the GHG inventory.

In order to fulfill the completeness principle, the GHG inventory team used splicing techniques to derive data for entire territory of Ukraine. This includes extrapolation, substitution and other methods, recommended by Chapter 5 Volume 1 of 2006 IPCC.

GHG emissions and removals trends in 2022-2023 obviously were impacted by the full-scale invasion of Ukraine. Many industries and activities were disrupted by the warfare leading to decrease of GHG emissions related to these activities. Moreover, in the end of 2022 and in 2023 Russian Federation started targeted attacks on the energy production facilities leading to even stronger decrease of GHG emission trend from Energy sector.

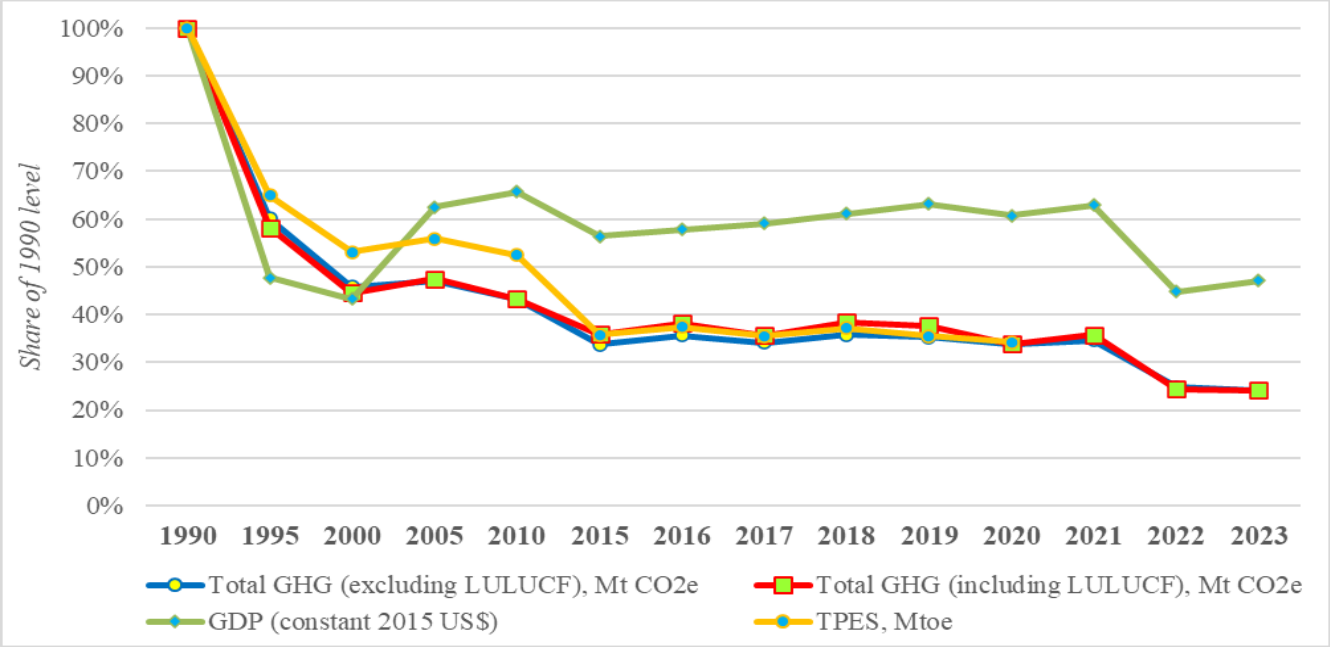
According to the Ukraine's greenhouse gas inventory 1990-2023[3], in Ukraine the inventory covers emissions of seven GHGs: carbon dioxide (CO2); methane (CH4); nitrous oxide (N2O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); sulfur hexafluoride (SF6); nitrogen trifluoride (NF3), as well as following precursor gases: carbon monoxide (CO); nitrogen oxides (NOx); non-methane volatile organic compounds (NMVOCs); sulfur dioxide (SO2). GHG emissions occur in the following sectors set by the IPCC: Energy, Industrial Processes and Product Use (IPPU), Agriculture, Land Use, Land Use Change and Forestry (hereinafter - LULUCF), Waste. Base year is 1990.

Total GHG emissions in Ukraine decreased by 55% (including LULUCF) and 54% (excluding LULUCF) in 2000 comparing to 1990 or to 408 Mt CO2-eq. (including LULUCF) and 441.7 Mt CO2-eq. (excluding LULUCF) respectively, primarily as a result of the post-Soviet economic decline. Although the Ukraine's economy started to recover after 2000 and GDP growth was significant, GHG emissions continued to decrease. This is due to significant structural changes in Ukraine's economy, with inefficient energy-intensive sectors being partially replaced by the services and agriculture sectors. Additionally, the energy intensity of the economy also decreased as outdated assets were gradually modernized. In the period between 2000 and 2007, there was some stabilization with a slight increase in production, and in the period since 2008, due to the global financial and economic crisis, there was a drop in production and, thus, in GHG emissions. As a result of the occupation and attempted annexation of Crimea and armed invasion by the Russian Federation in 2014-2021, many industrial enterprises were destroyed or damaged, resulting in a significant drop in economic activity and a reduction in GHG emissions.

[2] https://zakon.rada.gov.ua/laws/show/2115-20#Text
[3] https://unfccc.int/documents/646259

In 2022, the unprovoked full-scale invasion of Ukraine by the Russian Federation, resulting in mass emigration and displacement of the population, large-scale destruction of infrastructure (including, energy infrastructure), industry, buildings, etc. led to another stage of significant reduction of GHG emissions in Ukraine.

As for 2023 the full-scale invasion of Ukraine by the Russian Federation led to a deep crisis in the productional industries, both at the level of producers and consumers, who either completely stopped production/consumption or significantly reduced it, which impacted to a sharp decline of emissions compared to pre-invasion times, as well for base year.



* Total Primary Energy Supply (TPES) for 2022-2023 are not available.

Figure II.5. Total GHG emissions, GDP and TPES in Ukraine in 1990-2023

At the same time, in 2023, total GHG emissions decreased by 2.6% excluding LULUCF and by 0.8% including LULUCF, while real GDP grew by 5.3%.

The largest GHG emissions in Ukraine take place in the Energy sector. In 2023, the share of this sector accounted for around 74 % without the LULUCF sector. About 74 % of emissions in this sector account for emissions in the Fuel Combustion category, which include the categories of Energy Industries, Manufacturing Industries and Construction, Transport, Other Sectors, and Other, as well as 26 % – emissions in the category of Fugitive Emissions from Fuels.

It should be noted that the share of GHG emissions in the category of Fugitive Emissions from Fuels in total GHG emissions in the Energy sector gradually increased in the period of 1990-2000: from 19.2 % in 1990 to 30.1 % in 2000. This period is characterized by aging of the infrastructure and industrial capital of the country. Since 2001, the proportion of emissions associated with fugitive fuels was gradually decreasing. It is connected to the decrease of extraction of fossil fuels in Ukraine, decrease of transit of natural gas as well as decrease of use of natural gas by population due to increase of the prices.

Global pandemic of COVID-19 and measures against the disease slowed the economy resulting in decrease of GHG emissions in Energy sector in 2020. Particularly it affected energy industries, transport and other sectors.

In 2022-2023 energy industry facilities were heavily attacked by Russian Federation. That caused even stronger decline in GHG emissions in the sector.

In 2022 emissions in the IPPU sector decreased by 84.2 % compared to the base year. The key reasons for the reduction of emissions are the decreased production level due to the outflow of investment capital, unstable export dynamics, contraction of the domestic market, as well as the discrepancies in established "raw material-production-sales" connections in the regions of the country. Significant impact on industry development has situation on the East of the country. It is not only connected with catastrophic industry production drop in Donetsk and Lugansk regions. For neighboring regions, which had strong production-sales connections with temporarily occupied industrial parts of Donetsk and Lugansk regions, it is challenging to compensate those losses by other supply chains.

The share of the Agriculture sector in total GHG emissions without LULUCF was 14.2% in 2023. The major sources of emissions in the Agricultural sector are enteric fermentation and agricultural soils, 20.3% and 71.4% of the total emissions in the sector in 2023, respectively. Emissions in this sector decreased by 63.2% compared to the base year, and increased by 1.4% compared to the previous year mainly due to the fluctuation of agricultural activities (livestock, harvested area, applied fertilizers etc.) that associated with economic and political factors during the reporting period, and full-scale invasion of Ukraine by Russia. The significant rate of methane emissions fluctuation in the category Manure Management in comparison with emissions in the other categories in the period of 1990-2023 is directly related to partial replacement in the structure of manure distribution in cattle breeding enterprises of liquid slurry MMS with solid storage: in 1990 the percentage of cattle manure in liquid slurry amounted to 21.0 % of the total produced manure, while in 2023 − to only about 8.1 %. The conditions that arose as a result of full-scale invasion of Ukraine by Russian Federation are extremely unfavorable for sustainable rice cultivation. Methane emission's fluctuation in category Rice Cultivation caused by a harvested area variation. In 2023 these values have decreased sharply from 27.7 kha in 1990 to 5.7 kha. The amount of applied fertilizers, number of harvesting area under the crops and their productivity are the key factors that determine fluctuations of nitrous oxide emissions in category Agricultural Soils. Full-scale invasion of Ukraine by Russian Federation led to a significant reduction in the area where field crops were grown. Therefore, in 2023, there is a reduction in N_2O emissions by 30.41% compared to the base year and slight increasing by 3.88% compared to the previous year.

The LULUCF sector includes both emissions and removals of carbon dioxide, as well as emissions of CH4, and N2O. The LULUCF sector in 2023 is a net sink. Net CO2 removals in the sector in 2023 is equal to 11.2 Mt CO2-eq. and in the base 1990 year – 47.9 Mt CO2-eq. The main reason for such shift is change in agriculture management system on croplands, what has resulted in change from 20.3 Mt CO2-eq. of removals in 1990 to 24.6 Mt CO2-eq. of emissions in 2023. Particularly, significant influence has the areas, yield, and structure of harvested crops from those lands, as well as fertilizers applied. Also, big influence has decrease in peat extraction areas and volumes, what caused decrease in GHG emissions from 12.3 Mt CO2-eq. in 1990 to 0.1 Mt CO2-eq. in 2023. Moreover, rapid changes in land use, especially those resulting in emissions from living biomass, has significant impact on general level of emissions in the sector.

The contribution of the Waste sector in total emissions is 6.4 %. The main source of CH4 emissions is landfills of municipal solid waste (MSW), and that of emissions of N2O – human sewage. In relation to the base year, emissions in the sector decreased by 12.5 % in 2023.

As a result of many national circumstances, total GHG emissions in Ukraine decreased by 75.8% during period 1990-2023, from 916.5 Mt CO2-eq. (including LULUCF) in 1990 to 221.7 Mt CO2-eq. in 2023 (Table II.3).

Table II.3. Trends in aggregate direct action GHG emissions by sector, Mt CO2-eq.

Sector	1990	1995	2000	2005	2010	2015	2020	2021	2022	2023	Current year compared to base year, %
Energy	740.1	442.5	321.7	323.8	293.5	215.4	213.6	215.4	170.4	164.0	-77.8
IPPU	117.7	57.9	67.2	80.9	75.7	57.1	57.5	60.3	21.6	21.1	-82.1
Agriculture	89.6	62.6	36.8	32.7	31.5	36.2	37.7	41.7	32.5	33.0	-63.2
LULUCF (removals)	-47.9	-46.0	-33.4	-18.2	-21.0	4.1	-15.5	-5.4	-15.7	-11.2	-76.7
Waste	16.9	16.3	15.9	16.5	16.5	16.1	16.4	16.1	14.8	14.8	-12.5
Total (including LULUCF)	916.5	533.4	408.3	435.7	396.2	328.9	309.7	328.1	223.5	221.7	-75.8
Total (excluding LULUCF)	964.4	579.4	441.7	453.9	417.2	324.8	325.2	333.5	239.2	232.9	-75.9
Total (including LULUCF), including indirect CO2	916.5	533.4	408.3	435.7	396.2	328.9	309.7	328.1	223.5	221.7	-75.8
Total (excluding LULUCF), including indirect CO2	964.4	579.4	441.7	453.9	417.2	324.8	325.2	333.5	239.2	232.9	-75.9

Source: Ukraine's greenhouse gas inventory 1990-2023. Available from: https://unfccc.int/documents/646259

The largest share of GHG emissions in the base year is carbon dioxide – 71.8 % with LULUCF. Methane emissions in 1990 were 22.8 %, and those of nitrous oxide – 5.3 %. In 2023 carbon dioxide remained the largest emitted gas – 57.7 % of all GHG emissions, with 28.3 % and 12.8 % of methane and nitrous oxide respectively.

CO2 emissions take place in all sectors, as well as removals of CO2 in the LULUCF sector. CO2 emissions in 1990 amounted to 568.41 Mt and decreased as of 2023 by 80.6 %, to the level of 128.00 Mt (Table II.4). The economic decline that followed the collapse of the USSR in 1991 led to initial significant reduction of energy consumption, and thus in decreasing of CO2 emissions. In the period from 2000 through 2007, CO2 emissions stabilized with a slight upward trend. Despite the increase in CO2 emissions in this period was due to growth of the economy, the emissions are not directly correlated with the rate of economic development. This was due to restructuring of the economy, outstripping growth in the trading, services, and the financial sector compared to industrial production, which made a significant contribution to GDP growth in this period. The second important factor that had a significant impact on CO2 emission trends in this period was modernization of production, which made possible to reduce energy consumption, and, correspondingly, CO2 emissions, i.e. carbon-intensity of major commodity group production.

CO2 emission trend in 2008-2021 was determined by the influence of the global financial and economic crisis in 2008-2009 and a temporary occupation by the Russian Federation part of territory of Ukraine in 2014, which largely determined commodity production in the major export-oriented industries (metallurgy, chemical, mechanical engineering, etc.), which in turn affect supply sectors - electric power generation, mining (ore and coal mining)[4]. Recover of economy after strict anti-COVID-19 measures in 2020 resulted in increase of GHG emissions in all sectors, except Waste.

Totals of CO2 in 2015-2021 are presenting the results of number of factors, connected with overall economy growth of Ukraine, structure and amounts of fuels used in Energy and industry products outputs.

Moreover, during the entire time series since 1990 to 2013 GHG removals were decreasing in LULUCF and in 2013-2016, 2018-2019 the sector became a net source, what was connected mainly with national practices of cropland and grassland management, as well as forestry.

[4] On 18 January 2018, the Parliament of Ukraine adopted the law "On the peculiarities of State policy on ensuring Ukraine's State sovereignty over temporarily occupied territories in Donetsk and Luhansk regions", which defines the legal status of certain areas of the Donetsk and Luhansk regions as temporarily occupied territories of Ukraine

Table II.4 contains data on direct action GHG emissions expressed in the carbon dioxide equivalent.

Table II.4. GHG emissions, Mt CO2-eq.

Gas	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020	2021	2022	2023	Current year compared to base year, %
CO_2 (excluding LULUCF)	706.5	390.2	285.7	313.5	294.4	223.8	234.1	223.3	231.9	222.2	207.1	210.6	143.0	139.3	-80.3
CH_4	209.3	159.5	135.6	117.8	97.7	71.6	77.0	74.5	78.7	81.6	83.6	83.0	66.9	62.8	-70.0
N_2O	48.5	29.9	20.6	22.4	24.6	28.6	31.3	30.1	33.0	34.8	33.1	37.7	27.0	28.5	-41.4
HFCs*	NO	NO	14.4	271.9	715.3	826.3	943.7	1076.5	1483.2	1849.2	2000.4	2245.1	2329.8	2423.1	100
PFCs*,**	212.0	160.1	104.0	128.0	24.0	NO	NO	NO	NO	NO	NO	NO	NO	NO	-100
SF_6*	0.0	0.1	0.4	4.6	10.0	20.2	25.1	29.4	34.5	40.0	44.6	50.3	54.2	57.2	727229.5
NF_3*	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	-
Net CO_2 from LULUCF	-48.1	-46.3	-33.6	-18.5	-21.2	3.9	5.9	-2.7	6.9	4.9	-16.1	-5.6	-15.9	-11.3	-76.4
CO_2 (including LULUCF)	658.4	343.9	252.0	295.0	273.2	227.8	240.0	220.6	238.8	227.1	191.0	205.0	127.2	128.0	-80.6
Total (excluding LULUCF)	964.4	579.4	441.7	453.9	417.2	324.8	343.3	328.8	345.0	340.3	325.2	333.5	239.2	232.9	-75.9
Total (including LULUCF)	916.5	533.4	408.3	435.7	396.2	328.9	349.3	326.3	352.1	345.4	309.7	328.1	223.5	221.7	-75.8
Total (excluding LULUCF), including indirect CO_2	964.4	579.4	441.7	453.9	417.2	324.8	343.3	328.8	345.0	340.3	325.2	333.5	239.2	232.9	-75.9
Total (including LULUCF), including indirect CO_2	916.5	533.4	408.3	435.7	396.2	328.9	349.3	326.3	352.1	345.4	309.7	328.1	223.5	221.7	-75.8

* emissions quoted in kt CO2-eq.; ** there are no PFC emissions, as cooling agents containing the gas were not imported in 2011-2023
Source: Ukraine's greenhouse gas inventory 1990-2023. Available from: https://unfccc.int/documents/646259

One of the main obstacles on the way to achieving GHG emissions reduction is the armed aggression of the Russian Federation and temporary occupation of the Autonomous Republic of Crimea, the city of Sevastopol as well as certain areas of Donetsk, Luhansk, Kherson and Zaporizhzhia regions, which requires significant political, financial and human resources for protection of the territorial integrity and sovereignty of Ukraine.

The ongoing military aggression of the Russian Federation against Ukraine has a strong negative impact on the overall economic situation in Ukraine and has led to a reduction in industrial production.

All of the above-mentioned factors together with low incomes of the population lead to energy poverty. According to the results of the survey, the majority of the population of the country considers payment for utilities to be quite problematic. In 2019, 65 % of the population applied for state subsidies to pay for utilities.

Further GHG emissions reduction in Ukraine is possible through the implementation of structural sectoral reforms and transformations, that will also ensure sustainable economic growth.

Further decarbonisation of energy sector depends on the efficiency of energy markets and their full integration into the EU markets within the framework of the Association Agreement between the European Union and the European Atomic Energy Community and their member states, of the one part, and Ukraine, of the other part, and within the framework of the Agreement on the Establishment of the Energy Community with Ukraine.

GHG emissions reduction has also a significant social aspect associated with just transition of coal regions as well as thermal energy generation.

Taking into account the great deterioration of the main assets of large enterprises, modernization of the economy and ensuring sustainable economic development depends on the inflow of investments from

both private sources and international financial institutions. According to estimations, the amount of capital investments until 2030, necessary for the implementation of the NDC is 102 billion euro.

Access to investments mainly depends on the macrofinancial stability of Ukraine. After the dramatic crisis of 2014-2015, Ukraine was able to restore its macrofinancial stability, but Russia's full-scale war against Ukraine has deepened the macrofinancial stability problem enormously, and over the past three years, Ukraine has become increasingly dependent on the support of international partners, in particular the International Monetary Fund (IMF).

In spite of the national circumstances, Ukraine aims to continue reducing GHG emissions, energy intensity of GDP and achieving the Sustainable Development Goals.

A.7. Institutional arrangements for implementation of Ukraine's NDC

In order to ensure regulatory and organizational support for GHG inventory, the President Decree was signed, and several Resolutions of the Cabinet of Ministers of Ukraine were adopted. According to Decree of the President of Ukraine of September 12, 2005 of No. 1239/2005 the Ministry of Ecology and Natural Resources of Ukraine (hereinafter – MENR) is authorized as the coordinator of activities for the implementation of Ukraine's commitments under the UNFCCC and Kyoto Protocol to it. To execute the Decree, the Cabinet of Ministers of Ukraine adopted two Resolutions.

Resolution of the Cabinet of Ministers of Ukraine of April 21, 2006 of No. 554 established procedures for the national anthropogenic GHG emissions and removals not controlled by Montreal Protocol evaluation system, and defined its objectives and functions. Later this Resolution of the Cabinet of Ministers of Ukraine was amended (in line with the new Resolutions of the Cabinet of Ministers of Ukraine of July 16, 2012 No. 630, of December 04, 2019 No. 630, of September 09, 2020 No. 826). The changes mainly concerned the ways of the national system's functioning – additional information (data) request procedure for estimation of anthropogenic GHG emissions and removals, indicating the limited timing for data transfer (provision) by providers (in this case, these are public authorities and institutions, plants, etc.) – within 30 days from the date of receipt of the request.

In turn by the Order of the MENR of January 31, 2017 No. 35 «On approval of the Structure of the Ministry of Ecology and Natural Resources of Ukraine», amendments were introduced that influenced the structure of the central apparatus of the MENR, namely the Department of Climate Change and Ozone Layer Protection was set up.

According to Resolution of the Cabinet of Ministers of Ukraine of September 02, 2019 No. 829 «Some Issues of Optimization of the System of Central Executive Government Bodies», the decision was made to rename of the MENR to the Ministry of Energy and Environmental Protection of Ukraine (hereinafter – MEEP).

In turn by the Order of the MEEP of February 11, 2020 No. 83 «On approval of the Structure and number of independent structural units of the MEEP», amendments were introduced that influenced the structure of the central apparatus of the MEEP, namely the Directorate of Climate Change and Ozone Layer Protection was set up.

According to Resolution of the Cabinet of Ministers of Ukraine of May 27, 2020 No. 425 «Some Issues of Optimization of the System of Central Executive Government Bodies», the decision was made to rename of the MEEP to the Ministry of Energy of Ukraine and create a Ministry of Environmental Protection and Natural Resources of Ukraine (hereinafter – MEPR).

In accordance by the Order of the MEPR of July 08, 2020 No. 2 and the Order of the MEPR of August 29, 2022 No. 327, the new structure was approved, namely the Department of Climate Policy and Ozone

Layer Protection was set up. In accordance by the Order of the MEPR of August 29, 2022 No. 327 in redaction of December 01, 2022 No. 511, the new MEPR apparatus structure was approved, namely the Department of Industrial Pollution Prevention and Climate Policy was set up. In turn by the Order of the MEPR of February 06, 2025, the new structure was approved, namely the Climate Change Unit.

The impact of the implementation of climate change mitigation measures, including the implementation of the NDC, is also monitored by the Ministry of Economy of Ukraine and reflected in the Progress Report on the implementation of the National Energy and Climate Plan (NECP) for the period up to 2030, prepared in accordance with the requirements of Commission Implementing Regulation (EU) 2022/2299.

The NECP is a strategic document aimed at coordinating energy and climate policies to ensure sustainable development and economic recovery of Ukraine[5].

The preparation of NECP is Ukraine's obligation under the Treaty establishing the Energy Community, in accordance with the requirements of Regulation (EU) 2018/1999 and the relevant methodological recommendations of the European Commission. The document was also supposed to be prepared in accordance with the orders of the President of Ukraine dated November 8, 2019, No. 837/2019[6] and March 23, 2021, No. 111/2021[7]. In addition, the development and approval of NECP is a condition for the distribution of financial assistance from the EU under the future Ukraine Facility[8].

NECP is prepared in accordance with the clear requirements of Regulation (EU) 2018/1999, as well as taking into account the experience of preparing similar documents by EU Member States and Energy Community Contracting Parties and previous drafts[9]. The development of the draft NECP is carried out by a group of leading experts associated with DiXi Group think tank and the Institute of Economics and Forecasting of the National Academy of Sciences of Ukraine[10], with the support of the Embassy of United Kingdom (project "Ukrainian national development and preparation for the implementation of the energy and climate plan") and the US initiative Net Zero World.

The Ministry of Economy of Ukraine is responsible for coordinating the development of NECP on behalf of the Ukrainian government. The resolution of the Cabinet of Ministers of Ukraine dated August 19, 2023, No. 924 establishes an Interdepartmental Working Group on the preparation of proposals and recommendations for the development of the National Energy and Climate Plan, which includes all key ministries and agencies[11].

On 21 July 2025, the Government abolished the Ministry of Environmental Protection and Natural Resources (MEPR) and the Ministry of Agrarian Policy and Food, designating the Ministry of Economy as their legal successor, which was renamed as the Ministry of Economy, Environment and Agriculture (hereinafter – Mineconomy)[12].

[5] https://www.energy-community.org/legal/acquis.html
[6] https://www.president.gov.ua/documents/8372019-30389
[7] https://www.president.gov.ua/documents/1112021-37505
[8] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2018.328.01.0001.01.ENG
[9] https://www.lowcarbonukraine.com/uk/%D1%83%D1%80%D1%8F%D0%B4%D1%83-%D0%BF%D0%B5%D1%80%D0%B5%D0%B4%D0%B0%D0%BB%D0%B8-%D0%BF%D1%80%D0%BE%D1%94%D0%BA%D1%82-%D1%96%D0%BD%D1%82%D0%B5%D0%B3%D1%80%D0%BE%D0%B2%D0%B0%D0%BD%D0%BE%D0%B3%D0%BE/
[10] https://ief.org.ua/
[11] https://zakon.rada.gov.ua/laws/show/924-2023-%D0%BF#Text
[12] https://zakon.rada.gov.ua/laws/show/903-2025-%D0%BF#Text

B. DESCRIPTION OF A PARTY'S NATIONALLY DETERMINED CONTRIBUTION

B.1. Description of the Ukraine's updated NDC under Article 4 of the Paris Agreement

Ukraine as a Party of the United Nations Framework Convention on Climate and the Kyoto Protocol, recognizing the need for an effective and progressive response to the urgent threat of climate change and in accordance with decision 1/CP.19, prepared its Intended Nationally Determined Contribution (hereinafter - INDC) that was approved by the Governmental Decree dated September 16, 2015 #980 and submitted it to the Secretariat of UNFCCC on September 19, 2016. Ukraine defined its target not to exceed 60 % of the 1990 greenhouse gas emissions level in 2030.

Ukraine made a significant contribution to reducing global GHG emissions. As of 2019, GHG emissions in Ukraine decreased by 62.4% from the level of 1990 (including the sector LULUCF) and by 64.8% from the level of 1990 (excluding the sector LULUCF).

Following the decision 1/CP.21, that requests those Parties whose INDC pursuant to decision 1/CP.20 contains a time frame up to 2030 to communicate or update by 2020 these contributions and to do so every five years thereafter pursuant to Article 4, paragraph 9, of the Paris Agreement, Ukraine is introducing its Updated Nationally Determined Contribution (hereinafter - NDC).

Despite the ongoing military aggression of russia and temporary occupation of the Autonomous Republic of Crimea, the city of Sevastopol, as well as certain areas of Donetsk, Luhansk, Kherson and Zaporizhzhia regions, the economic crisis of 2014-2015 and the COVID-19 pandemic, Ukraine has taken many steps to significantly reduce energy consumption, development of energy efficiency and renewable energy.

In 2021 Ukraine updated Nationally Determined Contribution of Ukraine to the Paris Agreement (the Decree of the Cabinet of Ministers of Ukraine of July 30, 2021 #868-p)[13] based on geographical, economic and social circumstances. Ukraine has committed itself to achieving the target of reducing GHG emissions of 65% by 2030, compared to 1990 (including LULUCF), reaching carbon neutrality until 2060 as foreseen in the National Economic Strategy until 2030, approved by the Decree of the Cabinet of Ministers of Ukraine of March 3, 2021 # 179.

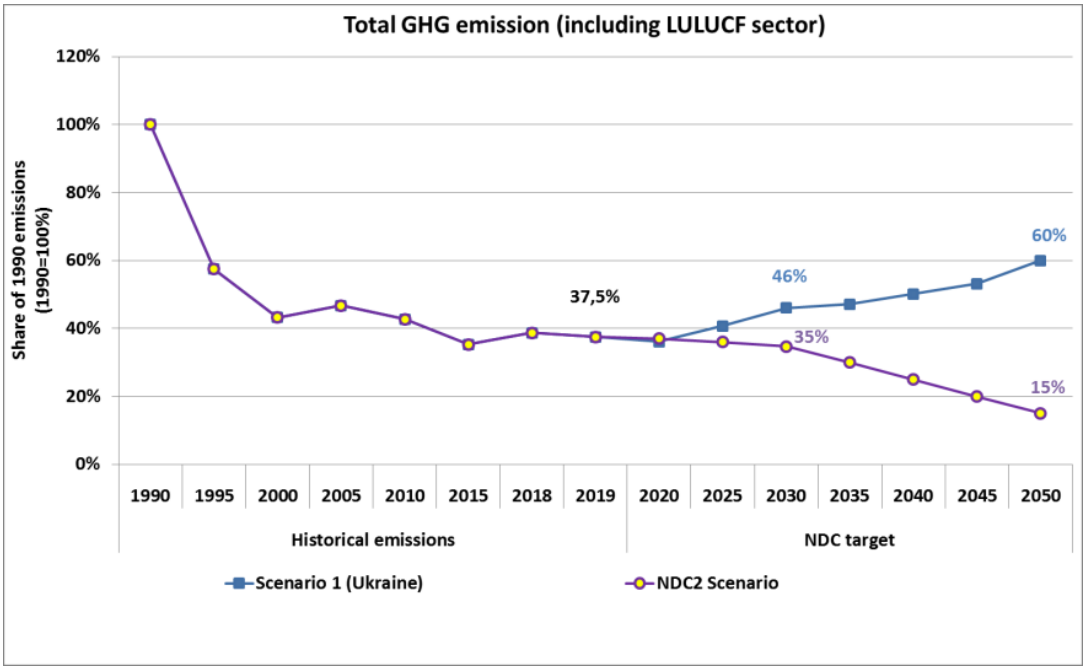


Figure II.6. Updated Ukraine's NDC scenarios

[13] https://unfccc.int/sites/default/files/NDC/2022-06/Ukraine%20NDC_July%2031.pdf

Ukraine's NDC represents a progression of the previously communicated INDC of GHG emission levels not exceeding 60% of 1990 emissions in 2030. This holds, especially taking into account the importance of economic recovery from the military aggression and the COVID-19 pandemic.

The Ukrainian NDC includes GHG emissions and targets for its uncontrolled and occupied territories, however the detailed information on the economic activities and GHG emissions on those territories is missing. This fact complicates, and sometimes makes impossible to collect and report data needed for the annual National GHG Inventory. Thus, for emission and reduction estimations on the temporarily occupied territory of Ukraine an expert estimation was performed.

After the reestablishment of Ukraine's control over occupied and uncontrolled territories, the Ukrainian NDC should be adjusted according to the updated and verified data.

Under updated NDC of Ukraine is committed to a legally binding target of a domestic reduction of net greenhouse gas emissions of 65 % by 2030, compared to 1990 GHG emissions level. The term 'domestic' means without the use of international credits. Ukrainian NDC target corresponds to an economy-wide absolute GHG reduction.

Table II.5. Description of the NDC of Ukraine

Information	Description
Target and description	Economy-wide net domestic reduction of 65 % in GHG emissions by 2030 compared to 1990. By 2030 Ukraine plans to create a baseline for adaptation to climate change in order to increase resilience and reduce vulnerability to climate change, as foresee in Article 7 of the Paris Agreement.
Target type	Economy-wide absolute emission reduction
Target year	2030 (single-year target)
Base year	1990
Base year value	According to Ukraine's GHG Inventory Report 1990-2023, Ukraine GHG emissions, including LULUCF, amounted to 916.5 Mt CO_2 equivalent in 1990. The value may be updated to reflect GHG inventory recalculations, resulting from methodological improvements in IPCC Guidelines.
Implementation period	2021-2030
Geographical scope	Ukraine's updated NDC covers the country's internationally recognized borders. The Ukrainian NDC's will be adjusted after the restoration of its territorial integrity and state sovereignty according to the updated data.
Sectors	Energy; Industrial Processes and Product Use; Agriculture, Land Use, Land-Use Change and Forestry; Waste
Gases	All GHGs not controlled by the Montreal Protocol – Carbon Dioxide (CO2), Methane (CH4), Nitrous Oxide (N2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), Sulphur Hexafluoride (SF6), Nitrogen Trifluoride (NF3) Percentage of GHG emissions covered: 100%.
LULUCF categories and pools	The included LULUCF categories and pools are as defined in decision 5/CMA.3.
Intention to use cooperative approaches	Ukraine's reduction of net GHG emissions of 65 % by 2030, compared to 1990 GHG emissions level is to be achieved through domestic measures only, without contribution from international credits. Ukraine will account and report for cooperation with other Parties in a manner consistent with the guidance adopted by CMA1 and any further guidance agreed by the CMA.
Information on the circumstances under which the Party may update the values of the reference indicators	Values of reference indicators may be updated due to methodological approach improvements to the GHG inventory. After the reestablishment of Ukraine's control over temporarily occupied and uncontrolled territories, the Ukrainian NDC should be adjusted according to the updated and verified data.

C. INFORMATION NECESSARY TO TRACK PROGRESS

C.1. Methodologies, accounting and modeling approaches

In accordance with paragraph 31 and of decision 1/CP.21, Ukraine reports on GHG emissions and removals using the methodology developed by the IPCC and adopted by the Conference of the Parties.

Ukraine uses methodology IPCC 2006 Guidelines as per UNFCCC decision 24/CP.19 to prepare National GHG Inventory in order to promote environmental integrity, transparency, accuracy, completeness, comparability and consistency, and ensure the avoidance of double counting, in accordance with guidance adopted by the Conference of the Parties serving as the meeting of the Parties to this Agreement according to paragraph 14, Article 4 of the Paris Agreement.

Where it would be appropriate, Ukraine also used the appropriate national methodologies, agreed with methodologies and refinements of the 2019.

Global warming potential (GWP) values relative to CO2 values from the IPCC Fourth Assessment Report are used.

Ukraine considers general guidance on reporting required under UNFCCC, established by Decision 4/CP.5 applicable for reporting of National Communications. All emissions and subsequent removals from natural disturbances on managed lands are included into accounting based on IPCC 2006 Guidelines as per UNFCCC decision 24/CP.19. Harvested wood products are included according to IPCC 2006 Guidelines as per UNFCCC decision 24/CP.19.

Age-class structure was considered in the development of NDC. The methodological approach is in line with methodological principles of IPCC 2006 Guidelines as per UNFCCC decision 24/CP.19 and IPCC 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol as per UNFCCC decisions 2/CMP.6 and 2/CMP.7.

Modelling the level of GHG emissions in Ukraine included three main scenarios of economic development that vary depending on the level of climate ambition. Despite the fact that the GHG reduction target is set for 2030, the necessary policies and measures until 2050 have also been taken into account in order to include the long-term decarbonisation target.

The proposed methodology and approaches to assessing the level of GHG emissions consist of several mathematical models such as the *TIMES-Ukraine model* relevant for the Energy and Industrial Processes and Product Use (IPPU) sectors (according to the IPCC categories), *mass balance model for Waste sector* and specific simulation *MS Excel tools for the Agriculture and LULUCF sectors*. All the investigated decarbonisation pathways were based on the successive macroeconomic scenario provided by the *Dynamic Ukrainian General Equilibrium model (UGEM)*.

For more details on the modeling approach, framework, key parameters, assumptions, definitions and data sources, please see "Report 3 / Modeling Report"[14], prepared by the Institute of Economics and Forecasting of the National Academy of Sciences of Ukraine (IEF) under the EBRD project support to the Government of Ukraine (GoU) on developing the second NDC under the Paris Agreement. This report describes the process and the results of Ukraine's GHG emissions pathways modelling up to 2050 based on projections and forecasting made applying available in Ukraine models tools: TIMES-Ukraine, UGEM, Waste Sector model, and tool for Agriculture and LULUCF Sectors.

For the purpose of wide communication with all stakeholders, the Analytical Review of the NDC was prepared, which includes information on the modelling process, sectoral goals on GHG emission

[14] https://mepr.gov.ua/wp-content/uploads/2023/07/Modeling-Report-3.pdf

reduction, adaptation to climate change, gender issues, as well as the necessary amount of investment for the implementation of the climate goals and achieving the long-term goal on climate neutrality, which is available by the link: https://mepr.gov.ua/wp-content/uploads/2023/07/ANALYT1.pdf.

Due to the current financial situation Ukraine needs to mobilize a significant amount of climate finance both public and private, which will contribute to this economic growth. Both public and private finances should be invested in the decarbonisation of various sectors: energy, industry, transport, residential sector, agriculture, waste and LULUCF.

For the implementation of current and planned policies and the necessary transformations, Ukraine will need access to international climate finance.

All technical reports, including the modelling and a detailed list of policies and measures used to inform the preparation and consultations of the NDC throughout its process, are available on the official website of the Ministry of Environmental Protection and Natural Resources of Ukraine: https://mepr.gov.ua/diyalnist/napryamky/zmina-klimatu/pom-yakshennya-zminy-klimatu/natsionalno-vyznachenyj-vnesok-ukrayiny/.

The total net GHG emissions are provided in the scope of the Ukraine's NDC and are compared to the economy-wide absolute emission reduction target as defined in the NDC. Ukraine will account for its cooperation with other Parties in a manner consistent with guidance adopted by the CMA.

C.2. Information on indicator, definitions and progress

For the tracking of progress towards implementing and achieving the NDC of Ukraine, an indicator is used which has the same unit and metric as the NDC base year and target values. The chosen indicator is *annual total net GHG emissions consistent with the scope of the NDC in CO2eq*.

The total net GHG emissions are provided in the scope of the Ukraine's NDC and are compared to the economy-wide absolute emission reduction target as defined in the NDC. Ukraine will account for its cooperation with other Parties in a manner consistent with guidance adopted by the CMA.

As far as emissions and removals from the LULUCF sector are concerned, net emissions are used for tracking progress towards the 2030 target of the NDC based on all reported emissions and removals.

Table II.6. Indicator for tracking progress towards the implementation and achievement of the NDC

Information	Description
	Indicator
Selected indicator	Annual total net GHG emissions consistent with the scope of the NDC in CO2eq.
Reference level and base year	The reference level is total net GHG emissions of Ukraine in the base year (1990). The reference level value is 916.5 Mt CO2eq.
Updates	This is the first time the reference level is reported, hence there are no updates. The value of the reference level may be updated in the future due to methodological improvements to the GHG inventory and to the determination of international aviation and navigation emissions in the NDC scope.
Relation to the NDC	The indicator is defined in the same unit and metric as the target of the NDC. Hence it can be used directly for tracking progress in implementing and achieving the NDC target.
	Definitions
Annual total net GHG emissions	Total net GHG emissions correspond to the annual total of emissions and removals reported in CO2 equivalents in the latest GHG inventory. The totals comprise all sectors and gases listed in the table entitled 'Reporting format for the description of a Party's nationally determined contribution under Article 4 of the Paris Agreement, including updates.' Indirect CO2 emissions are excluded.

Source: The reference level is based on the Ukraine's GHG Inventory Report 1990-2023[15].

[15] https://unfccc.int/documents/646259

A detailed description of methodological approaches that were used for estimating GHG emissions and removals is described in the relevant sections of Ukraine's GHG Inventory Report 1990-2023. Estimates GHG and pre-cursor emissions were performed using the first, second, and third level approaches. Thus, volumes of emissions in key categories were determined mostly using second-level approaches.

100-year time-horizon global warming potentials from the Fifth Assessment Report of IPCC were used as required by the Decision 6/CP.27.

Table II.7. Summary of progress towards implementing and achieving the NDC

Indicator	Unit	Base year value	Values in the implementation period				Target level	Target year	Progress made towards the NDC
			2021	2022	2023	2030			
Total net GHG emissions (including LULUCF)	Mt CO_2-eq.	916.5	328.1	223.5	221.7	NA	-65% of base year level	2030	The most recent level of the indicator is: -75.8% of base year level

Ukraine has made progress by implementing a number of measures and policies to reduce GHG emissions by intensifying the use of renewable and clean energy sources, increasing energy efficiency, optimizing energy flows, stimulating climate mitigation and adaptation projects, etc.

But the main reduction in GHG emissions occurred due to the occupation and annexation of Crimea and armed invasion by the Russian Federation in 2014-2021 and in 2022-2025, the unprovoked full-scale invasion of Ukraine by the Russian Federation, resulting in mass emigration and displacement of the population, large-scale destruction of infrastructure (including, energy infrastructure), industry, buildings, etc. led to another stage of significant reduction of GHG emissions in Ukraine.

From February 2022 the full-scale invasion of Ukraine by the Russian Federation led to a deep crisis in the productional industries, both at the level of producers and consumers, who either completely stopped production/consumption or significantly reduced it, which impacted to a sharp decline of emissions compared to pre-invasion times, as well for base year.

At the same time, in 2023, total GHG emissions decreased by 2.6% excluding LULUCF and by 0.8% including LULUCF, while real GDP grew by 5.3%.

The legal and institutional framework is in place to make further progress in the years ahead and to achieve the NDC target by 2030. In particular, the adoption of the National Energy and Climate Action Plan until 2030 in June 2024 provides a good basis for further reducing greenhouse gas emissions in Ukraine.

C.3. Key parameters, assumptions, data sources and model used

Below are the key parameters, assumptions, data sources and models used to prepare the updated NDC of Ukraine under Paris Agreement.

The Ukrainian NDC (based on modeling results) includes GHG emissions and targets for its uncontrolled and occupied territories, however the detailed information on the economic activities and GHG emissions on those territories is missing. This fact complicates, and sometimes makes impossible to collect and report data needed for the annual National GHG Inventory. Thus, for emission and reduction estimations on the temporarily occupied territory of Ukraine an expert estimation was performed.

After the reestablishment of Ukraine's control over occupied and uncontrolled territories, the Ukrainian NDC should be adjusted according to the updated and verified data.

Table II.8. Key parameters, assumptions, data sources and models used

Information	Description
	Key parameters
Economic	GDP, growth rate, % Mining and quarrying, growth rate, % Manufacturing, growth rate, % Construction, growth rate, % Services and Transport, share in GDP, %
Demographic	Population, mln Average life expectancy, years Average population age, years Share of working-age population, % Number of retired per working persons, persons Share of rural population, %
Energy	Energy prices Shares of renewables Energy Efficiency Indicators: • Primary Energy Intensity, toe/$1000 GDP (PPP) • Primary Energy (carbon-intensive resources) Intensity, toe/$1000 GDP (PPP) • Heat production losses, % • Transportation electricity losses, % • Transportation gas losses, % of 2015 • Energy performance indicators for Power Sector, Building Sector, Industry, Transport
Waste Sector	MSW generation per capita, tons/capita/year Share of MSW landfilling, % of generation Landfill methane utilization, % of landfill methane generation Water supply intensity, compared to 2015 in %
Agriculture Sector	Cattle population, thousand heads Poultry population, mln heads Methane removal by biogas production facilities from total methane produced from manure, % Area of organic crop production, thousand ha
LULUCF	Forest Cover, % of total area of Ukraine Yearly afforestation, thousand ha Share of final clear, % of 2015 Area of cropland and grassland, thousand ha Efficiency of synthetic N fertilizers application, % of 2015
Climate	Total CO2 equivalent emissions including LULUCF, Mt CO2e Carbon Intensity: • t CO2e per capita • t CO2e /$1000 GDP (PPP)
	Key assumptions
Geographical scope	Ukraine's updated NDC covers the country's internationally recognized borders. The Ukrainian NDC includes GHG emissions and targets for its uncontrolled and occupied territories, however the detailed information on the economic activities and GHG emissions on those territories is missing. This fact complicates, and sometimes makes impossible to collect and report data needed for the annual National GHG Inventory. Thus, for emission and reduction estimations on the temporarily occupied territory of Ukraine an expert estimation was performed. After the reestablishment of Ukraine's control over occupied and uncontrolled territories, the Ukrainian NDC should be adjusted according to the updated and verified data.
Energy prices	Brent Oil, USD 2017/barrel: 2015 – 85, 2030 – 83, 2050 – 89. Energy Coal, EU, USD 2017/t: 2015 – 52, 2030 – 96, 2050 – 132. Natural Gas, EU, USD 2017/ mln BTU: 2015 – 5.8, 2030 – 8.2, 2050 – 9.9.
Potential of Renewable Energy	Wind, GW: 2015 – 0.428, 2030 – 16, 2050 – 60; Solar (ground), GW: 2015 – 0.359, 2030 – 16, 2050 – 90; Solar (roof-top), GW: 2015 – 0.022, 2030 – 6, 2050 – 36; Bioenergy, mtoe: 2015 – 2.1, 2030 – 30, 2050 – 42.1; Hydro (large), GW: 2015 – 5.9, 2030 – 6.3, 2050 – 6.3; Hydro (small), GW: 2015 – 0.09, 2030 –0.250, 2050 – 0.375; Geothermal, GW: 2015 – ~0.0, 2030 –0.8, 2050 – 1.4.

Information	Description
Advanced and new technologies	Accessibility of Carbon Capture and Storage Techs Accessibility of Fuel Cells (FC) Techs Accessibility of New Nuclear Techs (Small Reactors)
	Data sources
National	1) National Inventory Reports (especially the sub-chapter 1.4. of the Inventory) 2) State Statistics Service of Ukraine, the National Bank of Ukraine, data from Ukrainian ministries and departments, housing and communal enterprises, energy generation and supply companies, specialized associations, academic institutions, etc. 3) IEF/EBRD "Report 3 / Modeling Report"[16]
International	1) UNFCCC decision and IPCC methodologies; 2) International Energy Agency (IEA), International Atomic Energy Agency (IAEA), Organisation for Economic Co-operation and Development (OECD); 3) International Monetary Fund, World Bank, United Nations, etc.) 4) Data from the Danish Energy Agency (DEA), the US National Laboratories; 5) Others.
	Model used (by IPCC sectors)
Energy and IPPU sectors	Energy system-wide TIMES-Ukraine model
Agriculture	Simulation MS Excel tool
LULUCF	Simulation MS Excel tool
Waste	Mass balance model
Macroeconomic	Dynamic Ukrainian General Equilibrium model

D. MITIGATION POLICIES AND MEASURES, ACTIONS AND PLANS

D.1. Main principles of the state climate policy

On October 8, the Verkhovna Rada adopted Law No. 3991-IX "On the Basic Principles of State Climate Policy", which regulates the development and implementation of state climate policy and is aimed at ensuring the achievement of climate neutrality, mitigating the effects of climate change and adapting to it, ensuring low-carbon and sustainable development, and defines:

- basic principles of the state climate policy;
- particularities of development and achievement of state climate policy goals;
- principles for ensuring climate planning at the national, regional and local levels;
- reporting in line with the requirements of the UN Framework Convention on Climate Change and data collection for these purposes;
- basic principles of the national system for tracking the implementation of policies, measures and forecasting in the field of climate change.

This Law was developed to fulfill a number of international obligations of Ukraine, it is aimed at implementing EU legislation in the field of climate change, in particular Regulation (EU) 2018/1999 and Regulation (EU) 2021/1119. The law established a long-term climate neutrality goal of Ukraine by 2050, which ensured alignment with the EU goal.

The Law provides for the development and approval of sectoral program documents on reducing anthropogenic GHG emissions, including in the transport sector, by October 2026. According to the Law, such a program document should, among other things, include a sectoral goal for reducing greenhouse gas emissions, specific policies and measures, amounts and sources of funding, and mechanisms for assessment, monitoring, and reporting.

[16] https://mepr.gov.ua/wp-content/uploads/2023/07/Modeling-Report-3.pdf

D.2. Cross-cutting policies and measures

D.2.1. Environmental tax levied on carbon dioxide emissions

Objective: Stimulating the reduction of carbon dioxide emissions (in millions tons of CO2), tax revenue generation for the state budget (millions of UAH).

Legal basis: Tax Code of Ukraine, Budget Code of Ukraine

Time frame: since 2010

Responsible bodies/organizations: Ministry of Environment, Ministry of Finance, State Tax Service, SAEE

Description: Environmental tax levied on carbon dioxide emissions in Ukraine was introduced in 2010 with the approval of the new Tax Code of Ukraine. The tax is levied on emissions of carbon dioxide into the atmosphere by stationary sources of pollution. Entities that emit CO2 in the amount of no more than 500 tons per year are exempted from the CO2 tax. In case of exceeding this amount, the entities are obliged to register as taxpayers in the tax (reporting) period, prepare and submit tax reports, calculate and pay tax for the tax (reporting) period. For entities whose annual emissions exceed 500 tons, the tax base is reduced by the amount of such emissions in the amount of 500 tons per year based on the results of the tax (reporting) year.

At first, the tax rate was only 0.2 hryvnias per 1 ton of emissions and was gradually increased until 2018. In 2019, the tax rate was increased more than 24 times – from UAH 0.41/t to UAH 10/t, and in 2022 – another 3 times. As of 2024, the tax rate is UAH 30/t. It is expected that the tax rate will continue to increase.

With the increase in the tax rate, tax revenues to the state budget gradually increased as well. Thus, in 2021, the tax brought 1.2 billion UAH to the state budget. Although the tax rate was increased 3 times from 2022, tax revenues increased by only 25% to UAH 1.5 billion, which is due to a significant decline in industrial production due to the full-scale invasion of the Russian Federation into Ukraine.

The Tax Code of Ukraine stipulates that at least 70% of the proceeds from the payment of the environmental tax for carbon dioxide emissions must be directed to measures that lead to the reduction of emissions (decarbonization) by industries classified in section C "Processing industry" and section D "Supply of electricity, gas, steam and conditioned air" of the National Classifier of Ukraine "Classification of types of economic activity" DK 009:2010 , in line with procedures defined by the Budget Code of Ukraine. At the same time, the Budget Code of Ukraine provides for the establishment of the State Fund for Decarbonization and Energy-Efficient Transformation from January 1, 2024, and envisions that at least 70% of the carbon tax revenue is earmarked as a funding source for the Decarbonisation Fund (for details, see section 3.2 of this Plan, PM_EE_WEM_02).

The Ministry of Environment, together with the Ministry of Finance, is developing a reform of the environmental tax levied on carbon dioxide emissions. In particular, the National Revenue Strategy until 2030, approved by the Decree of the Cabinet of Ministers of Ukraine of December 27, 2023 No. 1218 (Official Gazette of Ukraine, 2024 p., No. 11, Article 722) , provides that during 2024-2025 there should be a model of the transition from taxation of the actual amount of carbon dioxide emissions to taxation of the amount of production (import) of fossil fuels (oil, gas, coal, etc.), depending on the content of carbon, and the schedule for the introduction of changes to environmental and tax legislation has also been determined.

In addition, the Verkhovna Rada of Ukraine has registered a draft Law of Ukraine "On Amendments to the Tax Code of Ukraine regarding the establishment of a zero-hryvnia environmental tax rate for carbon dioxide emissions for installations that produce such emissions as a result of burning biofuel" (reg. No. 9596 of 09.08. 2023) and the draft of the Law of Ukraine "On Amendments to the Law of Ukraine "On Alternative Fuels" Regarding the Establishment of the Register of Installations Using

Biofuel as the Only Type of Fuel" (Reg. No. 9597 of 09.08.2023), which provide for exemption from payment of environmental a tax on carbon dioxide emissions of installations burning biofuels and the establishment of a register of installations using biofuels as the only type of fuel to ensure the administration of the zero tax rate. The adoption of these draft laws will allow Ukraine to apply widely used practices regarding the development of the use of biofuels for energy production and reduce the tax burden on bioenergy facilities, which will facilitate their development.

D.2.2. National emission reduction plan from large combustion plants

Objective: Gradual reduction of emissions (in million tons) of sulfur dioxide, nitrogen oxides and substances in the form of suspended solid particles, undifferentiated by composition, from existing large combustion plants, the nominal thermal power of which is 50 MW and more, and the first emission permit or permit for installation design was issued until July 1, 1992; enforcement of Directive 2010/75/EC on industrial emissions.

Legal basis: Decree of the Cabinet of Ministers of Ukraine of November 8, 2017 No. 796 "On the National Plan for Reducing Emissions from Large Combustion Plants (Government Courier, 2017, No. 226)

Time frame: from 2017

Responsible bodies/organizations: Ministry of Energy

Description: The Government approved the National Emission Reduction Plan from Large Combustion Plants (hereinafter NERP) (Government Courier, 2017, No. 226) on November 8, 2017 in order to fulfill Ukraine's obligations under the Treaty on the Establishment of the Energy Community in particular reducing emissions of pollutants. The Ministry of Energy is designated as the coordinator of the implementation of the mentioned National Plan.

Although the NERP is directly aimed at reducing air pollution, and not at reducing GHG emissions, the implementation of the NERP will indirectly contribute to the reduction of GHG emissions due to the reduction in the operation of thermal generation facilities. Thus, in Appendix 4 to the NERP, there is a list of installations that must be closed after a certain limit of working hours has been reached. Also, all other installations from Annex 2 to the National Plan, which have not been ecologically modernized in accordance with the requirements of Directive 2010/75/EU on industrial emissions, are subject to decommissioning. In addition, sulfur dioxide and nitrogen oxides are precursors of GHG, that is, they contribute to the formation of GHG under the influence of certain factors. Accordingly, reducing emissions of sulfur dioxide and nitrogen oxides will have an additional positive impact on GHG emissions reduction.

During 2024-25, it is planned to develop a normative act on determining the procedure and sources of funding for environmental protection measures provided for by the NERP, as well as approval of schedules for the reconstruction and closure of power units (with the possibility of revision depending on the consequences of the war).

D.2.3. National GHG Emissions Trading System

Objective: Stimulating the reduction of greenhouse gas emissions (in million tons of CO2-eq.)

Legal basis: the Law of Ukraine "On Principles of Monitoring, Reporting and Verification of Greenhouse Gas Emissions", draft Strategy for the Implementation of the National GHG Emissions Trading System for the Period Until 2033

Time frame: from 2026

Responsible bodies/organizations: Ministry of Environment

Description: Ukraine undertook the commitment on the implementation of Directive No. 2003/87/EU establishing a scheme for greenhouse gas emission allowance trading within the Community when it signed and ratified the Association Agreement between Ukraine, on the one hand, and the

European Union, the European Community of Atomic Energy and their member states, on the other hand, in 2014. The first step to establish a National GHG Emissions Trading System (hereinafter - ETS) was the adoption of the Law of Ukraine "On Principles of Monitoring, Reporting and Verification of Greenhouse Gas Emissions" (hereinafter MRV) in 2019 and by-laws that allowed the MRV system to be fully launched from 2021. Before the full-scale invasion of the Russian Federation into Ukraine, there were more than a thousand of installations that should have been covered by the Ministry of Foreign Affairs. According to the preliminary estimates of the Ministry of Environment, the number of such installations decreased by 40% due to the destruction by the Russian invaders of industrial facilities in the territories of Donetsk and Luhansk regions and in other regions of Ukraine. The registration of installations in the MRV system continues even during the full-scale invasion of the Russian Federation into Ukraine. However, the functioning of the MRV system is currently limited. This is due to the fact that the submission of reports and other documents, which is required in accordance with the norms of current legislation in paper and/or electronic form, is voluntary during the period of martial law or a state of war in accordance with the provisions of the Law of Ukraine "On the Protection of Interests of Subjects Submitting Reports and Other Documents During the Period of Martial Law or a State of War".

In June 2024, the Ministry of Environment released for public discussion the Strategy for the Implementation of the National GHG Emissions Trading System until 2033.

Taking into account the experience of the EU ETS, the draft Strategy assumes that the implementation of the ETS will be carried out during the following three stages until 2033:

- preparatory stage - 2024-2025. This stage of the implementation of ETS in Ukraine involves the development and adoption of the relevant law and other regulatory acts, the establishment of new or expansion of the functional responsibilities of existing institutions that will support ETS, and the implementation of appropriate administrative procedures, improvement of the technical infrastructure for monitoring, reporting and verification of emissions of greenhouse gasses, promoting the interaction and raising awareness of market participants, as well as organizing training and providing support to relevant institutions and stakeholders involved in the process of implementing the ETS.
- the pilot stage of the operation of the ETS in Ukraine (hereinafter - the pilot stage) - 2026-2028. The purpose of the pilot stage of the implementation of the ETS is to check the effectiveness, capabilities and readiness of this system in Ukraine, taking into account the national circumstances. This stage is aimed at identifying and solving any potential challenges, improving regulatory mechanisms, improving the qualifications of market participants, and preparing for the full functioning of the ETS.
- the first stage of full functioning of the ETS in Ukraine (hereinafter referred to as the first stage) - 2029-2033. This stage is aimed at the establishment of a reliable market system, strengthening regulatory control and improving relevant oversight (control) mechanisms, facilitating the integration of additional sectors into the ETS, ensuring accession or connection to the EU ETS and continuing efforts to increase the capacity to support the carbon market to achieve a sustainable development and climate stability.

The draft operational plan for the implementation of the Strategy in 2024-2026 includes 18 tasks, the implementation of which should ensure the launch and effective functioning of the STS. In particular, in 2024, it is planned to develop and agree with interested parties on substantiated proposals regarding the structure and parameters of the key components of the ETS in Ukraine, which take into account national circumstances and are harmonized with the Directive of the European Parliament and the Council No. 2003/87/EC of October 13, 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC (hereinafter -

Directive 2003/87/EC) and relevant European delegated rules, implementing acts, regulations. The development and adoption of the draft Law on the ETS is planned for 2024-2025.

D.2.4. Action plan for the implementation of Ukraine's climate policy within the framework of participation in the global initiative to reduce methane emissions "global methane pledge"

Objective: Stimulating the reduction of methane emissions (in million tons)

Legal basis: Order of the Cabinet of Ministers of Ukraine of July 7, 2023 No. 607 "On the approval of the plan of measures for the implementation of Ukraine's climate policy within the framework of participation in the global initiative to reduce methane emissions "Global Methane Pledge"" (Official Gazette of Ukraine, 2023 p., No. 67, Article 3842)

Time frames: 2023-2030

Responsible bodies/organizations: Ministry of Environment, Ministry of Energy

Description: To fulfill Ukraine's obligations within the framework of participation in the global initiative to reduce methane emissions "Global Methane Pledge", the Government developed and approved the Action Plan on July 7, 2023.[17]

The plan envisages the implementation of 23 measures by 2030 in the sectors of extraction, processing and transportation of natural gas and oil, coal mining, waste management and agriculture. As an example, some of the most significant activities in the oil and gas sector are presented in Table II.9. Implementation of the plan is expected to reduce methane emissions by 30% by 2030 from 2020 levels.

Table II.9. Selected measures to reduce methane emissions in the oil and gas sector

Name of the event	Responsible for implementation	Term of execution, years	Sources of funding
Conducting a full tracking of the volume of methane leaks during extraction, processing and transportation of natural gas and oil	Ministry of Energy, Ministry of Environment, JSC "Naftogaz of Ukraine" (with consent), LLC "Operator GTS of Ukraine" (with consent)	2023-2024	loans from international financial organizations; other sources of funding, which are not prohibited by the law
Implementation of effective accounting of methane leaks at energy sector enterprises in accordance with the OGMP 2.0 initiative	Ministry of Energy, Ministry of Environment, JSC "Naftogaz of Ukraine" (with consent), LLC "Operator GTS of Ukraine" (with consent)	2023-2030	loans from international financial organizations; other sources of funding, which are not prohibited by the law
Development and approval of a sectoral action plan for the reduction of methane leaks and the provision of such measures in investment programs at state-owned enterprises in the oil and gas sector	Ministry of Energy, Ministry of Environment, JSC "Naftogaz of Ukraine" (with consent), LLC "Operator GTS of Ukraine" (with consent)	2023-2030	loans from international financial organizations, including under the framework of financing the post-war reconstruction and development of Ukraine; other sources of funding, which are not prohibited by the law
Development and approval of the requirements for the operator of the gas transportation system and operators of gas distribution systems regarding regular practices for detection and elimination of leaks from gas networks (LDAR)	Ministry of Energy, NEURC (with consent), LLC "Operator GTS of Ukraine" (with consent), JSC "Naftogaz of Ukraine" (with consent)	2023	loans from international financial organizations; other sources of funding, which are not prohibited by the law

D.2.5. Decarbonisation and energy-efficient transformation fund

Objective: Co-financing of projects (measures) leading to reduction of CO2 emissions.

[17] https://zakon.rada.gov.ua/laws/show/607-2023-%D1%80#Text

Legal basis: Budget Code of Ukraine.

Time frames: 2023 - indefinitely.

Responsible bodies/organizations: Ministry of Infrastructure, State Agency on Energy Efficiency and Energy Saving (SAEE).

Description: In May 2023, amendments to the Budget Code of Ukraine entered into force, creating the State Fund for Decarbonisation and Energy-Efficient Transformation (Decarbonisation Fund) as a separate budget program as part of a special fund of the State Budget of Ukraine. The funds of the Decarbonisation Fund will be directed to:

- financing of measures and state target programs in the field of energy efficiency, increasing the use of RES and alternative fuels and reducing CO2 emissions;
- financing of compensation, compensation, reduction in the price of obligations of individuals and legal entities under credit and leasing agreements concluded for the implementation of energy efficiency measures, implementation of energy service, increased use of RES and alternative fuels and reduction of CO2 emissions;
- fulfillment of debt obligations for borrowing received by the state for the implementation of investment projects in the field of energy efficiency, increasing the use of RES and alternative fuels and reducing CO2 emissions.

The Decarbonisation Fund will be replenished at the expense of deductions from the tax on CO2 emissions (a component of the environmental tax), state borrowing and other revenues. The state budget for 2024 provides for financing of the Decarbonisation Fund in the amount of UAH 759.2 million. The mechanism for providing funds from the Decarbonisation Fund and the details of possible financing measures must be regulated by the Procedure for using funds from the State Fund for Decarbonisation and Energy Efficient Transformation, approved by the Cabinet of Ministers of Ukraine.

Energy savings achieved as a result of the implementation of measures funded by the Decarbonisation Fund can be taken into account when determining the cumulative end-use energy savings if a monitoring and verification system is implemented that will meet the requirements of Directive 2012/27/EU.

Results: Planned policy.

D.2.6. Energy efficiency obligation scheme

Objective: Implementation of energy-efficient measures under market conditions.

Legal basis: Law of Ukraine "On Energy Efficiency".

Time frames: Within the period determined by the Cabinet of Ministers of Ukraine.

Responsible bodies/organizations: Ministry for Development of Communities and Territories of Ukraine, SAEE.

Description: The Law of Ukraine "On Energy Efficiency" provides for the possibility of introducing an energy efficiency obligation scheme (EEOS). The relevant provisions can be activated by the Cabinet of Ministers of Ukraine in accordance with the following stages:

1. The Cabinet of Ministers of Ukraine approves the target indicator for the annual reduction of energy consumption (hereinafter referred to as the target indicator);
2. To achieve the target indicator, organisational, economic, and legal measures to stimulate energy efficiency are carried out, the Energy Efficiency Fund operates, and other mechanisms may be implemented;
3. SAEE monitors and evaluates the achievement of the target indicator;

4. In the event of non-achievement of the target indicator, SAEE notifies the Cabinet of Ministers of Ukraine;
5. The Cabinet of Ministers of Ukraine decides on the introduction of the procedure for the operation of the EEOS.

The Law of Ukraine "On Energy Efficiency" defines the obligated parties as electricity suppliers and natural gas suppliers. Obligated parties may fulfill the scheme's requirements by:

- implementing eligible energy efficiency measures at the level of final energy consumers;
- involving energy service providers and other business entities to implement energy-efficient measures;
- paying contributions to the Energy Efficiency Fund.

Lists of eligible measures within the scheme of energy efficiency obligations, determination of target indicators for achieving energy consumption reduction for individual obligated parties, and the procedure for monitoring achieved energy consumption reduction will be regulated by secondary legislation.

Expected cumulative and annual amount of energy savings and duration of the period(s) of the energy efficiency obligation scheme, target sectors, share of energy savings to be achieved in energy poverty households, amount of energy savings achieved by energy service providers or by other third parties, the possibilities of attracting loan funds are currently not defined, since the energy efficiency obligation scheme has not been implemented.

D.3. Policies and measures in the energy sector

D.3.1. Feed-in ("Green") tariff for renewable electricity producers

Objective: stimulating the development of the RES sector (share in the total final energy consumption)

Legal basis: Law of Ukraine "On Alternative Energy Sources", Law of Ukraine "On the Electricity Market", Law of Ukraine "On Amendments to Certain Laws of Ukraine Regarding the Establishment of a "Green" Tariff", Law of Ukraine "On Amendments to Certain Laws of Ukraine Regarding improving the conditions for supporting the production of electricity from alternative energy sources", Law of Ukraine "On Amendments to Certain Laws of Ukraine Regarding the Restoration and "Green" Transformation of the Energy System of Ukraine", Resolution of the NEURC of April 26, 2019 No. 641 "On Approval of Regulatory Legal Acts regulating the activities of the guaranteed buyer and the purchase of electricity under the "green" tariff, the purchase of services under the mechanism of the market premium"

Time frames: 2009-2029

Responsible bodies/organizations: Ministry of Energy, NEURC

Description: The main tool for stimulating the development of the RES sector was the "green" tariff, which was introduced in 2008 by the Law of Ukraine "On Amendments to Certain Laws of Ukraine Regarding the Establishment of a "Green" Tariff"[18].

In accordance with the Law of Ukraine "On Alternative Energy Sources" (hereinafter referred to as the Law), the "green" tariff is a special tariff for the purchase of electricity produced at electric power facilities, in particular at the commissioned phase of the construction of power stations (start-up complexes), from alternative energy sources (and with the use of hydropower only by micro-, mini- and small hydropower plants).

The "green" tariff for economic entities that produce electricity from wind energy is set at the level of the retail tariff for consumers of the second voltage class as of January 2009, multiplied by the coefficient of the "green" tariff. For business entities, private households and consumers, including

[18] https://zakon.rada.gov.ua/laws/show/601-17#Text

energy cooperatives, which produce electricity using alternative energy sources, the "green" tariff is set until January 1, 2030. The fixed minimum size of the "green" tariff for business entities, private households and consumers, including energy cooperatives, is established by converting the "green" tariff calculated in accordance with the rules of this Law into euros, as of January 1, 2009, at the official exchange rate of the National Bank of Ukraine on the specified date. Also, the "green" tariff is calculated in accordance with the requirements of the Law and is converted quarterly into the national currency at the average official exchange rate of the National Bank of Ukraine.

Fulfillment of state guarantees regarding the purchase of all electricity produced at power facilities that use alternative energy sources (in case of hydropower - produced only by micro-, mini- and small hydro-electric power plants), at the established "green" tariff, is carried out by the guaranteed buyer and universal services providers within the framework of the performance of special duties to ensure an increase in the share of electricity production from alternative energy sources. In turn, the guaranteed buyer and universal service providers receive compensation from the transmission system operator Ukrenergo for the service of ensuring an increase in the share of electricity production from alternative energy sources. The cost of supporting producers of renewable energy is included in the NPC "Ukrenergo" tariff for the transmission of electricity. However, due to the fact that the electricity transmission tariff is insufficient to cover the full cost of electricity production from renewable energy sources under the "green" tariff, as well as due to the consequences of the full-scale aggression of the Russian Federation against Ukraine, settlements of the SE "Guaranteed Buyer" with producers under the "green" tariff were not fully undertaken.

Taking into account the rapid commissioning of renewable energy facilities, the level of "green" tariffs, the total capacity of projects for which previous contracts have been concluded, as well as the imbalance that has arisen in the system and on the electricity market, the Government has initiated negotiations with investors in renewable energy through the Energy Community Secretariat about voluntary restructuring of "green" tariffs. On June 10, 2020, the key parties signed a Memorandum of Understanding on the settlement of problematic issues in the field of renewable energy in Ukraine. The provisions of the Memorandum were reflected in the Law of Ukraine "On Amendments to Certain Laws of Ukraine Regarding the Improvement of Conditions for Supporting the Production of Electricity from Alternative Energy Sources"[19], which provides for a reduction in the rates of benefits for wind and solar power plants by 7.5% and 15%, respectively, introduction of responsibility for the imbalance of electricity, repayment of debts, etc. Given the difficult situation in the industry, Ukraine did not go for a unilateral reduction of "green" tariffs, but reached a settlement on this issue through long negotiations with investors, search for compromises and conclusion of the Memorandum, which became the basis of the relevant law of Ukraine.

On June 30, 2023, the Verkhovna Rada of Ukraine adopted Law of Ukraine No. 3220-IX "On Amendments to Certain Laws of Ukraine Regarding the Restoration and "Green" Transformation of the Energy System of Ukraine"[20], which from January 1, 2024 narrows the application of the "green" tariff only to private households, provided that there are buildings and other capital structures in their ownership and that the electricity is consumed by private household. State support for renewable electricity producers and private households in the form of a "green" tariff will be available until December 31, 2029.

In general, the "green" tariff contributed to a rapid increase in the production of electricity from RES, from 51.8 million kWh in 2009[21] to 11.4 billion kWh in 2021[22]. At the beginning of 2022, the installed

[19] https://zakon.rada.gov.ua/laws/show/810-20#Text
[20] https://zakon.rada.gov.ua/laws/show/3220-20#Text
[21] Annual report of the NEURC for 2014, https://www.nerc.gov.ua/data/filearch/Catalog3/Richnyi_zvit_2014.pdf
[22] https://www.nerc.gov.ua/storage/app/sites/1/Docs/Byuleten_do_richnogo_zvitu/byuleten_do_richnogo_zvitu_NEURC- 2021.pdf

capacity of RES facilities that received a "green" tariff, excluding facilities located in temporarily occupied territories, amounted to 9,656 MW (10.1 GW, taking into account facilities occupied until February 24 2022). In addition, during 2022, about 312 MW of new RES capacities were built, of which:

- 220.1 MW – solar power plants (22 facilities up to 1 MW and 206 MW household SPP);
- 81.6 MW – wind power plants (4 facilities);
- 2.5 MW – biothermal power plant (1 facility);
- 6.3 MW – biogas plants (4 facilities);
- 1.17 MW – small hydroelectric power stations (2 facilities); (including about 200 MW of SPP of households).

During 2023, about 350 MW of new RES capacities were introduced:

- 145 MW of wind power plants in Mykolaiv, Odesa and Lviv regions;
- about 170 MW of solar power plants at the "green" tariff (industrial and household, data to be clarified);
- 40 MW biothermal power plant;
- 1 MW – biogas plants;
- 0.05 MW small hydropower plants.

D.3.2. Incentive tariff for thermal energy producers from RES

Objective: stimulating the generation of thermal energy from alternative sources (the share of the use of alternative energy sources in the production of thermal energy by facilities in the field of heat supply)

Legal basis: Law of Ukraine "On Heat Supply", Law of Ukraine "On Amendments to the Law of Ukraine "On Heat Supply" Regarding Stimulating the Production of Thermal Energy from Alternative Energy Sources"

Time frame: from 2017

Responsible bodies/organizations: Ministry of Infrastructure, Ministry of Energy, State Energy Efficiency Agency, NEURC, local self-government bodies

Description: In order to stimulate the production of thermal energy from RES, the Verkhovna Rada of Ukraine adopted the Law of Ukraine "On Amendments to the Law of Ukraine "On Heat Supply" on Stimulating the Production of Thermal Energy from Alternative Energy Sources" of March 21, 2017 No. 1959-VIII[23]. The law determines the approach for setting the tariff for thermal energy produced at installations using alternative energy sources for the needs of institutions and organizations financed from the state or local budget, as well as for the needs of households, particularly, the calculation and establishment of tariffs is envisioned at the level of 90% of the current tariff for thermal energy produced using natural gas (and in the absence of it - at the level of the weighted average tariff for thermal energy from gas in the region).

In order to resolve problematic issues of heat supply enterprises, including those that produce thermal energy using alternative energy sources, the Verkhovna Rada of Ukraine has registered a government draft Law of Ukraine "On Amendments to Certain Laws of Ukraine Regarding the Settlement of Accounts Payable of Heat and Water Supply Enterprises" (reg. No. 11273 of 05/20/2024)[24].

The above-mentioned draft Law envisages amendments to Art. 20 of the Law of Ukraine "On Heat Supply" to provide an opportunity for business entities that produce thermal energy using alternative energy sources to establish tariffs for thermal energy, its production, in addition to the calculation

[23] https://zakon.rada.gov.ua/laws/show/1959-19#Text
[24] https://itd.rada.gov.ua/billInfo/Bills/Card/44267

mechanism based on the 90% principle, also in accordance with the procedures (methods) of setting tariffs for thermal energy, its production, transportation and supply, approved by the Cabinet of Ministers of Ukraine or NEURC, which in turn will ensure coverage of all economically justified costs incurred by enterprises in the course of heat production. The method of calculating tariffs will be determined directly by the economic entity that produces thermal energy using alternative energy sources.

D.3.3. Tax benefits for importing RES equipment

Objective: Stimulation the RES development by reducing the cost of imported equipment operating on RES (share in the structure of total final energy consumption)

Legal basis: Tax Code of Ukraine, Customs Code of Ukraine, Resolution of the Cabinet of Ministers of Ukraine of March 30, 2016 No. 293 "On the import of energy-saving materials, equipment and components into the customs territory of Ukraine under Japanese technologies demonstration projects" (Official Gazette of Ukraine, 2016 p., No. 31, Article 1242)

Time frame: since 2010

Responsible bodies/organizations: Ministry of Finance, State Tax Service, State Customs Service

Description: The Tax Code of Ukraine provides for a number of tax benefits for businesses operating in the RES sector. In particular, it provides for exemption from payment of value-added tax on import operations into the customs territory of Ukraine:

- equipment that works on renewable energy sources, energy-saving equipment and materials, means of measurement, control and management of consumption of fuel and energy resources, equipment and materials for the production of alternative types of fuel or for the production of energy from renewable energy sources;
- materials, equipment, components used for production:
- equipment that works on renewable energy sources;
- materials, raw materials, equipment and components that will be used in the production of alternative types of fuel or the production of energy from renewable energy sources;
- energy-saving equipment and materials, products, the operation of which ensures saving and rational use of fuel and energy resources.

In addition, Article 282 of the Customs Code of Ukraine stipulates that the above-mentioned equipment and devices are exempt from customs duties when imported into the customs territory of Ukraine or exported outside its borders. However, the duty exemption applies only if these goods are used by the taxpayer for their own production and if identical goods with similar quality indicators are not produced in Ukraine.

Moreover, the application of the above norms is possible only on the condition that such goods are included in the List of energy-saving materials, equipment and components under the Japanese technologies demonstration projects, which are exempt from import duties and VAT, approved by the resolution of the Cabinet of Ministers of Ukraine of March 30, 2016 No. 293 (Official Gazette of Ukraine, 2016 p., No. 31, Article 1242)[25].

D.3.4. Market premium mechanism for renewable electricity producers (feed-in premium)

Objective: ensuring the development of renewable electricity on a competitive basis, integration of "green" generation into the power system and the electricity market.

Legal basis: Law of Ukraine "On the Electricity Market", Law of Ukraine of June 30, 2023 No. 3220-XX "On Amendments to Certain Laws of Ukraine Regarding the Restoration and "Green"

[25] https://zakon.rada.gov.ua/laws/show/293-2016-%D0%BF#n16

Transformation of the Energy System of Ukraine", Resolution of the NEURC of April 26, 2019 No. 641 "On the approval of legal acts regulating the activities of the guaranteed buyer and the purchase of electricity at the "green" tariff, the purchase of services using the market premium mechanism."

Time frame: from 2024

Responsible bodies/organizations: Ministry of Energy, NEURC

Description: On June 30, 2023, the Verkhovna Rada of Ukraine adopted Law of Ukraine No. 3220-IX "On Amendments to Certain Laws of Ukraine Regarding the Restoration and "Green" Transformation of the Energy System of Ukraine", which introduced a number of new market instruments to support producers of electricity from RES, in particular, the mechanism of market premium (Feed-in-Premium) for producers at the "green" tariff and contracts for the difference for the winners of the auctions.

In order to implement the provisions of the Law of Ukraine of June 30, 2023 No. 3220-XX "On Amendments to Certain Laws of Ukraine Regarding the Restoration and "Green" Transformation of the Energy System of Ukraine", the Resolution of the National Energy Regulatory Commission of Ukraine of January 24, 2024 No. 178 "On Amendments to some resolutions of the National Commission, which carries out state regulation in the areas of energy and communal services", which fully implemented the market premium mechanism at the level of subordinate regulatory legal acts.

For the implementation of the norms of the Law of Ukraine of June 30, 2023 No. 3220-XX "On Amendments to Certain Laws of Ukraine Regarding the Restoration and "Green" Transformation of the Energy System of Ukraine", Resolution of the NEURC of January 24, 2024 No. 178 "On Amendments to some resolutions of the National Commission, which carries out state regulation in the areas of energy and communal services" introduced the following:

- amendments were made to the Procedure for the purchase by a guaranteed buyer of electricity produced from alternative energy sources, in particular regarding the determination of the cost of the service under the market premium mechanism and the procedure for concluding a service contract under the market premium mechanism;
- the Standard contract for the provision of services to support the production of electricity from alternative sources under the market premium mechanism was approved;
- the issue of entry-exit of the electricity facility from the balancing group of the guaranteed buyer has been settled. That is, one installation of the power industry can be in the balancing group, and the other can carry out activities in market segments and receive the difference between "green" tariff and market (calculated) price;
- when a guaranteed buyer leaves the balancing group, the "green" tariff is not canceled, the licensee or individual object can return to the balancing group and continue to sell electricity at the "green" tariff.

The market premium mechanism is a system of stimulating the production of electricity from alternative energy sources, according to which the guaranteed buyer pays economic entities that have a "green" tariff and economic entities that have acquired the right to support as a result of the auction, the difference between the "green" tariff or auction price, taking into account the surcharge to it and the estimated price, determined in accordance with the procedure established by the Law of Ukraine "On the Electricity Market". Financing of the market premium mechanism will take place in accordance with the procedure defined by the legislation and will not involve attracting funds from the state and local budgets.

The market premium mechanism creates the conditions for RES electricity producers to become full-fledged market participants and independently sell the generated electricity, reducing their imbalances and optimizing revenues.

D.3.5. Direct electricity purchase and sale contracts between producers and final energy consumers (corporate PPAs)

Objective: Stimulating the development of the RES sector on a market basis.

Legal basis: Law of Ukraine "On Alternative Energy Sources", Law of Ukraine "On the Electricity Market", Law of Ukraine of June 30, 2023 No. 3220-IX "On Amendments to Certain Laws of Ukraine Regarding the Restoration and "Green" Transformation of Energy system of Ukraine".

Time frame: from 2024

Responsible bodies/organizations: Ministry of Energy, NEURC

Description: The Law of Ukraine of June 30, 2023 No. 3220-IX "On Amendments to Certain Laws of Ukraine Regarding the Restoration and "Green" Transformation of the Energy System of Ukraine" removed a number of regulatory obstacles for the conclusion of direct electricity purchase and sale contracts between producers and end energy consumers (corporate PPAs), according to which the buyer of electricity is a private consumer, and not the state in the form of a guaranteed buyer. In particular, the obligation for RES producers to sell electricity under bilateral contracts at electronic auctions was removed, but the right to continue using this tool on a voluntary basis remained. The Law of Ukraine also expanded the list of counterparties for concluding a contract for the provision of services to ensure the stability of the price of electricity produced from alternative energy sources to the electricity supplier and trader (in addition to the consumer). In addition, the right of NEURC to set the maximum term of validity of bilateral contracts does not now extend to contracts concluded by producers of electricity from RES. These changes have created opportunities for businesses that produce electricity from RES or plan to become such a producer to look for partners for long-term bilateral contracts for the purchase and sale of electricity at the project development stage.

It is expected that the legislative changes introduced by the Law of Ukraine of June 30, 2023 No. 3220-XX "On Amendments to Certain Laws of Ukraine Regarding the Restoration and "Green" Transformation of the Energy System of Ukraine" will stimulate the development of the segment of direct contracts for the purchase and sale of electricity between the producer of electricity from alternative energy sources and consumers (Corporate PPA's) both physical and virtual.

D.3.6. System of auctions for distribution of support quota for RES

Objective: to establish a competitive basis for providing support to renewable energy projects and achieve a balance of interests of society and consumers of electricity and other market participants, ensuring at the same time the further development of renewable energy and reducing the burden on the electricity price.

Legal basis: Law of Ukraine "On Alternative Energy Sources", Law of Ukraine "On the Electricity Market", Law of Ukraine of April 25, 2019 No. 2712-VIII "On Amendments to Certain Laws of Ukraine Regarding Ensuring Competitive Conditions for the Production of Electricity from Alternative Energy Sources" , Law of Ukraine of June 30, 2023 No. 3220-IX "On Amendments to Certain Laws of Ukraine Regarding Restoration and "Green" Transformation of the Energy System of Ukraine", Resolution of the Cabinet of Ministers of Ukraine of December 29, 2019 No. 1175 "On introduction of competitive conditions for stimulating the production of electricity from alternative energy sources" (Official Gazette of Ukraine, 2020 p., No. 10, Art. 388), Resolution of the NEURC of April 26, 2019 No. 641 "On the approval of regulatory acts regulating the activity of the guaranteed buyer and the purchase of electricity at a "green" tariff, the purchase of services using the market premium mechanism", Order of the Ministry of Energy of September 14, 2020 No. 596 "On approval of the standard agreement on conducting electronic auctions on the distribution of the support quota between the auction customer and the operator of the electronic platform".

Time frame: operation until 2029

Responsible bodies/organizations: Ministry of Energy, NEURC, SE "Guaranteed Buyer", SE "Prozoro.Prodazhi", NPC "Ukrenergo"

Description: In order to increase the competition in the renewable energy market, the Law of Ukraine No. 2712-VIII[26] introduced an auction mechanism for large renewable energy installations in 2019. According to the Law of Ukraine, wind and solar installations with an installed capacity of more than 5 MW and 1 MW, respectively, are required to participate in auctions for the allocation of support quotas, and small producers can participate voluntarily. Small installations at household level with a capacity not exceeding 50 kW are still eligible for green tariffs until 2029.

In order to launch RES auctions, the Cabinet of Ministers of Ukraine adopted Resolution No. 1175 of December 27, 2019 "On the introduction of competitive conditions for stimulating the production of electricity from alternative energy sources" (Official Gazette of Ukraine, 2020 p., No. 10, Article 388)[27], which approves the procedure for conducting auctions and allocating quotas to support RES.

On June 30, 2023, the Verkhovna Rada of Ukraine adopted the Law of Ukraine No. 3220-IX "On Amendments to Certain Laws of Ukraine Regarding the Restoration and "Green" Transformation of the Energy System of Ukraine", which improved the model of conducting auctions for the distribution of quotas for supporting electricity producers from energy sources, in particular, the above-mentioned Law introduced the following changes:

- setting the term of support up to 12 years;
- introduction of a contract-for-difference model (market premium mechanism) instead of a fixed tariff;
- simplification of conditions for participation in auctions;
- conducting auctions for the construction of renewable energy facilities together with energy storage facilities;
- determining certain hours of the day during which support can be provided based on the results of the auction;
- granting the right to the Cabinet of Ministers of Ukraine to determine the share of the auction price, which is fixed in euros, but not less than 50%;
- determining the load profiles of renewable energy facilities for which the right to support was acquired as a result of the auction.

In accordance with Article 9^3 of the Law of Ukraine "On Alternative Energy Sources", the Cabinet of Ministers of Ukraine, at the request of the Ministry of Energy, establishes the annual support quota and the schedule of auctions for the following year, as well as indicative forecast indicators of the annual support quotas for four years following the year for which the annual support quota is established. Proposals regarding the amount of annual support quotas are prepared by NPC "Ukrenergo" taking into account Ukraine's international obligations regarding the development of renewable energy, the Energy Strategy of Ukraine, the national action plan for the development of renewable energy, the Generation capacity adequacy assessment report and the plan for the development of the transmission system, the state of implementation of projects for the construction of renewable energy facilities. Proposals regarding the maximum price offered by the auction participant for the next year per each alternative energy source are prepared by the National Commission, which carries out state regulation in the areas of energy and communal services. The first quotas and indicative indicators are planned to be established by the end of 2024 for the years 2025-2029. The possibility of holding pilot auctions in 2024 is being considered.

[26] https://zakon.rada.gov.ua/laws/show/2712-19#Text
[27] https://zakon.rada.gov.ua/laws/show/1175-2019-%D0%BF#Text

It is expected that the auction mechanism will promote the development of RES on a competitive basis. However, as of the beginning of 2024, this tool is not yet operational. Currently, the Ministry of Energy is working on the possibility of launching auctions taking into account the challenges of martial law.

D.3.7. Guarantees of origin of electricity from RES

Objective: stimulating the development of renewable electricity on a competitive basis, as well as implementing the provisions of European legislation, in particular, Directive 2018/2001/EU of the European Parliament and of the Council of December 11, 2018 "On the promotion of the use of energy from renewable sources".

Legal basis: Law of Ukraine "On Alternative Energy Sources", Law of Ukraine of June 30, 2023 No. 3220-IX "On Amendments to Certain Laws of Ukraine Regarding Restoration and "Green" Transformation of the Energy System of Ukraine", Resolution of the Cabinet of Ministers of Ukraine of 27 of February 2024 No. 227 "On the introduction of guarantees of the origin of electricity produced from renewable energy sources" (Official Gazette of Ukraine, 2024 p., No. 26, Article 1653), resolution of the NEURC of December 27, 2023 No. 2624 "On Approval of the procedure for establishment and maintaining a register of electricity facilities and electrical installations of consumers (including active consumers) that use alternative energy sources for the production of electricity", DSTU EN 16325:2022 Guarantees of origin related to energy, Guarantees of origin of electricity (EN 16325:2013+A1:2015, IDT).

Time frame: from 2024

Responsible bodies/organizations: NEURC, Ministry of Energy

Description: At the end of June 2023, the Verkhovna Rada of Ukraine adopted the Law of Ukraine of June 30, 2023 No. 3220-IX "On Amendments to Certain Laws of Ukraine Regarding the Restoration and "Green" Transformation of the Energy System of Ukraine", which introduced a mechanism for issuing, using and terminating guarantees of origin of electricity produced from RES. The law of Ukraine specifies that the guarantee of origin of electricity produced from renewable energy sources is an electronic document created on the basis of information from the register of guarantees of origin of electricity produced from renewable energy sources, which confirms that a certain amount of electricity is produced from renewable energy sources, confirms its ecological value and certifies the rights associated with the positive effect of the production of electricity from RES. Guarantees of origin confirm the origin of electricity produced from RES by:

- a business entity that produces electricity from RES,
- by a consumer who has installed a generating unit for his own consumption, or
- an active consumer.

The guarantee of origin is issued for the volume of 1 MWh of electricity from RES, released into the network or produced and used for own consumption. The guarantee of origin is formed automatically in a special register and is issued free of charge in accordance with the procedure for issuance, circulation and repayment, which is approved by the Cabinet of Ministers of Ukraine. NEURC is the body responsible for issuing, circulating and redeeming guarantees of origin and ensuring the functioning of the register of guarantees of origin.

The circulation of the guarantee of the origin of electricity from RES is carried out within 12 months from the date of its production. At the same time, the owner of the guarantee of origin has the right to repay it within 18 months from the date of production of the corresponding amount of electricity. The purchase and sale of guarantees of origin of electricity produced from renewable energy sources is carried out on a market basis at free prices. Export and import of guarantees of origin of electricity produced

from renewable energy sources is carried out under foreign economic agreements (contracts). However, in order to realize export opportunities, it is necessary to ensure full compliance of the guarantee of origin mechanism with European standards. For this purpose, among the tasks of the National Energy Regulatory Commission of Ukraine, the Law of Ukraine includes ensuring the integration of the register of guarantees of the origin of electricity from RES with the registers of the countries of the Energy Community, the European Union and the Organization for Economic Cooperation and Development. In addition, the European Commission, together with the Secretariat of the Energy Community, is developing a road map for bringing the legislation of the Contracting Parties of the Energy Community, which are not members of the European Union, into compliance with the requirements of the European Union legislation. Thus, full recognition of Ukrainian guarantees of origin in the EU will be possible only after ensuring the integration of the Ukrainian and European registers of guarantees of origin and the fastest possible implementation of the road map requirements.

The Cabinet of Ministers of Ukraine adopted Resolution No. 227 of February 27, 2024 "On the Introduction of Guarantees of Origin of Electricity Produced from Renewable Energy Sources"[28] (Official Gazette of Ukraine, 2024, No. 26, Article 1653), which approved the Procedure of issuance, circulation and repayment of guarantees of origin of electricity produced from renewable energy sources and the Procedure for determining the ecological value of electricity produced from renewable energy sources.

In addition, in accordance with the requirements of the Law of Ukraine of June 30, 2023 No. 3220-XX "On Amendments to Certain Laws of Ukraine Regarding the Restoration and "Green" Transformation of the Energy System of Ukraine", the NEURC adopted the following resolutions:

- No. 2624 "On approval of the Procedure for the establishment and maintenance of the register of power facilities and electrical installations of consumers (including active consumers) that use alternative energy sources for the production of electricity" of December 27, 2023, which provides for the introduction of a respective register of generating facilities of producers and consumers, the information from which will be a component of the register of guarantees of origin for electricity from RES. On March 25, 2024, the NEURC published the relevant register for public access;
- No. 2626 "On the approval of the Procedure for disclosure of information to consumers of electricity about energy sources, in the general structure of the balance of electricity purchased by the electricity supplier and/or produced at its own electrical installations"of December 27, 2023, which is necessary for the introduction of the mechanism of guarantees of origin.

The Law of Ukraine of June 30, 2023 No. 3220-XX "On Amendments to Certain Laws of Ukraine Regarding the Restoration and "Green" Transformation of the Energy System of Ukraine" determined that the National Energy Regulatory Commission within six months from the date of approval of the procedure for issuing, circulating and repaying guarantees of origin for electricity from RES, should ensure the functioning of the registry of guarantees of origin for electricity from RES. Thus, it is expected that the register of guarantees of origin of electricity from RES will be operational from 2024.

In accordance with the provisions of the Law of Ukraine of June 30, 2023 No. 3220-IX "On Amendments to Certain Laws of Ukraine Regarding the Restoration and "Green" Transformation of the Energy System of Ukraine", within six months from the date of approval by the Cabinet of Ministers of Ukraine of the procedure for issuance, circulation and redemption of guarantees of the origin of electricity produced from renewable energy sources, the functioning of the registry of guarantees of the origin of electricity produced from renewable energy sources must be ensured. Considering that the Cabinet of

[28] https://zakon.rada.gov.ua/laws/show/227-2024-%D0%BF#Text

Ministers of Ukraine adopted Resolution No. 227 "On the introduction of guarantees of the origin of electricity produced from renewable energy sources" (Official Gazette of Ukraine, 2024 p., No. 26, Article 1653) on February 27, 2024, the full functioning of the register of guarantees of origin of electricity produced from renewable energy sources in Ukraine should start no later than August 27, 2024. At the same time, the Government, with the involvement of all interested parties, needs to develop and implement mechanisms to stimulate the domestic market of guarantees of origin.

It is expected that the introduction of an effective system of guarantees of the origin of electricity from RES will be a significant impetus for the development of the RES sector in Ukraine and will create prerequisites for the export of "green" electricity.

D.3.8. Mandatory use of liquid biofuel (biocomponents) in the field of transport, which meets sustainability criteria

Objective: development of production, circulation and use of sustainable liquid biofuel in transport.

Legal basis: Energy Strategy of Ukraine for the period until 2050, Directive (EC) 2018/2001 on the promotion of energy production from renewable sources

Time frame: from 2024

Responsible bodies/organizations: Ministry of Infrastructure, SAEE, State Environmental Inspectorate, Ministry of Energy

Description: The introduction of mandatory use of liquid biofuel (biocomponents) in the field of transport will contribute to:

- increasing the workload of distilleries and the production potential of adjacent areas;
- creation of new jobs;
- improvement of the environmental conditions due to the reduction of emissions into the atmosphere of harmful substances released during the combustion of fossil fuels;
- creation of prerequisites for attracting foreign and domestic investments in the field of production of liquid biofuel (biocomponents).

The Verkhovna Rada of Ukraine has registered a draft Law of Ukraine "On Amendments to Certain Legislative Acts of Ukraine Regarding Mandatory Use of Liquid Biofuel (Biocomponents) in the Transport Industry" (Reg. No. 3356-d of November 5, 2020), which was adopted in the second reading, and provides for the establishment of a regulatory framework for the development of the area of production, circulation and use of liquid biofuel in transport and the establishment of a mandatory share of the use of biofuel in the field of transport. In addition, the draft law provides for the introduction of sustainability criteria for liquid biofuel (biocomponents) and biogas intended for use in the transport sector. At the same time, the implementation of the system of sustainability criteria for all types of biofuels, bioliquids and fuels from biomass is envisaged within the framework of the draft law on the implementation of Directive 2018/2001, which is being developed by the Ministry of Energy.

D.3.9. Implementation of unified electronic trade in solid biofuels

Objective: development of the solid biofuels market by creating a single electronic platform for trading in solid biofuels

Legal basis: Energy Strategy of Ukraine for the period up to 2050

Time frame: from 2025.

Responsible bodies/organizations: Ministry for Development of Communities and Territories of Ukraine (hereinafter – Mindevelopment), SAEE, Ministry of Energy.

Description: Today, the solid biofuel market has a number of problems, including the instability of biofuel prices, low quality, and unreliable supply. The mechanism for organizing the biofuel market in Ukraine should be the use of an electronic platform (exchange), where all interested producers and consumers will trade biofuel.

A package of draft laws has been registered in the Verkhovna Rada of Ukraine, which provides for the establishment of legislative prerequisites for the introduction of electronic trade in solid biofuels, namely:

- the draft Law of Ukraine "On Amendments to Certain Legislative Acts of Ukraine Regarding the Development of Electronic Trade in Alternative Fuels" (Reg. No. 8052 of September 19, 2022), which, in particular, provides for the creation of legislative prerequisites for the introduction of electronic trade in solid alternative fuels[29];
- the draft Law of Ukraine "On Amendments to the Code of Ukraine on Administrative Offenses Regarding Liability for Offenses in the Field of Electronic Trade in Alternative Fuels" (Reg. No. 8053 of September 19, 2022).

Introduction of a solid biofuel trade exchange will enable establishment a transparent and competitive biofuel market in Ukraine; will contribute to the reduction of biofuel prices; will provide generating capacity with biofuel; will stimulate investment attraction in bioenergy of Ukraine.

D.3.10. Development of the energy crops sector

Objective: establishment of prerequisites for simplifying the economic activity on growing energy crops.

Legal basis: Energy Strategy of Ukraine for the period up to 2050

Time frame: from 2025

Responsible bodies/organizations: Mineconomy, Minenergy, Minfinance, Mindevelopment, SAEE

Description: A promising RES for thermal energy production is energy crops, which are grown on low-productivity lands and can be resistant to arid conditions and require less or no chemical pesticides.

Energy crops sector in Ukraine is at the initial stage of development, which is associated with a number of barriers that prevent such development, in particular of a legislative nature (the absence of the term "energy crops" in the legislation of Ukraine, the complicated procedure for leasing state and communal land), administrative (short term land lease agreements, lack of a civilized biomass market) and financial (need to attract significant investments at the initial stages of planting energy crops plantations, long payback period of projects).

At the same time, the cultivation of energy crops has a significant potential for strengthening the energy independence of Ukraine and the development of renewable energy sources by replacing the use of natural gas in the production of heat and electricity.

The implementation of projects on the cultivation of energy crops has a number of positive consequences, in particular:

- development of a new type of economic activity and domestic biofuel market;
- reduction of greenhouse gas emissions due to the use of CO2-neutral fuel and replacement of fossil fuels with biomass;
- obtaining profit from unproductive or degraded agricultural lands and restoring their fertility;
- cleaning of contaminated land;
- creation of new jobs and generating tax revenue to budgets of all levels, socio-economic stability of regions.

[29] https://itd.rada.gov.ua/billInfo/Bills/Card/40449

In order to ensure the possibility of using the potential of unproductive lands for the cultivation of energy crops and their further use in the energy sector, the People's Deputies of Ukraine developed a package of draft Laws of Ukraine:

- "On Amendments to Some Legislative Acts of Ukraine Regarding Promotion of the Development of Energy Crops" (Reg. No. 5227 of March 12, 2021)30;
- "On Amendments to Article 288 of the Tax Code of Ukraine regarding rent for land plots on which energy plants are grown" (reg. No. 5228 of March 12, 2021)31.
- The main provisions of the bills are:
- establishment of the maximum amount of rent for land plots of state and communal property at the level of 5% of the normative monetary assessment;
- introduction of the minimum lease term for land plots provided for the cultivation of energy crops - 20 years;
- lease of unproductive and marginal land plots of state and communal property (without holding land auctions);
- providing a definition of the term "energy crops" and introducing state support for the cultivation of energy crops.

D.3.11. Simplification of permit procedures for RES projects

Objective: Accelerating the development of RES projects.

Responsible bodies: Ministry of Energy, NEURC.

Time frame: until 2030

Legal basis: Law of Ukraine of June 30, 2023 No. 3220-IX "On Amendments to Certain Laws of Ukraine Regarding the Restoration and "Green" Transformation of the Energy System of Ukraine", Energy Strategy of Ukraine for the period until 2050.

Description: Directive of the European Parliament and Council (EC) 2018/2001 of December 11, (revised in 2023) on the promotion of the use of energy from renewable sources provides that in the zones of accelerated development of renewable energy, the time for obtaining permits for new power plants should not exceed one year and six months for repowering projects, including all administrative permits, grid connection permits and environmental impact assessment. EU member states must now treat renewable energy projects as being of "overriding public interest" to speed up any legal challenges.

The principle of overriding public interest, which was introduced in the EU countries, provides for the simplification of procedures for obtaining permits and the introduction of a presumption of feasibility and absence of negative impact on the environment for renewable energy projects, etc.

Today, the procedure for obtaining permit documentation for the implementation of RES projects in Ukraine is complex and long. Project developers are faced with a number of bureaucratic barriers, overcoming which and obtaining all the necessary permits and approvals takes 3-5 years, which is unacceptable given the existing difficult situation in the energy sector of Ukraine, caused by constant shelling of energy infrastructure of Ukraine by the russia. In order to simplify the permitting procedures, as a first step, it is planned to conduct research on obstacles to accession, adopting legislative changes with a focus on the implementation of EU legislation, in particular Council Regulation (EU) 2022/2577 of December 22, 2022 laying down a framework to accelerate the deployment of renewable energy.

[30] http://w1.c1.rada.gov.ua/pls/zweb2/webproc4_1?pf3511=71384
[31] http://w1.c1.rada.gov.ua/pls/zweb2/webproc4_1?pf3511=71385

In addition, it is planned to consider the following measures:

- Introduce digitalization of registry archives and other information necessary in the process of project development, in particular regarding:
  - objects of archaeological and cultural heritage with their protection zones;
  - detailed plans of territories, urban planning documentation of various levels;
  - the existing road infrastructure with the indication of the main parameters and the plan of repairs/reconstructions;
  - existing environmental studies.
- Extend the validity period of permit documentation to at least 5 years from the moment of its issuance (aviation, environmental impact assessment, agricultural passports, technical conditions, geological and geodetic surveys, etc.).
- To reform approaches to issuing technical conditions for connection to electricity grids:
  - providing the possibility of joint use of already issued and implemented technical conditions;
  - canceling the dependence of the validity period of the contract on connection to electricity grids on the validity period of technical conditions;
  - reservation of technical conditions or technical solutions for a certain period under a financial guarantee.
- Create the possibility of obtaining aviation approvals without reference to urban planning documentation.
- Simplify the permit procedure for Repowering projects, if the object's characteristics increase by no more than 30% (in the absence of a change in the connected capacity).

Simplification of the permitting procedure, early detection of "no-go" risks and identification of sites with the greatest combined potential for the state and the developer of RES projects will help unlock existing projects at the stage of obtaining permits and accelerate the implementation of new projects. Reducing bureaucratic barriers for renewable energy projects will reduce the time and effort required to obtain the necessary permits, which will contribute to a faster start-up and implementation of projects.

D.4. Policies and measures in the transport sector

D.4.1. Tax benefits for vehicles equipped with electric motors

Objective: Stimulating the production and use of vehicles equipped with electric motors.

Legal basis: Tax Code of Ukraine, Customs Code of Ukraine, Law of Ukraine "On the Compulsory State Pension Insurance Fee"[32], Law of Ukraine "On Customs Tariff of Ukraine"[33]

Time frame: from 2018

Responsible bodies/organizations***:*** Ministry of Finance, State Tax Service, State Customs Service.

Description: The Tax and Customs Codes of Ukraine provide for a number of tax benefits to encourage the use of electric passenger cars, which were introduced in 2018 and have been extended several times. In particular, no customs duty is charged on the import of electric vehicles, and transactions involving importation into the customs territory are also exempt from VAT (Clause 64 of Subsection 2 of Chapter XX of the Tax Code of Ukraine) until 2026. In addition, the excise tax rate for electric cars is much lower than for cars with internal combustion engines or hybrid cars - 1 EUR per 1 kWh of battery capacity.

[32] https://zakon.rada.gov.ua/laws/show/400/97-%D0%B2%D1%80/ed20231208#Text
[33] https://zakon.rada.gov.ua/laws/show/2697-20#n9

From July 1, 2022, electric passenger cars are also exempted from payment of mandatory state pension insurance fee upon first registration in accordance with the Law of Ukraine "On the Compulsory State Pension Insurance Fee".

In order to stimulate the domestic production of electric vehicles, from January 1, 2022 to January 1, 2031, import of goods into the customs territory, which are used for the own production of transport vehicles equipped exclusively with electric motors, are exempted from import duties in accordance with the Customs Code of Ukraine and VAT taxation in accordance with the Tax Code of Ukraine. In addition, from January 1, 2022 to December 31, 2035, the profit of enterprises engaged exclusively in the production of electric motors, as well as manufacturers of lithium-ion (lithium-polymer) batteries and chargers intended for vehicles, equipped exclusively with electric motors, as well as manufacturers of vehicles equipped exclusively with electric motors is exempted from taxes in accordance with the Tax Code of Ukraine.

At the same time, the released funds (tax amounts that are not paid to the budget and remain at the disposal of the taxpayer) must be used for research and development work in the field of electric transport, establishment or re-equipment of the material and technical base, increase in the volume of production, introduction of the latest technologies.

According to the estimates of the Ministry of Finance[34], the expected amount of the tax revenue foregone in 2022 in connection with the provided tax benefits is:

- in connection with the exemption from VAT of operations on the supply to the customs territory of Ukraine of vehicles equipped exclusively with electric motors - about UAH 364 million;
- in connection with the exemption from taxation of the profit of enterprises that are exclusively engaged in the production of electric motors intended for vehicles equipped exclusively with electric motors and electric vehicles - UAH 584 million.

The effectiveness of the above mentioned tax benefits was not evaluated purposefully. However, the number of electric cars increased from 7,439 units in 2018 (as of May 1)[35] to 85,881 units in 2023 (at the end of the year)[36], that is, more than ten times, which may indirectly indicate the effectiveness of fiscal stimulation of development sector of vehicles equipped with electric motors.

At the same time, the National Revenue Strategy until 2030 provides for the development of a unified approach to the application of tax incentives in the period from 2025 to 2030 and a plan to reform the tax legislation to implement such an approach.

D.4.2. Stimulating the development of electric charging infrastructure

Objective: Reducing the consumption of fossil fuels by the transport sector

Legal basis: Law of Ukraine of February 24, 2023 No. 2956-IX "On some issues of the use of vehicles equipped with electric motors and amendments to some laws of Ukraine regarding overcoming fuel dependence and development of electric charging infrastructure and electric vehicles."

Time frame: from 2023.

Responsible bodies/organizations: Ministry of Infrastructure, Ministry of Energy, JSC “NNEGC “Energoatom”

Description: In March 2023, the Law of Ukraine of February 24, 2023 No. 2956-IX "On some issues of the use of vehicles equipped with electric motors and amendments to some laws of Ukraine regarding overcoming fuel dependence and development of electric charging infrastructure and electric transport"

[34] https://itd.rada.gov.ua/billInfo/Bills/pubFile/1473870
[35] https://texty.org.ua/fragments/85448/Skilky_de_ta_jakyh_jelekromobiliv_v_Ukrajini-85448/
[36] https://kompek.rada.gov.ua/uploads/documents/31243.pdf

entered into force. In accordance with this Law, ensuring the development of electric vehicles and the infrastructure of charging stations for electric vehicles is a priority for the development of state policy in the field of road transport. The concept of an electric car covers both an electric passenger car and an electric truck, equipped exclusively with electric motors (one or several) and an electricity storage system.

According to current construction standards, at least 5% of the total number of parking spaces in parking lots must be provided for parking of electric vehicles. Such places can be equipped with charging stations[37].

In accordance with the Law of Ukraine of February 24, 2023 No. 2956-IX "On some issues of the use of vehicles equipped with electric motors and amendments to some laws of Ukraine on overcoming fuel dependence and development of electric charging infrastructure and electric vehicles" state authorities and by December 31, 2023, local self-government bodies must approve programs for the development of electric charging infrastructure, which will provide for the provision of state-owned or communal facilities with charging stations for electric cars in existing parking lots, garages and other parking spaces (except for those used exclusively by such bodies, or state or communal enterprises, institutions, organizations) in accordance with construction standards. In accordance with such programs, state and communal commercial enterprises, state owned enterprises must provide existing objects owned by such entities or secured by them with the right of economic ownership, with the necessary contractual capacity and electric vehicle charging stations in existing parking lots, garages and other parking spaces (except those used exclusively by such entities) by December 31, 2024.

The Law of Ukraine on electric transport stipulates that projects of new construction of multi-story residential buildings must take into account the need to provide at least 50% of parking spaces for electric vehicles with charging stations. The development of electric charging infrastructure for existing buildings is also foreseen: associations of co-owners of apartment buildings have the right to install charging stations on the premises and independently determine the procedure for using and paying for such stations.

In addition, it is planned to transpose Commission Delegated Regulation (EU) 2019/1745 of August 13, 2019 supplementing and amending Directive 2014/94/EU of the European Parliament and of the Council as regards recharging points for L-category motor vehicles, shore-side electricity supply for inland waterway vessels, hydrogen supply for road transport and natural gas supply for road and waterborne transport and repealing Commission Delegated Regulation (EU) 2018/674.

D.4.3. Stimulating the development of low-carbon municipal transport

Objective: Reducing the consumption of fossil fuels by the transport sector

Legal basis: Law of Ukraine of February 24, 2023 No. 2956-IX "On some issues of the use of vehicles equipped with electric motors and amendments to some laws of Ukraine regarding overcoming fuel dependence and development of electric charging infrastructure and electric vehicles."

Time frames: 2023-2036

Responsible bodies/organizations: Ministry of Infrastructure

Description: The Law of Ukraine "On Urban Electric Transport" provides for the gradual replacement of municipal transport with low-carbon alternatives. On city bus routes in cities with a total population of more than 250,000 people, the share of electric buses and/or buses running exclusively on methane (compressed or liquefied) or biogas, and/or buses with a hydrogen fuel cell in the fleet buses should be at least:

- 25% on January 1, 2030;
- 50% on January 1, 2033.

[37] 205 DBN V.2.3-15:2007. Parking lots and garages for cars. https://e-construction.gov.ua/laws_detail/2845786368808847244?doc_type=2

In addition, from January 1, 2036, only electric buses or buses running exclusively on methane (compressed or liquefied) or biogas and/or buses with a hydrogen fuel cell are allowed to transport passengers on public city bus routes in the mode of regular passenger transportation in cities of district and regional significance.

At the same time, local self-government bodies have the right to revise these shares (but not more than by 50%) and terms (not more than by two years).

From January 1, 2028, gradual restrictions will be imposed on the purchase of buses with internal combustion engines for use in the field of public transport.

D.5. Policies and measures in the buildings sector

D.5.1. Activities of the Energy Efficiency Fund

Goal: Support for energy efficiency initiatives, implementation of incentive tools and support for measures to increase the level of energy efficiency of buildings and energy saving, in particular in the residential sector

Legal basis: Law of Ukraine "On the Energy Efficiency Fund".

Time frames: 2018 - indefinitely.

Responsible bodies/organizations: Energy Efficiency Fund, Ministry of Infrastructure.

Description:

a) Energodim program

The Fund provides partial reimbursement of costs for measures to increase energy efficiency in accordance with the "Energodim" Fund Program.

According to the Law of Ukraine "On the Energy Efficiency Fund", the Fund provides grants exclusively to homeowners' associations of multi-apartment buildings (HOAs).

The creation of HOAs is not mandatory in Ukraine. According to the State Statistics Service, as of January 1, 2024, 39,709[38] HOAs were registered, while the total number of multi-apartment buildings is about 180,000. In accordance with the Law of Ukraine of July 14, 2023 No. 3270-IX "On Amendments to Certain Laws of Ukraine on Simplifying the Management of Multi-apartment Buildings", as a general rule, a a HOA decision is adopted if it is voted for by homeowners, which together have more than half of the total number of votes of all homeowners. The HOA may increase the required number of votes (up to 67 percent of the total number of votes of all homeowners) to adopt decisions on the following issues: election of association management bodies, change of management form, establishment and change of the amount of contributions/payments, budget approval.

Beneficiaries of the Fund can choose one of two packages of energy efficiency measures to implement in their home, "Light" or "Comprehensive".

The "Light" package (Package A) includes the following mandatory measures:

- installation of a heat meter;
- installation or modernisation of an individual heat sub-station (IHS).

Additionally, HOAs can receive partial reimbursement of the cost of implementing additional measures determined by the Energodim Program.

The "Comprehensive" package (Package B) includes the following mandatory measures:

- mandatory measures for Package A;

[38] https://www.ukrstat.gov.ua/edrpoy/ukr/EDRPU_2024/ks_opfg/ks_opfg_s_0124_ue.xls

- thermal insulation and/or replacement of pipelines of the internal heat supply system and hot water supply system in the unheated premises;
- installation of automatic (balancing) valves;
- replacement or repair of external doors and/or arrangement of external entrance vestibules; replacement or repair of windows in common areas of the building.

Similarly to Package A, condominiums have the opportunity to receive a grant for the implementation of additional (optional) measures defined by the Program. The amount of partial reimbursement of the cost of energy efficiency improvement measures (grant) differs depending on the time of application submission (increased grant amount for the first 500 applications) and the selected package of measures. The current amounts of grants are:

- 70% of the cost of the preliminary energy audit; development of project documentation and its examination; technical and copyright supervision services; certification of energy efficiency after the implementation of the project and inspection of the engineering systems of the building, on which energy efficiency improvement measures were implemented during the implementation of the project - for both packages of measures;
- 40% of the cost of works, equipment, materials - for Package A
- 50% of the cost of works, equipment, materials - for Package B.

The government plans to gradually reduce the share of reimbursement for energy efficiency measures after the termination/revocation of martial law[39].

Grants are provided by the Energy Efficiency Fund in separate tranches, after the implementation of the relevant stage of the project and its verification by the Fund. Condominiums can receive a partial advance for construction works, provided that it is confirmed that the contractors selected by the condominium meet the requirements of the Fund established in the Energodim Program.

Results: As of December 15, 2023, construction works on 316 projects of the Fund were fully or partially completed. The cumulative value of the achieved energy savings is 315.2 million kWh/year, the cumulative value of CO2 emission reduction is 84.8 thousand tons/year[40]. Achieving an annual increase in the energy efficiency of energy consumption due to the activities of the Energy Efficiency Fund largely depends on sustainable state funding. At the same time, expenses for the functioning of the Energy Efficiency Fund were not provided for in the State Budget for 2020, 2023-2024. For 2018-2026, the Energy Efficiency Fund plans to implement more than 800 projects and expects that another 300 projects will be at the implementation stage. The expected reduction of CO2 emissions is more than 120,000 tons/year[41].

Planned measures: The government also plans to expand the areas of activity of the Energy Efficiency Fund by directing funding to:

- measures aimed at increasing the share of energy produced from renewable energy sources;
- measures aimed at increasing the number of buildings with close to zero energy consumption;
- energy-efficient measures in private (manor) houses.

Corresponding changes to the Energy Efficiency Fund Program will be introduced in the Q4 of 2024.

Among the measures in the direction of "Energy poverty reduction" in the phase up to 2025, the ESU provides for the study of the feasibility of introducing subsidies for the implementation of small energy renovations for vulnerable households on the principle of "first in line for repairs", with priority

[39] Operational plan of measures for the implementation in 2024-2026 of the Long-term strategy of thermal modernisation of buildings for the period until 2050. https://zakon.rada.gov.ua/laws/show/1228-2023-p#Text

[40] https://eefund.org.ua/wp-content/uploads/2024/01/strategiya-fondu-energoefektyvnosti-2024-2026-povna-versiya-1.pdf

[41] Ibid

given to vulnerable consumers. It is advisable to carry out such an analysis as part of the assessment of options for expanding the financing of the Energodym Program of the Energy Efficiency Fund. According to the ESU, the introduction of energy-efficient measures will be stimulated by subsidizing vulnerable categories of consumers, providing grants and low-interest loans for a defined group of households (those with a low level of income) until 2032.

Currently, the Fund is concentrating on the implementation of individual projects, however, in the II quarter of 2024, the pilot project of thermal modernisation of a residential quarter (the "Energy-efficient district of Lviv" project), which is implemented by the Energy Efficiency Fund with the support of GIZ, is expected to be completed. This approach will make it possible to operationalize the principle of "energy efficiency first" and ensure complex synergistic thermal modernisation of buildings, heat networks and heat-generating equipment.

b) Vidnovydim program

In August 2022, the Law of Ukraine "On the Energy Efficiency Fund" was amended, which allowed the Fund to finance not only energy efficiency measures, but also programs related to the restoration of buildings destroyed and/or damaged as a result of armed aggression. From November 2022, the new Program of the Fund - Vidnovydim began to operate. The participants of this Program are also exclusively HOAs. Funding under the Vidnovydim Program is provided for the following types of work (services):

- replacement or repair of damaged windows, external and internal vestibule doors;
- repair of damaged building facades;
- repair of damaged roof structures / building covering;
- repair of damaged equipment of roof boiler houses and engineering networks.

Financing is provided for the implementation of construction works, as well as the purchase of materials and equipment necessary for the performance of such works. Such financing is provided in the form of a grant in the amount of 100% of the costs of the implementation of eligible measures under the project, with a cap not exceeding UAH 7.2 million. As of December 15, 2023, construction works on 211 projects of the Fund have been fully or partially completed[42].

D.5.2. Implementation of the State Targeted Economic Program to Support Thermal Modernisation of Buildings by 2030

Goal: Achievement of long-term goals in improving the energy efficiency of buildings.

Legal basis: Law of Ukraine "On Energy Efficiency of Buildings"; Long-term Strategy for thermal modernisation of buildings for the period until 2050; The concept of the State targeted economic program to support thermal modernisation of buildings until 2030, approved by the order of the Cabinet of Ministers of Ukraine of December 29, 2023 No. 1228 "Some issues of strategic development of the energy efficiency of buildings" (Official Gazette of Ukraine, 2024 p., No. 13, Article 843) .

Time frames: 2024-2030

Responsible bodies/organizations: Ministry of Infrastructure, SAEE.

Description: To achieve the goals of the first stage of the Long-Term Strategy for the Thermal Modernisation of Buildings up to 2050, the Cabinet of Ministers of Ukraine approved[43] Concept of the State Targeted Economic Program of Support for Thermal Modernisation of Buildings until 2030 (hereinafter referred to as the Concept of the Program for Thermal Modernisation of Buildings 2030).

The Concept of the Program for Thermal Modernisation of Buildings 2030 outlines the following tasks:

[42] https://eefund.org.ua/wp-content/uploads/2024/01/strategiya-fondu-energoefektyvnosti-2024-2026-povna-versiya-1.pdf
[43] https://zakon.rada.gov.ua/laws/show/1228-2023-%D1%80#Text

Task 1. Stimulating an increase in energy efficiency in the residential sector;
Task 2. Ensuring the exemplary role of central and local executive authorities in enhancing the energy efficiency of buildings;
Task 3. Implementing energy management systems in line with international ISO 50000 series standards;
Task 4. Ensuring proper collection and analysis of data on energy and operational characteristics of buildings;
Task 5. Facilitating related construction works to support the implementation of thermal modernisation of buildings;
Task 6. Promoting sanitary and epidemic safety in buildings alongside energy savings;
Task 7. Creating favorable market environment for thermal modernisation of buildings;
Task 8. Stimulating the development of the energy service as an investment mechanism for thermal modernisation of buildings;
Task 9. Increasing public awareness regarding the possibilities of thermal modernisation of buildings;
Task 10. Stimulating local self-government bodies to increase the level of energy efficiency of buildings;
Task 11. Ensuring the development of competencies and qualifications in the field of increasing the energy efficiency of buildings;
Task 12. Supporting scientific, technical, and innovative advancements in improving energy efficiency, including the development of nearly-zero energy buildings.

As part of Task 1 on **increasing the level of energy efficiency in the housing sector,** the Concept proposes expanding the range of support tools for energy efficiency projects. This includes extending support to citizens who own individual houses (currently, support is only available to co-owners of multi-apartment buildings). Specifically, it is planned to reimburse a portion of the loan amount for energy-efficient measures or thermal modernisation, and to provide support for constructing residential buildings with nearly zero energy consumption for owners of properties destroyed as a result of military actions. Additionally, there are plans to assist co-owners in installing heat pumps in the individual heating systems of multi-apartment buildings that are not connected to district heating systems.

To **ensure the exemplary role of central and local executive bodies** in increasing the level of energy efficiency of buildings (Task 2), the Concept includes provisions for the certification of the energy efficiency of buildings and the creation of technical passports for state and municipal properties where central executive bodies and other state institutions are located. It also involves implementing energy efficiency measures or thermal modernisation in buildings housing central and local executive authorities, as well as ensuring that the construction (or reconstruction) of state-owned public buildings housing state authorities meets the requirements for nearly-zero energy buildings.

Within Task 3, it is envisaged **to implement energy management systems** taking into account the international standards of the ISO 50000 series in central executive bodies and local state (military) administrations, local self-governments, and encouraging local self-government units to local energy planning.

Task 4 is aimed at **forming an analytical base** in the field of energy efficiency. This task includes conducting a survey of the national stock of residential and public buildings and creating a national database of their energy and operational characteristics. Additionally, the task proposes addressing thermal energy and hot water metering by installing commercial metering units in state-owned buildings and providing incentives for local authorities to install thermal energy distribution metering systems along with automatic air temperature regulators in apartment buildings.

In accordance with Task 5, it is planned to stimulate local self-governments to **carry out related construction works** necessary to comply with state building regulations. This includes ensuring fire safety, lightning protection, and accessibility for people with limited mobility during the thermal

modernisation of communally owned and apartment buildings. The task also involves stimulating local authorities to support the execution of construction work needed to address defects in load-bearing and/or enclosing structures that prevent the thermal modernisation of multi-apartment buildings.

To promote **sanitary and epidemic safety of the population** in buildings (Task 6), it is planned to encourage citizens to install mechanical ventilation systems with heat recovery in both multi-apartment and individual residential buildings. Additionally, local authorities will be encouraged to install such systems in public buildings that are communally owned.

Tasks 7 and 8 are aimed at **stimulating business**. They involve providing partial state guarantees and reimbursing part of the interest on loans taken out by micro and small businesses engaged in or planning to engage in the thermal modernisation of buildings. This support is intended to finance the thermal modernisation of buildings and to promote the development of energy-efficient equipment and energy-saving construction products within Ukraine. Additionally, to encourage the growth of the energy service sector, it is planned to reimburse part of the interest on loans taken out by energy service providers for implementing comprehensive thermal modernisation in state and communal buildings, as well as introducing factoring for energy service contracts.

To **increase public awareness** of the possibilities of thermal modernisation of buildings (Task 9), it is envisaged to inform the population and popularize the advantages of thermal modernisation of buildings, programs of state support for thermal modernisation of buildings in the mass media, stimulation of local governments to form information and consultation centers on issues of technical, financial and organizational support for the implementation thermal modernisation of buildings, formation of associations of co-owners of multi-apartment buildings, implementation of educational activities aimed at citizens of various ages and target groups, with the aim of fostering a conscious attitude and motivation to increase energy and resource efficiency, developing energy-saving habits.

Within the scope of Task 10 of the Ministry of Infrastructure, it provides for **the stimulation of local authorities** to carry out the certification of the energy efficiency of communally owned buildings, the implementation of complex thermal modernisation of such buildings and the provision of support for the construction (including the reconstruction of public communally owned buildings damaged as a result of military actions) in compliance with the requirements for nearly-zero energy buildings.

Another direction of the Concept is **ensuring the development of competences and qualifications** in the field of increasing the energy efficiency of buildings. Within the framework of this Task 11, provision of vocational education institutions with a modern material and technical base is envisaged; development and implementation of modern programs of training, retraining, advanced training in the field of increasing the energy efficiency of buildings, design, energy management; implementation of competence development programs/trainings for employees of state authorities and local governments.

Task 12 of the Concept is important - **support of scientific, technical and innovative development** in the field of increasing the energy efficiency of buildings. It is planned to ensure the conduct of research and scientific and technical developments to determine and review the requirements for nearly-zero energy buildings; stimulation of subjects of scientific and technical and innovative activities for research and participation in international scientific and technical cooperation programs in the field of increasing the energy efficiency of buildings.

According to the calculations of the Ministry of Infrastructure, **the total approximate size of the need for financial resources** for the implementation of the Program is from UAH 172.91 billion to UAH 934.25 billion for the entire period of validity (until 2030), the majority of which is planned to be covered from extrabudgetary sources (including h. funds from foreign financial institutions, international financial organizations and technical support programs, etc.).

D.6. Policies and measures in the agriculture sector

D.6.1. Promoting the development of organic crop production

Objective: stimulating the increase of areas under organic crop production and increasing the export of organic products (area of agricultural land (thousand hectares); share of agricultural land under organic production in the total area of agricultural land, % ; export (billion USD).

Legal basis: Law of Ukraine "On Basic Principles and Requirements for Organic Production, Circulation and Labeling of Organic Products" No. 2496-VIII of July 10, 2018, National Economic Strategy of Ukraine for the period until 2030, draft Strategy for the Development of Agriculture and Rural Territories in Ukraine for the period until 2030

Time frame: from 2018

Responsible bodies/organizations: Ministry of Agrarian Policy

Description: The development of organic agriculture is one of the priority directions of the medium-term "green transformation" of agriculture. Organic production can play an important role in adapting to and mitigating climate change, as well as in preserving biodiversity. NES has set goals for increasing the area of land with organic status to at least 3% of the total area of agricultural land by 2030 and increasing the export of organic products to USD 1 billion by 2030.

In recent years, Ukraine has been among the top 5 exporters of organic products to the EU. In particular, in 2022, 2.73 million tons of organic agricultural products were imported into the EU, more than 8% of which was accounted for by Ukraine. Ukraine, as a candidate for the EU membership, can strengthen the EU organic market and reduce its dependence on the import of organic products from countries outside Europe. The legislation of Ukraine in the field of organic production, circulation and labeling of organic products is harmonized with Council Regulation (EC) No. 834/2007. The draft Strategy for the Development of Agriculture and Rural Areas in Ukraine for the period until 2030 provides for its further adaptation to the new Regulation of the European Parliament and the Council (EU) No. 2018/848 of May 30, 2018 on organic production and labeling of organic products, which entered into force in January 2022.

In addition, the NES envisages the development of financial and advisory support programs for producers of organic products and the involvement of a larger number of producers in conducting organic production by improving state regulation in this area.

D.6.2. Disseminating the use of information and electronic communication technologies in crop production

Objective: increasing productivity and reducing the impact on the environment by improving the technology of the agricultural sector

Legal basis: National Economic Strategy of Ukraine for the period until 2030

Time frame: from 2018

Responsible bodies/organizations: Ministry of Agrarian Policy

Description: The development of information and electronic communication technologies makes possible their effective use in crop production for the purpose of multilateral monitoring of agricultural lands and effective planning and implementation of technologies for growing field crops. The timely implementation of appropriate measures (foliage fertilization, irrigation, application of pesticides, soil cultivation, phytosanitary monitoring, etc.) in the appropriate amount will contribute to the optimization of the technology of growing agricultural crops and will have an additional positive effect - the reduction of GHG emissions.

The national economic strategy provides for an increase in the technological level of the agricultural sector and for monitoring the quality of land resources, which includes the implementation of the following tasks by 2030:

- development of a program and tools for the introduction of technologies in the agro-industrial sector with the help of state support with an emphasis on the domestic producer;
- development of software for cooperatives (interaction between participants, standardization of processes, accounting and planning, training, use of knowledge bases);
- establishment of a network of weather stations with dense coverage and data accuracy acceptable for modeling due to the inclusion of existing private sector weather stations;
- creating development programs and attracting companies to open research centers;
- systematic monitoring of soil fertility indicators and their quality, introduction of satellite monitoring;
- ensuring the adjustment of crop cultivation technologies taking into account the results of navigation with the global positioning system and agricultural machinery.

D.7. Policies and measures in the waste sector

D.7.1. Disseminating the practice of household waste components reuse

Objective: increasing the amount of household waste prepared for reuse and recycling (1000s tons/year)

Legal basis: Law of Ukraine "On Waste Management" of June 20, 2022 No. 2320-IX[44], draft National Waste Management Plan of Ukraine until 2033[45]

Time frames: 2024-2033

Responsible bodies/organizations: Ministry of Environment, Ministry of Infrastructure, local self-government bodies

Description: The Law of Ukraine "On Waste Management" (Article 37) establishes the following targets for preparation for reuse and recycling of household waste:

- by 2025 - at least 10% of their mass;
- by 2030 - at least 20% of their mass;
- by 2035 - at least 25% of their mass;
- by 2040 - at least 35% of their mass.

At the same time, the draft Law of Ukraine "On Packaging and Packaging Waste" (reg. No. 10066 of September 18, 2023), submitted by the Cabinet of Ministers of Ukraine, provides, among other things, the postponement of the introduction of the indicator of preparation for reuse and recycling of household waste after its termination or cancellation of martial law.

According to the action plan of the draft National Waste Management Plan (NWMP) of Ukraine, in 2024, the Ministry of Infrastructure plans to develop a methodology for calculating target indicators for preparation for reuse and recycling of household waste, as well as the procedure and form of reporting on their implementation. The Ministry of Environment is responsible for the development of the draft act of the Cabinet of Ministers of Ukraine "On approval of Recommendations on reuse and charitable donation of products" in 2026.

The action plan of the draft NWMP also plans to create an appropriate infrastructure for the collection, storage, preparation for reuse, recycling, and other recovery of packaging waste during 2024–2030. Further, during 2024–2033, it is planned to create centers/mobile points for the separate collection and preparation for reuse of household waste for which the extended producer responsibility system has not been established.

In addition, the action plan of the draft NWMP envisions, during 2024–2028, the introduction of tools to stimulate and encourage manufacturers to ensure the availability of spare parts, operating

[44] https://zakon.rada.gov.ua/laws/show/2320-20#Text
[45] https://mepr.gov.ua/wp-content/uploads/2023/12/proyekt-Natsionalnyj-plan-upravlinnya-vidhodamy-23.11-002.docx

instructions, technical information or other tools, equipment or software that allow for repairs and ensure the reuse of products without reducing the level of its quality and safety of functioning when products are sold on the territory of Ukraine.

D.7.2. Disseminating the practice of household waste recycling

Objective: increase in the volume of household waste for which recycling operations have been carried out (thousand tons/year).

Legal basis: Law of Ukraine "On Waste Management" of June 20, 2022 No. 2320-IX, draft of the National Waste Management Plan of Ukraine until 2033

Time frames: 2024-2033

Responsible bodies/organizations: Ministry of Environment, Ministry of Infrastructure, local self-government bodies

Description: According to the Law of Ukraine "On Waste Management", "recycling is a recovery operation, as a result of which waste is processed into products, materials or substances for their use for a primary or other purpose. This operation includes the processing of organic material, but does not include the production of energy or the conversion of waste into materials that can be used as fuel or as backfill materials.'

Today, there are 94 waste recycling enterprises in Ukraine: 17 waste paper recycling enterprises, 39 polymer recycling enterprises, 19 plastic bottle recycling enterprises, and 19 broken glass recycling enterprises. However, their capacities are used by 50–70% due to the shortage of secondary raw materials on the domestic market, which is covered by imports. The secondary raw materials obtained are of rather low quality due to irresponsible waste management, primarily packaging. Legislation should establish mechanisms for financing the recycling sector, which will facilitate the establishment of sorting and recovery facilities that will provide the market with a sufficient amount of quality raw materials.

The Verkhovna Rada has registered a draft governmental law "On packaging and packaging waste" (reg. No. 10066 of 18.09.2023), which provides that the following year after the implementation of this law, the general rate of packaging recycling will be 30%, with the determination of the percentage of recycling separately for each type of waste (paper/cardboard, glass, plastics, ferrous metals, aluminum, wood) with subsequent increases each year.

According to the draft NWMP, in 2024, the Ministry of Infrastructure plans to develop a methodology for calculating target indicators for preparation for reuse and recycling of household waste, as well as the procedure and form of reporting on their implementation.

In addition, the action plan of the draft NWMP plans to create an infrastructure for the collection, storage, preparation for reuse, recycling, and other recovery of packaging waste during 2024–2033.

D.7.3. Disseminating the practice of household waste organic components composting

Objective: increasing the amount of household waste that has undergone biological treatment using anaerobic fermentation and composting methods (thousand tons/year)

Legal basis: Law of Ukraine "On Waste Management" of June 20, 2022 No. 2320-IX, draft of the National Waste Management Plan of Ukraine until 2033

Time frames: 2024-2033

Responsible bodies/organizations: local self-government bodies, Ministry of Infrastructure, Ministry of Environment

Description: The average annual volume of biowaste makes up about half of the total volume of generated household waste in Ukraine, which, in turn, differs significantly by region and type of settlement. Biodegradable waste is currently not collected separately.

The draft NWMP proposes the construction of facilities for composting waste in territorial communities (or their associations as a result of the signing of cooperation agreements) with a population of 100,000 or more inhabitants with an average optimal capacity of 5,000 tons of finished compost per year as part of complexes of mechanical and biological processing or regional centers for separate collection of waste. Such an approach will significantly shorten the process of their design and construction, as the need for land allocation procedures and the development and approval of project documentation will disappear, as well as logistical and operating costs will be significantly reduced. There is a positive experience of such a project in the city of Lviv. The implementation of composting and the choice of technology are determined by regional and local waste management plans. In territorial communities with a population of up to 100,000 people, it is advisable to carry out composting at specialized composting sites, and in small territorial communities - composting at waste disposal sites in curbs or "sleeves". Bio-waste composting can be carried out in rural areas and suburban areas of cities in homesteads, summer cottages and garden plots. Composting operations can be used by waste reception/collection centers to process separately collected waste from green spaces (waste from households, parks, gardens, other landscaping objects). Composting of the above-mentioned waste can be done outdoors.

The action plan of the draft NWMP envisions during 2024–2033 the construction of composting facilities for household waste and waste from green plantings from landscaping facilities, as well as promoting the introduction of waste composting in homesteads, summer cottages, and garden plots. In addition, it is envisaged to install sorting lines at landfills for non-hazardous waste, to separate biodegradable waste, and to create composting sites in order to reduce the landfilling of biodegradable waste: by 2028 - at landfills that accept 100 tons of waste per day; by 2030 - at landfills that receive more than 100 tons of waste per day.

D.7.4. Disseminating the practice of thermal treatment of household waste (with obtaining useful energy)

Objective: to increase the volume of household waste, in respect of which recovery operations have been carried out (incineration with obtaining energy), as well as waste, in respect of which operations of treatment by other thermal methods (pyrolysis, gasification, plasma process) have been carried out (thousand tons/year).

Legal basis: Law of Ukraine "On Waste Management" of June 20, 2022 No. 2320-IX, draft of the National Waste Management Plan of Ukraine until 2033

Time frames: 2024-2033

Responsible bodies/organizations: Ministry of Environment, Ministry of Infrastructure, local self-government bodies

Description: According to the Law of Ukraine "On Waste Management", thermal treatment of waste is a technological process of thermal treatment of waste that meets the rules of technical operation of the relevant installation. By Order of the Cabinet of Ministers of Ukraine No. 229 of March 1, 2024, the technical requirements for the operation of waste incineration plants and waste co-incineration plants were approved (Official Gazette of Ukraine, 2024 p., No. 25, Article 1613), which will enter into force on September 5 2024.

There is only one waste incineration plant operating in Ukraine - with a capacity of about 250,000 tons per year in the city of Kyiv, which produces useful thermal energy for the communal and household needs of the nearby housing stock, and provides processing of about 2% of the total volume of waste generated in the country. Currently, household waste is not used as an alternative type of fuel in industry.

The action plan of the draft NWMP envisages the development and approval of recommendations for the use of fuel derived from waste (RDF) until 2026. In addition, during 2025–2033, it is planned to build household waste treatment facilities, including heat treatment, within the budget funding provided for local executive bodies and local self-government bodies, at the expense of the funds of the

environmental protection fund, the involvement of "green" bonds, funds of international technical assistance and other sources not prohibited by law.

D.7.5. Increasing the amount of disposal (recovery and flaring) of biogas at landfills

Objective: increasing the share of disposal (recovery and flaring) of biogas at landfills (% of the total volume of methane generated).

Legal basis: Law of Ukraine "On Waste Management" of June 20, 2022 No. 2320-IX, draft of the National Waste Management Plan of Ukraine until 2033

Time frames: 2024-2033

Responsible bodies/organizations: Ministry of Environment, Ministry of Infrastructure, local self-government bodies

Description: The landfill methane flaring technology became widespread in Ukraine in 2005-2010 as part of the financial incentives of the Kyoto Protocol. Over the next 10 years, this technology was completely replaced by electrical energy production facilities, the financial incentive for which was the "green tariff". Nevertheless, flaring is a cheaper technology, so its use is appropriate under conditions of low biogas throughput and a significant increase in operating costs associated with emissions of pollutants and especially the greenhouse gas methane.

According to the draft NWMP, the closure and reclamation of old landfills and those that do not meet the requirements will be carried out in parallel with the construction of new regional landfills. The Law of Ukraine "On Waste Management" from 2030 prohibits the operation of landfills that are not equipped with biogas and leachate extraction and disposal systems (Clause 5 of the Final and Transitional Provisions), systems for monitoring emissions into the atmosphere and monitoring soil and groundwater pollution, therefore by this time, measures in regional and local plans for closing, reclamation and construction of landfills should be foreseen and implemented. If it is not possible to implement these measures by 2030, the ban does not apply if the plan to bring the waste disposal site into compliance with legal requirements is implemented.

Thus, the action plan of the draft NWMP foresees the construction of regional landfills for non-hazardous waste during 2024–2033 with the possibility of creating separate maps of landfills for the removal of inert or hazardous waste or other waste treatment facilities, and during 2028–2033 the phase-out of the operation of household waste disposal sites (landfills) that do not meet the requirements of the law is planned (after the construction of new landfills), in particular, those landfills that, as of January 1, 2030, will not be equipped with biogas extraction and disposal systems in accordance with paragraph 5 of the Final Regulations and transitional provisions of the Law of Ukraine "On Waste Management".

D.8. Policies and measures in the LULUCF sector

D.8.1. Demining and reforestation after hostilities

Objective: establishment of effective forest management in the territories that were negatively affected by the armed aggression of the Russian Federation against Ukraine for their demining and restoration (thousands of hectares of demined and restored forests)

Legal basis: Forest Code of Ukraine, Decree of the Cabinet of Ministers of Ukraine of December 29, 2021 No. 1777-r "On the Approval of the State Forest Management Strategy of Ukraine until 2035" (Official Gazette of Ukraine, 2022, No. 4, Article 265)

Time frames: from 2024

Responsible bodies/organizations: Ministry of Environment, State Forestry Agency, State Agency of Ukraine for Exclusion Zone Management, State Emergency Service, Ministry of Defense, regional and Kyiv city state (military) administrations

Description: According to the Forest Management Strategy of Ukraine until 2035, approved by the Decree of the Cabinet of Ministers of Ukraine of December 29, 2021 No. 1777-r (Official Gazette of Ukraine, 2022, No. 4, Article 265), as a result of the armed aggression of the Russian Federation against Ukraine from February 20, 2014, hostilities continue on an area of about 2,731 thousand hectares of forests. Heavy military equipment is being moved in the forests, military operations have been or are being conducted, which can lead to both contamination with explosive objects and disruption of terrestrial ecosystems, soils, water bodies and water management systems. According to the estimates of the Ministry of Environment, it is necessary to demine at least half a million hectares of forests in the territories under the control of Ukraine and another 0.8 million hectares in the temporarily occupied territory.

The strategy of forest management of Ukraine until 2035 provides for the establishment of effective management of forests in the exclusion zone and in the territories that have been negatively affected by the armed aggression of the Russian Federation against Ukraine.

The operational plan for the implementation of the Strategy in 2024 provides for the approval of action plans (projects) aimed at the rehabilitation of forests and the restoration of forest natural complexes damaged as a result of hostilities, as well as the survey of forests contaminated by explosive objects in the de-occupied territories. And after the end of hostilities, it is planned to carry out work on the detection, extraction and disposal of explosive objects (demining, in particular humanitarian) in forest areas in the de-occupied territories.

D.8.2. Nationwide targeted program of land use and protection

Objective: the implementation of the state policy of Ukraine to ensure the sustainable development of land use, ensuring ecologically safe conditions for the population to live and conduct economic activities, the protection of land from depletion, degradation and pollution, the reproduction and increase of soil fertility, the preservation of the functions of the soil cover, the preservation of landscape and biological diversity in the conditions of the market environment and taking into account global climate change.

Legal basis: Law of Ukraine "On Land Protection" No. 962-IV of June 19, 2003, Order of the Cabinet of Ministers of Ukraine No. 70-r of January 19, 2022 "On Approval of the Concept of the Nationwide Target Program for Land Use and Protection" (Official Gazette of Ukraine, 2022, No. 11, Article 588)

Time frame: approval of the program is expected approximately six months after the end of martial law

Responsible bodies/organizations: Ministry of Agrarian Policy

Description: The concept of the State-wide targeted program of land use and protection (hereinafter - the Program) approved by the Order of the Cabinet of Ministers of Ukraine of January 19, 2022 No. 70-r (Official Gazette of Ukraine, 2022, No. 11, Article 588) defines that the main result of the implementation of the Program is the preservation and reproduction of the productive potential of land as the main means of production in agriculture and forestry in the conditions of global climate change, the land market and decentralization of power.

At the first stage of the implementation of the Program, it is envisaged to improve the legislative, scientific, informational, organizational support for the rational use of land resources and their protection at the national level, the creation of a normative-legal and normative-technical base, including norms and rules in the field of land management, for the implementation of the Program as a whole, as well as the development of land management schemes and technical and economic justifications for the use and protection of lands of administrative-territorial units, territories of territorial communities;

comprehensive plans for the spatial development of the territory of territorial communities; development of criteria for monitoring; principles of monitoring based on automated information and analytical systems and remote sensing of the Earth. It is also assumed the implementation of urgent and effective measures regarding the use and protection of land, which will ensure the achievement of a positive economic, social and ecological effect, and the cessation of soil degradation.

At the second stage, it is planned to implement measures provided for by land management schemes and technical and economic justifications for the use and protection of lands of administrative-territorial units, territories of territorial communities; comprehensive plans for the spatial development of the territory of territorial communities; development and implementation of algorithms and technologies for the automated collection, processing, supply and publication of land-spatial information within the framework of the geo-informational automated platform of the national level.

It is assumed that the implementation of the measures defined by the Program will ensure the achievement of such results as:

- decrease area of land used for agricultural purposes (by 5 percent) and plowed territory (by 10 percent);
- optimization of the structure of the agricultural landscape, land plots;
- increasing the productivity of agricultural land (by 40-50 percent) through the rational use of organic, organo-mineral and mineral fertilizers and chemical meliorants on acidic and saline soils;
- increasing the area of land with natural landscapes to a level sufficient to preserve landscape and biological diversity (up to 10.5 percent of the total area of the country);
- establishment of a unified and complete system of forest improvement measures, preservation of protective forest stands, taking measures to restore them;
- conservation of degraded, unproductive and technologically polluted lands;
- conservation of natural wetlands;
- implementation of ecological and socio-economic rehabilitation of lands contaminated with radionuclides;
- reducing the threat to land resources from degradation processes and promoting the achievement of a neutral level of land degradation;
- establishment and regulation of water protection zones and coastal protective strips of water bodies, introduction of a special regime of land use in the areas where rivers flow;
- preservation of natural landscapes on the lands of industry, transport, communications, defense, etc.;
- development of ecological-economic, soil-erosion and other types of land zoning of Ukraine, which generalize the idea of the land fund of the country and are the basis of the information base and justification of the system of environmental protection measures;
- improvement of natural and agricultural zoning of Ukrainian lands taking into account global climate change;
- introduction of a complete system of normative legal acts and normative technical documents in the field of land use, accounting and protection;
- substantiating directions of fundamental and applied scientific research in the field of land use and protection;
- introduction of the land use regime in protective and security zones;
- introduction of periodic soil survey; improvement of soil monitoring on lands of all categories and forms of ownership;

- improvement of state administration in the field of land use and protection;
- development of a model of sustainable land use for natural and agricultural regions of Ukraine and ensuring the sustainable development of land use as a whole;
- development of scientific and methodical principles of land monitoring based on remote sensing of the Earth, geo-information technologies;
- provision of information exchange by unique identifiers of objects of information systems.

The development and submission to the Verkhovna Rada of Ukraine of the draft Law of Ukraine on the approval of the Nationwide target program of land use and protection is provided for by the Order of the Cabinet of Ministers of Ukraine of January 19, 2022 No. 70-r "On the approval of the Concept of the State-wide target program of land use and protection" and was planned for 2022. However, due to the full-scale invasion of the Russian Federation, the development of the program was postponed due to the impossibility of assessing the condition of the lands in the temporarily occupied territories.

D.9. Expected and achieved GHG emission reductions

Since the expected reduction of GHG emissions from the individual measures described above was not assessed during their development and implementation, the expected integrated impact of policies and measures on the reduction of GHG emissions for the purpose of this BTR was calculated as a difference between updated WEM and WAM projection scenario originally presented in the National Energy and Climate Plan 2024. The expected impact by sector and by period is summarized in Table II.10 below.

Table II.10. Expected GHG emission reductions of policies and measures in mt CO2-eq.

Sector	2025	2030
1. Energy + 2. Industrial processes and product use	**16.2**	**64.6**
Electricity and heat production	2.5	22.5
Other energy industries	3.7	14.2
Manufacturing industries and construction	9.0	20.3
Transport	0.8	7.0
Commercial and Residential	0.1	0.6
Agriculture	0.02	0.06
3. Agriculture	**0.2**	**1.2**
4. Land use, land-use change and forestry	**2.9**	**5.1**
5. Waste	**0.5**	**1.6**
TOTAL (including LULUCF)	**19.8**	**72.5**

For the moment, it is impossible to separate the impacts of individual measures that focus on the same (sub)sectoral activity. However, during the processes of updating the NCEP and preparation of the second BTR, additional analysis will be conducted to identify and assess the potential for GHG emission reductions under individual policies (policy groups) and analyze their economic and social impacts.

E. SUMMARY OF GREENHOUSE GAS EMISSIONS AND REMOVALS

As a result of the occupation and attempted annexation of Crimea and armed invasion by the Russian Federation in 2014-2021, many industrial enterprises were destroyed or damaged, resulting in a significant drop in economic activity and a reduction in GHG emissions. In 2022-2023 energy industry facilities were heavily attacked by Russian Federation. That caused even stronger decline in GHG emissions in all sectors, but the least in the Waste sector. In 2022, total GHG emissions (including LULUCF) decreased by 31.9% compared to 2021, and GDP by 29.1%.

Total GHG emissions (including LULUCF) in 2021 amounted to 328.1 MtCO2e or -64.2% of the 1990 level, in 2022 - 223.5 MtCO2e or -75.6% of the 1990 level, in 2023 - 221.7 MtCO2e or -75.8% of

the 1990 level. The largest GHG emissions in Ukraine take place in the Energy sector. In 2023, the share of this sector accounted for around 70.4 % without the LULUCF sector, while IPPU – 9.1%, Agriculture – 14.2% and Waste sector – 6.4%. The LULUCF sector includes both emissions and removals of carbon dioxide, as well as emissions of CH4, and N2O. The LULUCF sector in 2023 is a net sink. Net CO2 removals in the sector in 2023 is equal to 11.2 Mt CO2-eq. and in the base 1990 year – 47.9 Mt CO2-eq.

As a result of many national circumstances, total GHG emissions (including LULUCF) in Ukraine decreased by 75.8% during period 1990-2023, from 916.5 Mt CO2-eq. in 1990 to 221.7 Mt CO2-eq. in 2023.

Table II.11. Trends in aggregate direct action GHG emissions by sector, Mt CO2-eq.

Sector	1990	1995	2000	2005	2010	2015	2020	2021	2022	2023	Current year com-pared to base year, %
Energy	740.1	442.5	321.7	323.8	293.5	215.4	213.6	215.4	170.4	164.0	-77.8
IPPU	117.7	57.9	67.2	80.9	75.7	57.1	57.5	60.3	21.6	21.1	-82.1
Agriculture	89.6	62.6	36.8	32.7	31.5	36.2	37.7	41.7	32.5	33.0	-63.2
LULUCF (removals)	-47.9	-46.0	-33.4	-18.2	-21.0	4.1	-15.5	-5.4	-15.7	-11.2	-76.7
Waste	16.9	16.3	15.9	16.5	16.5	16.1	16.4	16.1	14.8	14.8	-12.5
Total (including LULUCF)	916.5	533.4	408.3	435.7	396.2	328.9	309.7	328.1	223.5	221.7	-75.8
Total (excluding LULUCF)	964.4	579.4	441.7	453.9	417.2	324.8	325.2	333.5	239.2	232.9	-75.9

Source: Ukraine's greenhouse gas inventory 1990-2023. Available from: https://unfccc.int/documents/646259

The largest share of GHG emissions in the base year is carbon dioxide – 71.8 % with LULUCF. Methane emissions in 1990 were 22.8 %, and those of nitrous oxide – 5.3 %. In 2023 carbon dioxide remained the largest emitted gas – 57.7 % of all GHG emissions, with 28.3 % and 12.8 % of methane and nitrous oxide respectively.

Table II.12. GHG emissions, Mt CO2-eq.

Gas	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020	2021	2022	2023	Current year compa-red to base year, %
CO_2 (excluding LULUCF)	706.5	390.2	285.7	313.5	294.4	223.8	234.1	223.3	231.9	222.2	207.1	210.6	143.0	139.3	-80.3
CH_4	209.3	159.5	135.6	117.8	97.7	71.6	77.0	74.5	78.7	81.6	83.6	83.0	66.9	62.8	-70.0
N_2O	48.5	29.9	20.6	22.4	24.6	28.6	31.3	30.1	33.0	34.8	33.1	37.7	27.0	28.5	-41.4
HFCs*	NO	NO	14.4	271.9	715.3	826.3	943.7	1076.5	1483.2	1849.2	2000.4	2245.1	2329.8	2423.1	100
PFCs*,**	212.0	160.1	104.0	128.0	24.0	NO	NO	NO	NO	NO	NO	NO	NO	NO	-100
SF_6*	0.0	0.1	0.4	4.6	10.0	20.2	25.1	29.4	34.5	40.0	44.6	50.3	54.2	57.2	727229.5
NF_3*	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	-
Net CO_2 from LULUCF	-48.1	-46.3	-33.6	-18.5	-21.2	3.9	5.9	-2.7	6.9	4.9	-16.1	-5.6	-15.9	-11.3	-76.4
CO_2 (including LULUCF)	658.4	343.9	252.0	295.0	273.2	227.8	240.0	220.6	238.8	227.1	191.0	205.0	127.2	128.0	-80.6
Total (excluding LULUCF)	964.4	579.4	441.7	453.9	417.2	324.8	343.3	328.8	345.0	340.3	325.2	333.5	239.2	232.9	-75.9
Total (including LULUCF)	916.5	533.4	408.3	435.7	396.2	328.9	349.3	326.3	352.1	345.4	309.7	328.1	223.5	221.7	-75.8
Total (excluding LULUCF), including indirect CO_2	964.4	579.4	441.7	453.9	417.2	324.8	343.3	328.8	345.0	340.3	325.2	333.5	239.2	232.9	-75.9
Total (including LULUCF), including indirect CO_2	916.5	533.4	408.3	435.7	396.2	328.9	349.3	326.3	352.1	345.4	309.7	328.1	223.5	221.7	-75.8

* emissions quoted in kt CO2-eq.; ** there are no PFC emissions, as cooling agents containing the gas were not imported in 2011-2023
Source: Ukraine's greenhouse gas inventory 1990-2023. Available from: https://unfccc.int/documents/646259

One of the main obstacles on the way to achieving GHG emissions reduction is the armed aggression of the Russian Federation and temporary occupation of the Autonomous Republic of Crimea, the city of Sevastopol as well as certain areas of Donetsk, Luhansk, Kherson and Zaporizhzhia regions, which requires significant political, financial and human resources for protection of the territorial integrity and sovereignty of Ukraine.

The ongoing military aggression of the Russian Federation against Ukraine has a strong negative impact on the overall economic situation in Ukraine and has led to a reduction in industrial production.

In spite of the national circumstances, Ukraine aims to continue reducing GHG emissions, energy intensity of GDP and achieving the Sustainable Development Goals.

F. PROJECTIONS OF GREENHOUSE GAS EMISSIONS AND REMOVALS

In this chapter the projections of greenhouse gas emissions and removals for all economic sectors, except the land use, land use change and forestry (LULUCF) are presented. The forecast numbers are based on the submitted National energy and climate plan for which they were produced using methods and models described in the next section. The Russia's full-scale military invasion of Ukraine made it impossible to analyse the situation in the LULUCF sector due to lack of reliable data, hence the development of a reasonable forecast on GHG emissions in this sector has not been conducted. The projections in other sectors are also impacted by the scarcity of data and are subject to uncertainty due to the war and martial law-related issues. The 2021 data is based on the National Inventory of Anthropogenic Emissions from Sources and Absorption by Sinks of Greenhouse Gases in Ukraine for 1990-2021.

The Table II.13 and the corresponding Figure II.7 are shows the modelling and forecasting results obtained using Times-Ukraine and other modelling tools for GHG emissions in Ukraine by sectors in scenario With Existing Policies and Measures (WEM) and with Additional Policies and Measures (WAM).

Table II.13. The main results of modelling in the field of GHG emissions in Ukraine according to 'with existing measures' and 'with additional measures' (WAM) scenario

	2021	2025	2030	2035	2040	2045	2050
Scenario With Existing Policies and Measures (WEM)							
The total amount of GHG emissions, excluding LULUCF, *million tons of CO_2-eq.*	**327.3**	**236.3**	**252.5**	**271.3**	**285.7**	**293.7**	**301.6**
Sectors of energy, industrial processes and product use	268.1	188	199	214	227	234	241.5
Agriculture	47	37	42	46	48	50	51
Land use, land use change and forestry*	14.2	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Waste sector	12.1	11.3	11.5	11.3	10.7	9.7	8.6
The share of GHG emissions from the level of 1990, excl. LULUCF %	**34.7**	**25.9**	**27.6**	**29.6**	**31.2**	**32.0**	**32.9**
Sectors of energy, industrial processes and product use	31.8	22	24	25	27	28	29
Agriculture	54.1	43	48	52	55	57	58
Land use, land use change and forestry and forestry	221	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Waste sector	97.6	91	86	85	79	72	63
Scenario with Additional Policies and Measures (WAM)							
The total amount of GHG emissions, excluding LULUCF, *million tons of CO_2 -eq.*	**327.3**	**221.0**	**185.6**	**177.5**	**157.7**	**137.9**	**120.1**
Sectors of energy, industrial processes and product use	268.1	173	134	122	101	81	62
Agriculture	47	37	41	46	48	49	51
Land use, land use change and forestry*	14.2	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Waste sector	12.1	11	10,6	9,5	8,7	7,9	7,0
The share of GHG emissions from the level of 1990, excl. LULUCF %	**34.7**	**24.1**	**20.3**	**19.4**	**17.2**	**15.0**	**13.1**
Sectors of energy, industrial processes and product use	31.8	22	19	16	15	12	9
Agriculture	54.1	42	47	52	55	56	58
Land use, land use change and forestry and forestry	221	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Waste sector	97.6	42	47	50	52	54	55

Source: National Inventory of Anthropogenic Emissions from Sources and Absorption by Sinks of Greenhouse Gases in Ukraine for 1990-2021, Institute for Economics and Forecasting of the National Academy of Sciences of Ukraine.

Notes: *Currently, it is impossible to analyze the situation in the LULUCF sector and develop a reasonable forecast of GHG emissions in this sector due to the war and the related lack of reliable data on the LULUCF sector. n.d. - no data.

Total GHG Emissions (Excluding LULUCF) in WEM after a significant drop from 2021 (327.3 Mt CO_2-eq.) to 2025 (236.3 Mt CO_2-eq) due to the Russian invasion, begin to rise again, reaching 301.6 Mt CO_2-eq. by 2050 constituting almost 33% of 1990 level. This suggests that without additional policies, emissions will gradually increase due to economic and industrial activity regain its growth. In WAM, emissions follow a decreasing trend, reaching 120.1 Mt by 2050 or 13.1% of 1990 showing the effectiveness of additional policies implementation.

In Energy, Industrial Processes and Product Use under WEM emissions decrease from 268.1 Mt in 2021 to 188 Mt in 2025, but then gradually increase to 242 Mt by 2050 following the same logic as total emissions. In WAM, emissions decrease continuously, from 268.1 Mt in 2021 to just 62 Mt by 2050, as a result of carbon taxation and other measures.

Agricultural emissions dynamics in both scenarios is almost indistinguishable. After a drop from 47 Mt in 2021 to 37 Mt in 2025 the steady increase is followed, reaching 51 Mt by 2050 in WEM and WAM.

Waste sector emissions show a slow but steady decline from 12.1 Mt in 2021 to 8.6 Mt in 2050. Under WAM emissions decline more sharply, reaching just 7.0 Mt by 2050.

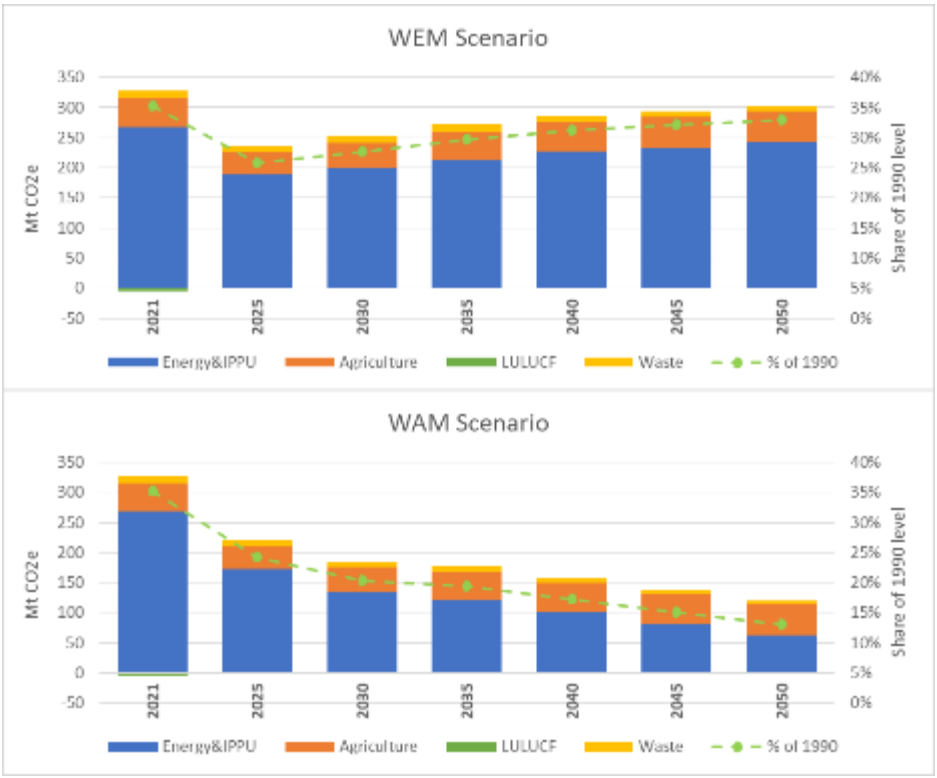


Figure II.7 The main results of modelling in the field of GHG emissions in Ukraine according to WEM and WAM scenarios by sectors, excluding LULUCF projection

F.1. Greenhouse gas emissions in the "Energy" and "Industrial processes and product use" sectors

The Figure II.8 below presents the forecast of greenhouse gas emissions until 2050 in the UN IPCC sectors "Energy" and "Industrial processes and product use" for WEM and WAM scenarios using the TIMES-Ukraine model. Here and forth in this Chapter F.1, numbers for 2020 are not statistical, but the modelling output instead. The modelling results indicate that even with a rapid recovery of Ukraine's economy in the post-war period, it is possible to avoid an increase in greenhouse gas (GHG) emissions in the "Energy" and "Industrial Processes and Product Use" sectors by adhering to the "build back better" approach. This involves implementing energy efficiency measures, expanding the use of renewable energy sources, and undertaking other decarbonization and technological modernization efforts.

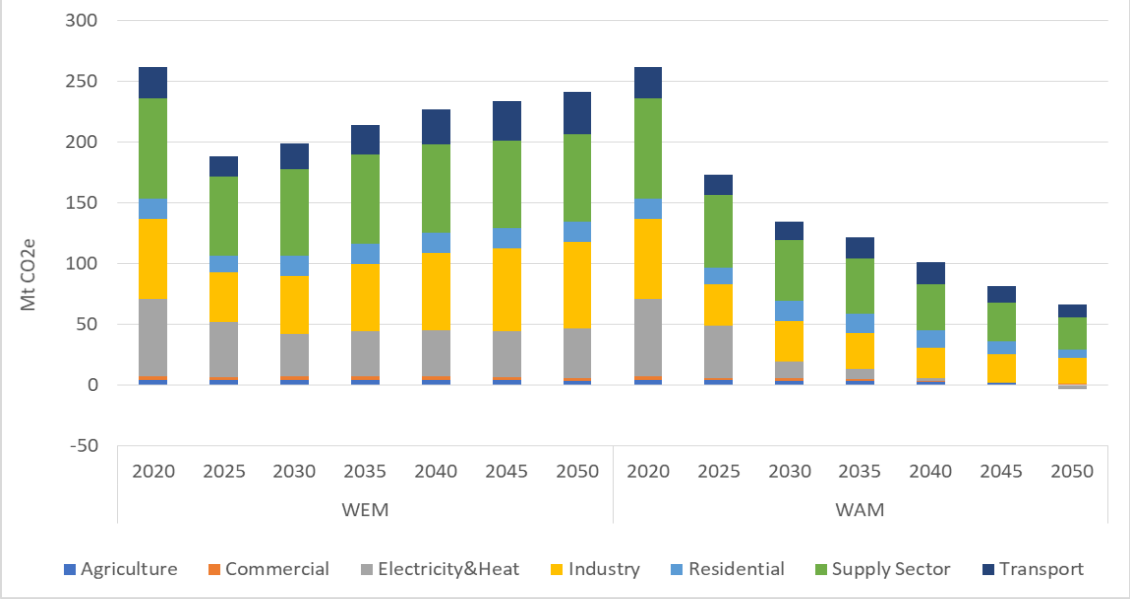


Figure II.8. GHG emissions in the "Energy" and "IPPU" by economic sectors

Under the WEM scenario, GHG emissions in these sectors might decrease by 28% by 2025 compared to 2020 levels due to Russian invasion. However, without additional measures, emissions are projected to rise again following economic growth by 2050, though they would still remain below 2020 levels. Conversely, implementing further planned measures (WAM scenario) could result in a significant reduction in GHG emissions—49% below 2020 levels by 2030 and 76% by 2050.

Furthermore, under the WAM scenario, achieving net-zero GHG emissions in the electricity and heat generation sector before 2050 is feasible, with potential negative CO2 emissions through the integration of bioenergy and carbon capture and storage (CCS) technologies. While Ukraine aims for climate neutrality in the energy sector by 2050, the current policies and measures are insufficient to meet this target. Table II.14. below shows the same projection but in kilotons of CO2-eq.

Table II.14. Greenhouse gas emissions in the "Energy" and "Industrial processes and product use" by economic sectors, kt of CO2-eq

Scenario	Sector	2020	2025	2030	2035	2040	2045	2050
WEM	Agriculture	4148	3868	4145	4066	3904	3649	3401
	Commercial	3099	2056	2957	2921	2782	2248	1719
	Electricity & Heat	63377	45388	35034	36885	37850	37899	41274
	Industry	66174	41077	47541	55595	63662	68221	71577
	Residential	16700	13532	16717	16899	16944	16922	16734
	Supply Sector	82244	65373	71325	73180	73245	72183	71485
	Transport	26061	17033	21100	24232	28194	32377	35299
	Total	261803	188328	198819	213778	226581	233499	241488
WAM	Agriculture	4148	3611	3463	2950	2149	1299	265
	Commercial	3099	2045	2321	1676	827	553	365
	Electricity & Heat	63377	42652	13560	8185	2124	-801	-3840
	Industry	66175	34221	33236	29618	25052	23664	21516
	Residential	16700	14058	16671	15832	14389	10614	7058
	Supply Sector	82244	59785	49544	45988	38527	31323	26035
	Transport	26061	16403	15282	17382	17873	13860	10781
	Total	261803	172773	134077	121631	100942	80513	62180

In the gas type dimension, the modelling results are shown in the Table II.15. and Figure II.9. The WEM display an increasing emission across all gases after a drop between 2020-2025. In the WAM scenario, CO_2 and CH_4 emissions are effectively reduced, showing a clear impact of additional climate policies, including contribution to the Global methane pledge. In turn, N_2O and HFC emissions continue to rise in both scenarios, but the WAM scenario shows a more pronounced rise of HFC gases, reaching 309 kt in 2050 and share of 1.8% compared to 176 kt and 0.47% under WEM due to penetration of heat pumps. This suggests that while mitigation measures reduce CO_2, CH_4, and N_2O, HFCs require additional targeted policies and measures.

Table II.15. GHG emissions in the "Energy" and "IPPU" sectors by gas, kt of CO2-eq

Scenario	Gas	2020	2025	2030	2035	2040	2045	2050
WEM	CO_2	208256	148968	156978	169375	180683	187401	195215
	CH_4	52643	38640	41063	43575	44944	45059	45141
	N_2O	798	617	643	676	791	869	955
	HFC	105	104	135	152	162	170	176
WAM	CO_2	208256	136405	104812	94040	77806	61327	45257
	CH_4	52643	35681	28527	26766	22136	18103	15805
	N_2O	798	580	573	623	767	820	809
	HFC	105	107	164	202	233	264	309

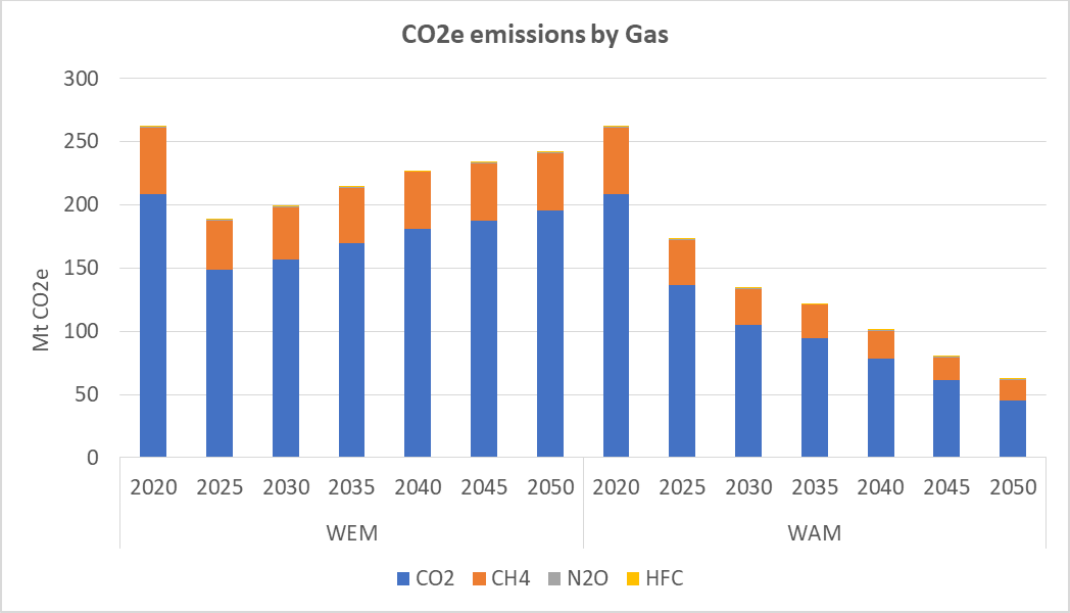


Figure II.9. GHG emissions in the "Energy" and "IPPU" sectors by gas

F.1.1. Industrial emissions

Both the projected volumes and the structure of GHG emissions in industry from fuel combustion and industrial processes differ significantly between WEM and WAM (Figure II.10 and Table II.16). While WEM trajectory does not show the decoupling of the sector output from emissions, WAM presents such possibility if modernization of industry will take place right after 2025.

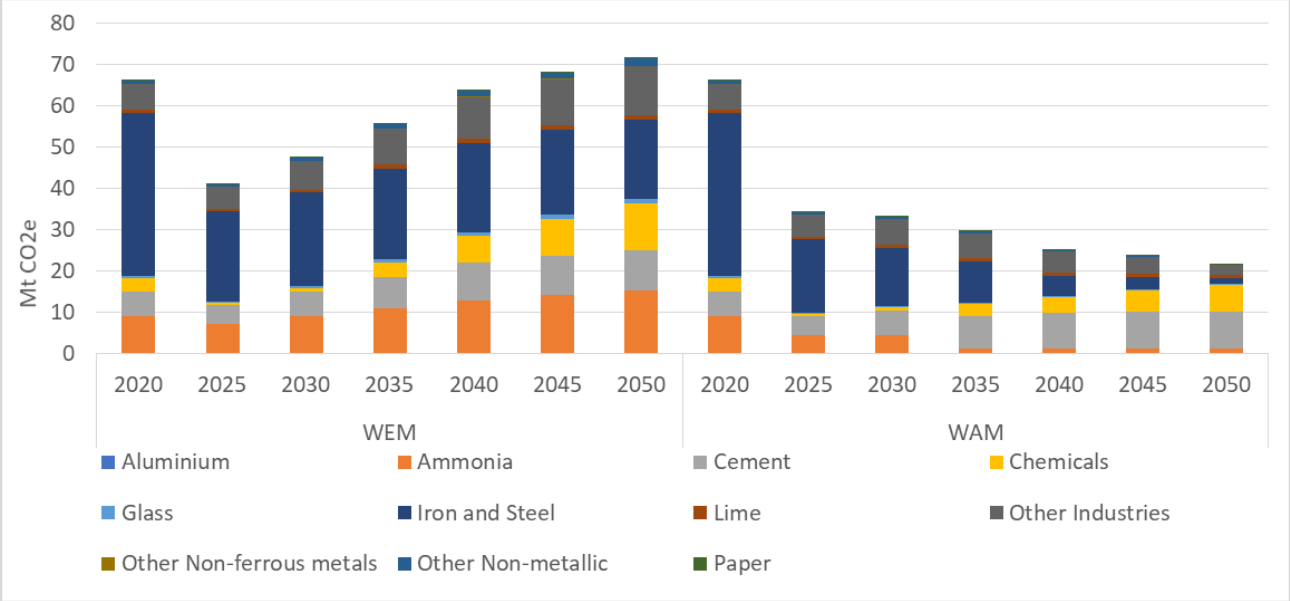


Figure II.10. GHG emissions in the Industry sector by activity

Notably, there is a multiple reduction in emissions from ammonia production under the WAM scenario to 1.1 million tons of CO2, thanks to the implementation of more efficient technological chains and the use of CCS in hydrogen production from natural gas. Use of the electrolytic green hydrogen is not in place.

Table II.16. GHG emissions in the Industry sector by activity, kt of CO2-eq

Scenario	Activity	2020	2025	2030	2035	2040	2045	2050
WEM	Aluminium	210	211	215	218	222	225	229
	Ammonia	8916	6911	8914	10914	12801	14240	15599
	Cement	5920	4563	6011	7701	9183	9494	9516
	Chemicals	3282	585	754	3453	6545	9083	11471
	Glass	503	328	500	701	885	1000	1091
	Iron and Steel	39425	21896	22612	22043	21428	20343	19079
	Lime	866	555	734	919	1071	1144	1198
	Other Industries	6119	5376	6962	8576	10221	11237	11844
	Other Non-ferrous metals	62	25	57	61	62	66	70
	Other Non-metallic	818	574	811	1108	1381	1555	1689
	Paper	52	53	64	102	143	194	222
	Total	**66175**	**41077**	**47669**	**55842**	**63980**	**68614**	**72088**
WAM	Aluminium	210	212	195	171	136	84	32
	Ammonia	8916	4165	4423	1269	1143	1082	1079
	Cement	5920	4563	5973	7598	8667	9012	9064
	Chemicals	3282	585	552	3046	3876	5135	6535
	Glass	503	328	372	369	324	228	203
	Iron and Steel	39425	17801	14021	9885	4680	3066	1387
	Lime	866	555	734	838	880	867	817
	Other Industries	6119	5362	6259	5913	5065	4012	2346
	Other Non-ferrous metals	62	25	52	39	25	13	2
	Other Non-metallic	818	574	656	520	378	229	48
	Paper	52	53	58	66	57	40	5
	CCS				-2	-29	-29	
	Total	**66175**	**30473**	**29330**	**29659**	**25053**	**23510**	**20118**

Emissions in the metallurgy sector also significantly decrease over time due to the shift to electric steel production. However, some sectors, such as the chemical industry (excluding ammonia production), increase emissions over time in all scenarios due to methane and carbon dioxide emissions from technological processes in the growing industry.

The rise in GHG emissions from cement production is also driven by industry growth and is caused by chemical processes, while energy related emissions are eliminated owing to biomass use.

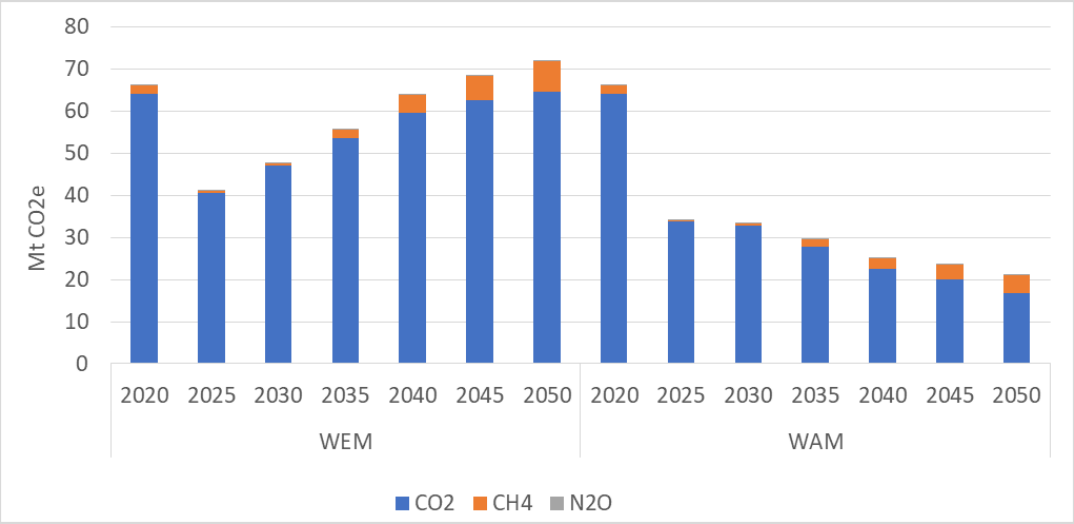


Figure II.11. GHG emissions in the Industry sector by gas

In overall, CO2 emissions from the energy use in industry shrink from 57 Mt to only 1.8 Mt CO2e in 2050 as a result of planned measures implementation. Process emissions of all gases, in turn, doubles by 2050 indicating the need in additional measures to tackle such growth (Figure II.11 and Table II.17).

Table II.17. GHG emissions in the Industry sector by gas, kt of CO2-eq

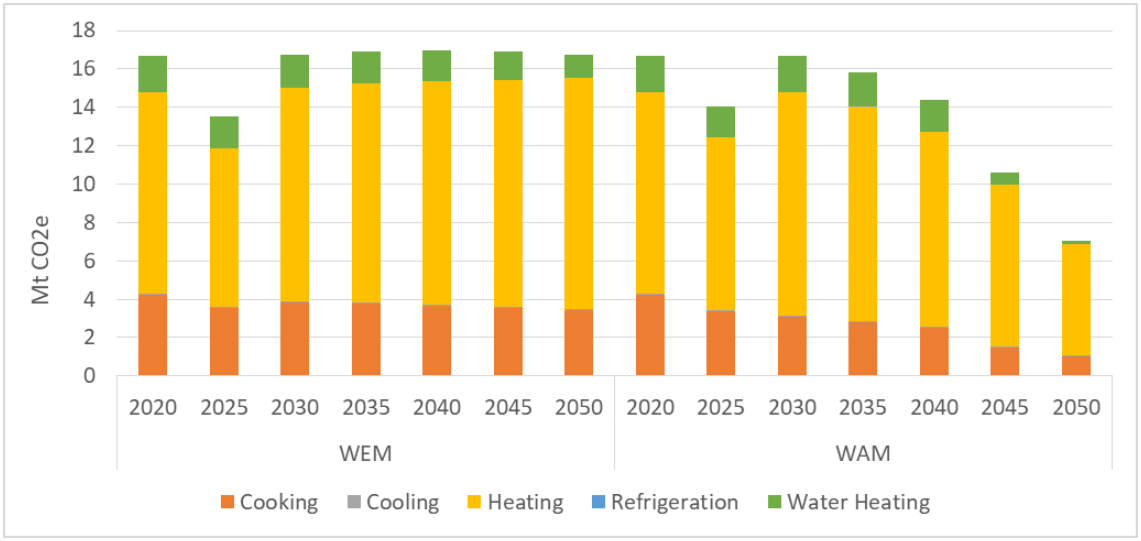
Scenario	Gas	2020	2025	2030	2035	2040	2045	2050
WEM	CO_2	64005	40586	46936	53274	59371	62318	64157
	CH_4	1991	371	471	2167	4115	5715	7222
	N_2O	179	119	135	155	176	189	198
WAM	CO_2	64005	33777	32820	27634	22495	20270	17191
	CH_4	1991	349	317	1890	2461	3297	4216
	N_2O	179	95	99	94	96	98	109

F.1.2. Emissions in Buildings

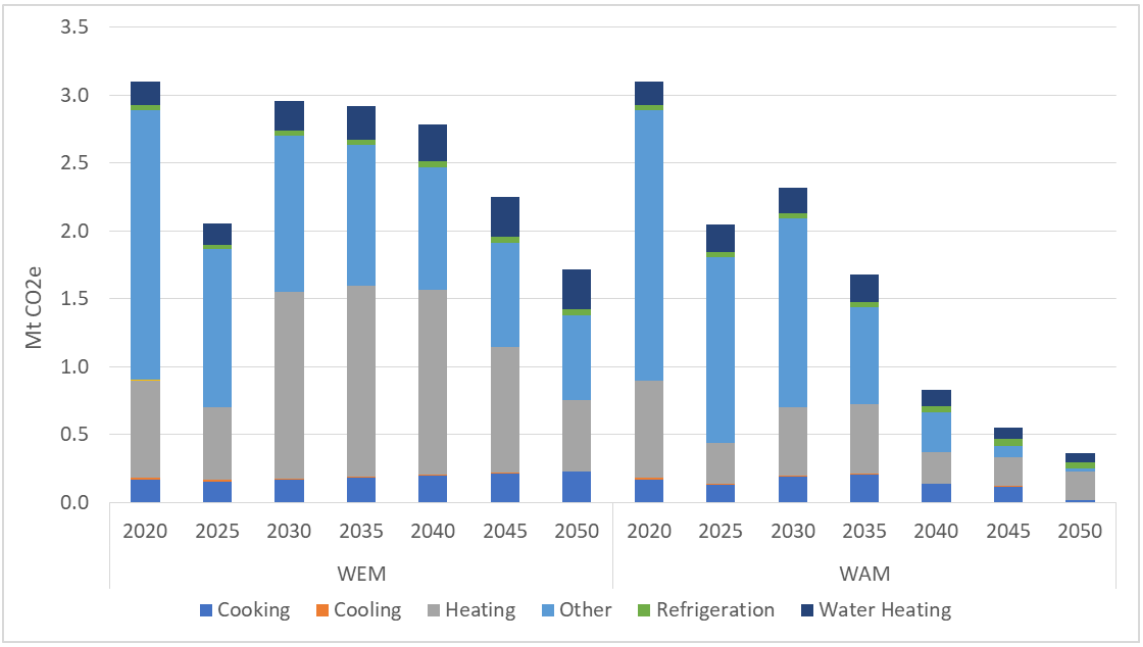
GHG emissions in the buildings sector are presented separately for residential buildings (Figure II.12a and Table II.18a) and the services sector (Figure II.12b and Table II.18b) by categories of activity. As shown in the figures, the majority of emissions from residential buildings and a significant share in the services sector come from meeting the demand for space heating.

By implementing the baseline scenario targets of the Strategy of building thermal modernization by 2050 and adopting advanced energy-efficient technologies, such as heat pumps, emissions from heating have the potential to decrease twice in residential buildings and thrice in the services sector under the WAM scenario.

The second and third largest sources of emissions in residential buildings are cooking and water heating. Through the electrification of these demands and the substitution of natural gas with biomethane, emissions from these processes are also expected to decrease.



(a)



(b)

Figure II.12. GHG emissions in the Residential (a) and Commercial (b) buildings sector by activity

In the services sector, the most carbon-intensive category is currently the combined demand for other needs. However, through the use of biofuels and a more intensive utilization of district heating, emissions in this category are minimized across all scenarios.

Table II.18. GHG emissions in the Residential (a) and Commercial (b) buildings sector by activity, kt of CO2-eq

(a)		2020	2025	2030	2035	2040	2045	2050
WEM	Cooking	4231	3547	3837	3754	3658	3555	3430
	Cooling	42	43	57	63	64	66	65
	Heating	10535	8245	11111	11431	11652	11793	12049
	Refrigeration	11	10	11	11	11	11	11
	Water Heating	1880	1688	1701	1640	1558	1498	1179
	Total	16700	13532	16717	16899	16944	16922	16734
WAM	Cooking	4231	3378	3088	2810	2529	1492	1046
	Cooling	42	43	55	61	60	61	61
	Heating	10535	9003	11658	11194	10110	8407	5778
	Refrigeration	11	10	11	11	11	11	11
	Water Heating	1880	1625	1860	1756	1678	644	163
	Total	16700	14058	16671	15832	14389	10614	7058
(b)		**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
WEM	Cooking	166	155	164	182	199	216	230
	Cooling	18	12	9	6	4	2	1
	Heating	716	532	1375	1412	1364	930	524
	Other	1991	1167	1151	1035	900	761	622
	Refrigeration	33	31	37	41	45	48	50
	Water Heating	174	159	221	246	270	291	293
	Total	3099	2056	2957	2921	2782	2248	1719
WAM	Cooking	166	127	189	207	135	119	15
	Cooling	18	12	9	6	4	2	1
	Heating	716	300	508	509	232	214	214
	Other	1991	1371	1387	716	296	83	19
	Refrigeration	33	31	37	41	45	48	50
	Water Heating	174	203	191	197	116	88	66
	Total	3099	2045	2321	1676	827	553	365

In gas dimension (Figure II.13 and Table II.19), absolute majority hold energy CO_2 emissions in both segments of buildings sector. The share of CH_4 from combustion might grow in commercial buildings by 2050 in both scenarios as biomass for heating and other activities grow in use. HFC gases also are being emitted more extensively in commerce and tend to grow over time due to heat pumps penetration.

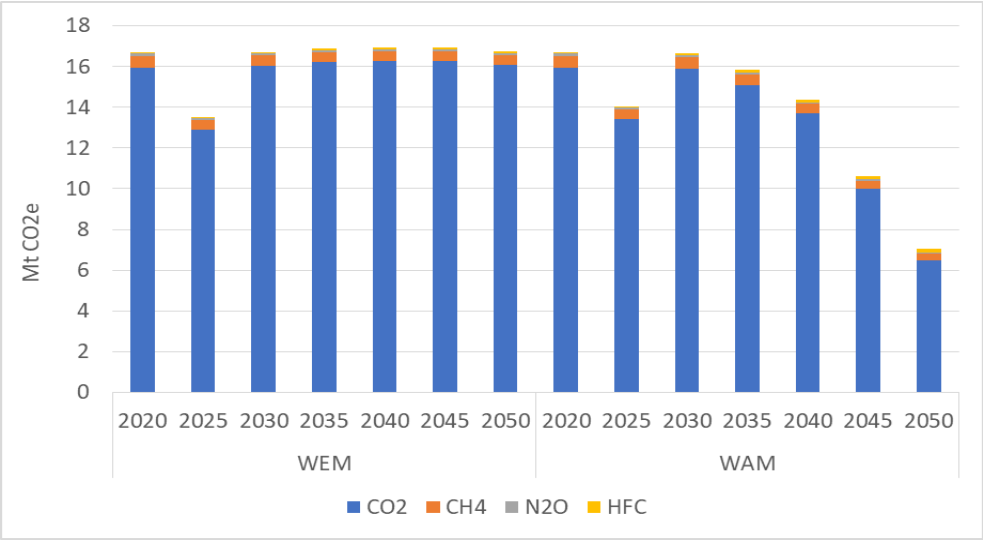


Figure II.13a. GHG emissions in the Residential buildings by gas

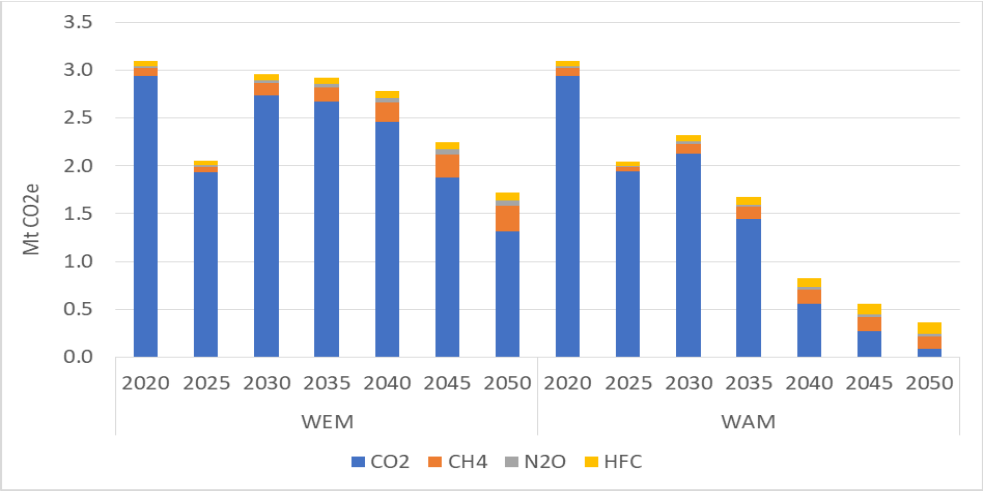


Figure II.13b. GHG emissions in the Commercial buildings by gas

Table II.19. GHG emissions in the Residential (a) and Commercial (b) buildings sector by gas, kt of CO2-eq

(a)		2020	2025	2030	2035	2040	2045	2050
WEM	CO_2	15954	12917	16029	16217	16272	16264	16103
	CH_4	579	466	512	499	487	474	449
	N_2O	112	94	99	97	94	92	87
	HFC	54	55	76	86	90	93	95
WAM	CO_2	15954	13436	15903	15098	13703	9982	6488
	CH_4	579	470	562	512	455	396	316
	N_2O	112	95	110	101	92	80	64
	HFC	54	57	96	121	139	157	191
(b)		**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
WEM	CO_2	2942	1932	2735	2670	2457	1875	1315
	CH_4	84	61	134	152	209	245	269
	N_2O	21	15	30	33	44	50	54
	HFC	52	49	59	66	72	78	82
WAM	CO_2	2942	1942	2126	1440	560	272	80
	CH_4	84	42	105	129	144	145	138
	N_2O	21	10	23	27	29	29	27
	HFC	52	50	68	80	94	107	118

F.1.3. Transport emissions

In 2021, the transport sector in Ukraine accounted for 41% of all atmospheric emissions and 29% of the country's CO_2 emissions, marking a significant increase compared to 2020 in both relative and absolute terms (in 2020, transport accounted for 17% of CO_2 emissions).

Although the level of car ownership in Ukraine remains relatively low (239 passenger cars per 1,000 people as of 2023 compared to 574 in the EU), emissions from Ukrainian road transport are significant due to the outdated vehicle fleet. The average age of cars in Ukraine continues to rise each year, reaching 23.2 years in 2023 compared to 11.8 years in the EU. This trend shows no signs of reversing, as in 2023, 40% of new car registrations were for vehicles over 10 years old, and they made up 85.8% of the total vehicle fleet. The used car market in Ukraine is 3.8 times larger than the new car market, largely due to the country's economic situation.

Despite challenges with power supply, the number of electric vehicles in Ukraine continues to grow (an increase of over 37,000 in 2023, accounting for one in six registrations).

In 2021, the average distance for freight transport by land was 400 km. However, due to the full-scale war, freight transport volumes have significantly decreased: air transport dropped by 100%, maritime transport by 85%, rail transport by 48%, and road transport by 22%.

WAM scenario demonstrate the potential for significant emission reductions in the transport sector by 2050 (Figure II.14 and Table II.20), where by 2050, the only major emitter left is freight road transport and aviation.

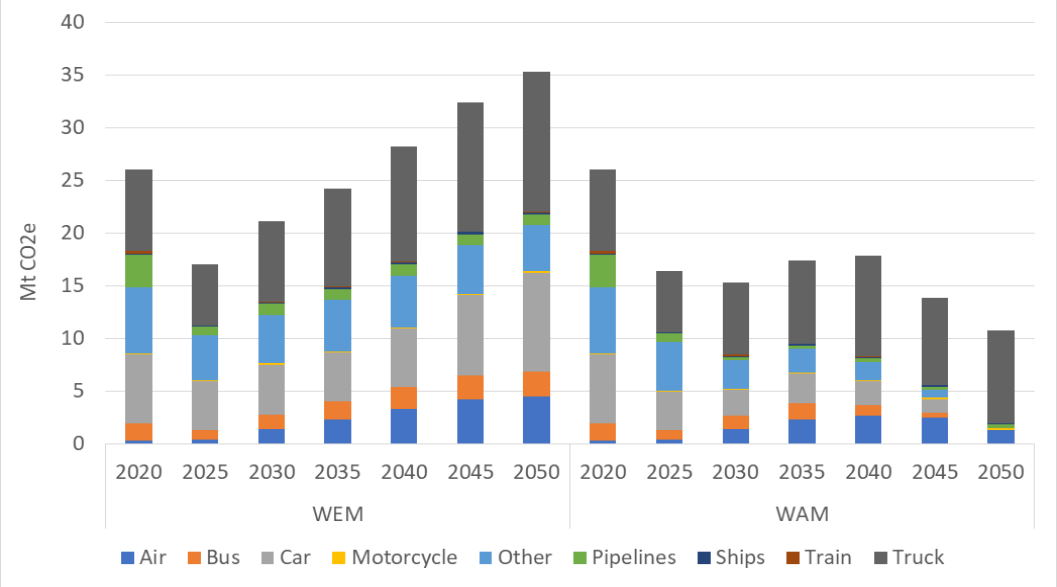


Figure II.14. GHG emissions in the Transport sector by mode

Table II.20. GHG emissions in the Transport sector by mode, kt of CO2-eq

Scenario	Transport mode	2020	2025	2030	2035	2040	2045	2050
WEM	Air	379	415	1441	2302	3329	4252	4541
	Bus	1561	915	1388	1774	2049	2260	2353
	Car	6550	4676	4724	4629	5614	7584	9373
	Motorcycle	98	93	94	93	95	106	120
	Other	6232	4199	4611	4882	4890	4650	4335
	Pipelines	3125	827	1047	1042	1042	1046	1052
	Ships	108	78	111	139	167	191	202
	Train	238	52	48	134	120	58	34
	Truck	7769	5779	7636	9237	10887	12231	13289
	Total	**26061**	**17033**	**21100**	**24232**	**28194**	**32377**	**35299**
WAM	Air	379	415	1441	2302	2721	2526	1357
	Bus	1561	916	1268	1567	1013	435	14
	Car	6550	3633	2417	2856	2248	1316	
	Motorcycle	98	93	94	93	95	106	120
	Other	6232	4625	2703	2206	1725	730	34
	Pipelines	3125	813	311	299	308	310	315
	Ships	108	78	111	139	167	165	103
	Train	238	52	129	46	70	33	
	Truck	7769	5777	6809	7874	9526	8238	8838
	Total	**26061**	**16403**	**15282**	**17382**	**17873**	**13860**	**10781**

In aviation the share of clean fuels (bio-kerosene) in meeting the demand by 2050 could make up to 70%, while in freight transport - 36% (ethanol and biomethane). Emissions from road freight transport increased by 14% comparing to 2020 while turnover grew by 60%, which shows the importance of a new

fleet of efficient vehicles, mostly petrol based though, in contributing to decarbonisation targets. It is also evident that planned measures are not sufficient in stimulating procurement of electric freight vehicles or more wide spread of advanced biofuels.

Despite the growing energy demand for transport due to increased economic activity, decoupling is possible after 2035 through the use of advanced and sustainable biofuels, direct electrification, and hydrogen. In WAM, Emissions from transport sector in total are reduced by 60% compared to 2020 through the use of biofuels, electricity and hydrogen, by 2050 it will emit about 11 million tons of CO2-equivalent.

Major GHG in the transport sector is CO_2 (Figure II.15 and Table II.21). CH_4 insignificantly grow in numbers and share by 2050 as more biofuels penetrate the market.

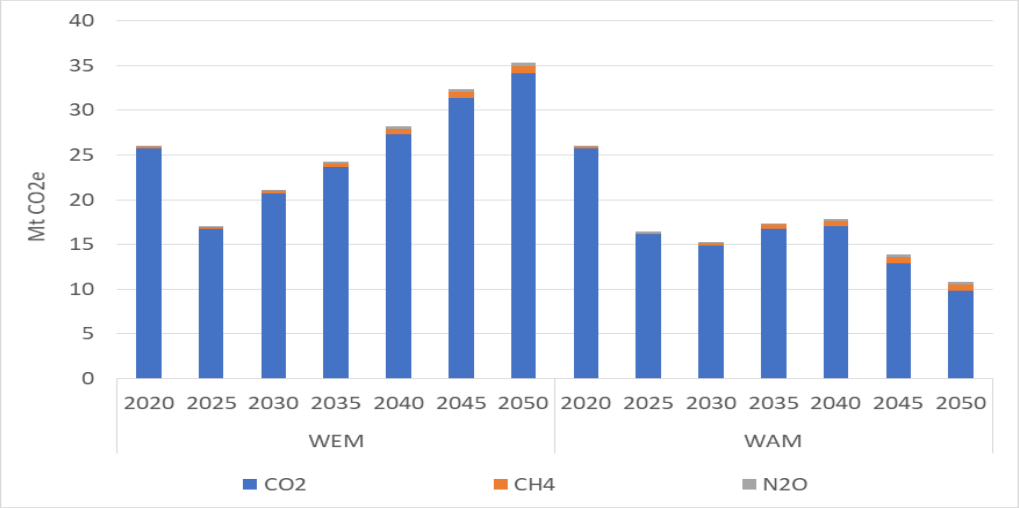


Figure II.15. GHG emissions in the Transport sector by gas

Table II.21. GHG emissions in the Transport sector by gas, kt of CO2-eq

Scenario	Gas	2020	2025	2030	2035	2040	2045	2050
WEM	CO_2	25701	16741	20711	23696	27348	31359	34140
	CH_4	199	172	235	343	580	702	805
	N_2O	162	121	154	194	267	315	354
WAM	CO_2	25701	16121	14870	16788	17013	12933	9869
	CH_4	199	168	280	421	635	696	692
	N_2O	162	114	132	173	226	232	220

F.2. Greenhouse gas emissions in the "Agriculture" sector

The assessment of GHG emissions in the agriculture sector for developing projections, which are shown in Figures II.16, II.17 and Tables II.22, II.23, follows the methodological recommendations outlined in the "Guidelines for National Greenhouse Gas Inventories" by the Intergovernmental Panel on Climate Change (IPCC). The projections are driven by key agricultural activity factors, with their indicators for 2030, 2040, and 2050 established by the Ministry of Agriculture. These indicators were developed considering various conditions, including:

- Cessation of hostilities (both current and potential future escalations);
- Restoration of agricultural infrastructure, including the reconstruction of damaged or destroyed livestock farms;
- Demining of pastures, hayfields, arable land, and other agricultural areas;
- Replenishment of agricultural machinery and equipment;
- Population recovery and resettlement, including return migration, relocation of internally displaced persons, and natural population growth;

- Demographic policy effectiveness;
- Domestic demand for agricultural products;
- Export opportunities for the agricultural sector;
- National strategy for post-war reconstruction and agricultural development.

The assessment of GHG emissions across various agricultural activities, based on projected data (Figure II.16), indicates that emissions under the WEM scenario which reflects the current (limited) implementation of legislation—where policy development, adoption, and execution experience significant delays—will lead to a gradual increase in GHG emissions. As such their level will reach 42.4 million t CO_2-eq in 2030, 48 million t CO_2-eq in 2040, and 51 million t CO_2-eq in 2050, which compared to the base year of 1990, amounts to 47.9% in 2030, 54.7% in 2040, and 58.1% in 2050.

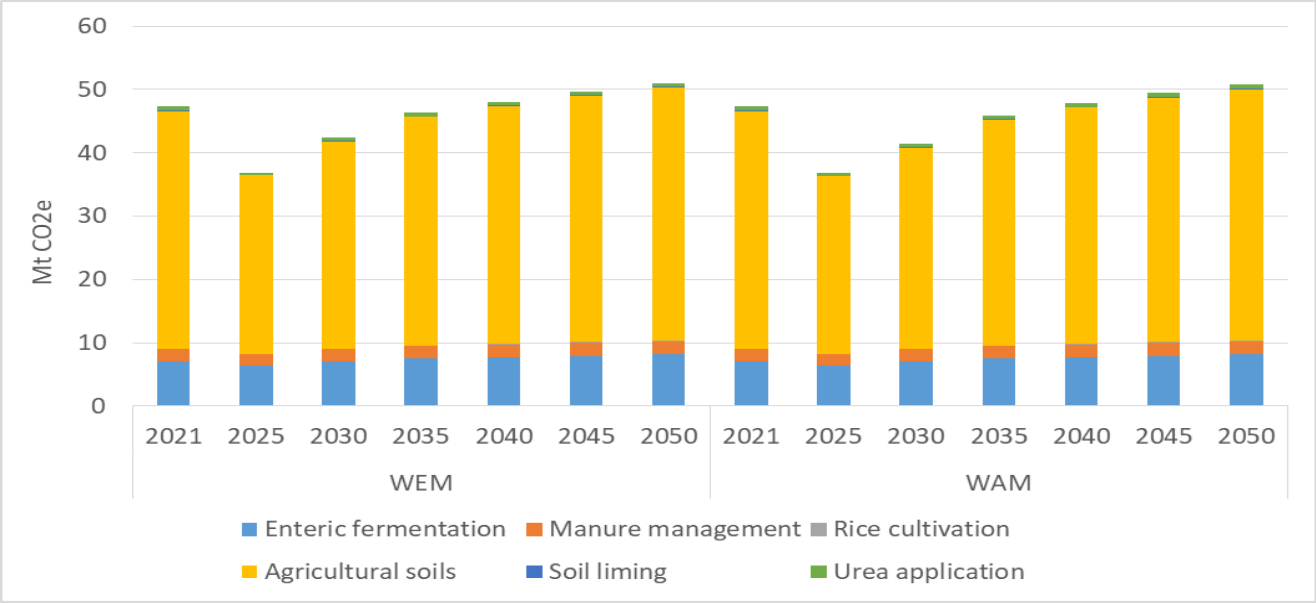


Figure II.16. GHG emissions in the "Agriculture" sector by activity

Table II.22. GHG emissions in the "Agriculture" sector by activity, kt of CO2-eq

Scenario	Activity	2021	2025	2030	2035	2040	2045	2050
WEM	Enteric fermentation	7	6	7	7	8	8	8
	Manure management	2	2	2	2	2	2	2
	Rice cultivation	0	0	0	0	0	0	0
	Agricultural soils	38	28	33	36	37	39	40
	Soil liming	0	0	0	0	0	0	0
	Urea application	1	0	1	1	1	1	1
WAM	Enteric fermentation	7	6	7	7	8	8	8
	Manure management	2	2	2	2	2	2	2
	Rice cultivation	0	0	0	0	0	0	0
	Agricultural soils	38	28	32	36	37	39	40
	Soil liming	0	0	0	0	0	0	0
	Urea application	1	0	1	1	1	1	1

The greening of agriculture necessitates the environmentally responsible development of the industry, which involves the adoption of information and electronic communication technologies, the enhancement of soil cultivation techniques, advancements in crop production methods, and the sustainable development of animal husbandry - both in terms of breeding practices and manure management.

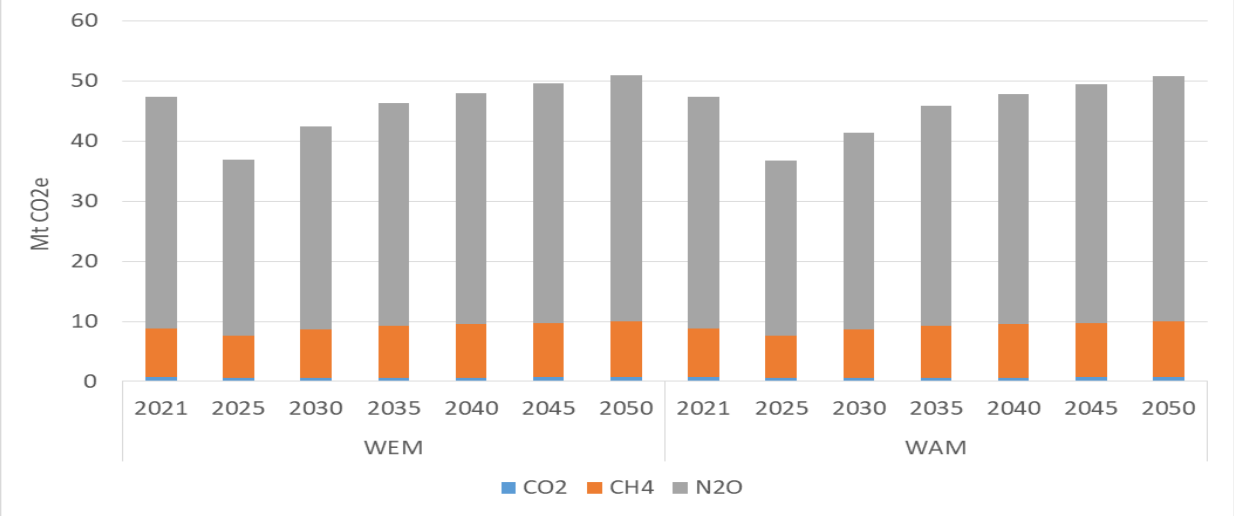


Figure II.17. GHG emissions in the "Agriculture" sector by gas

Considering the identified priorities and objectives for sustainable, climate-oriented development, the WAM scenario emphasizes the expanded implementation of two key agricultural policies, aimed at reducing greenhouse gas (GHG) emissions: promotion of organic crop production development, which should be expanded to 1.1 million hectares and prospected to reduce GHG emissions by 1.1 Mt CO2-eq and dissemination of the use of information and electronic communication technologies in crop production which might reduce up to 0.4 Mt. While organic crop production has long been recognized, its full potential remains underutilized. Its climate-focused approach plays a crucial role in adapting to climate change, mitigating its effects, and preserving biodiversity, making it a key instrument in agriculture's "green transformation". The integration of information and electronic communication technologies in crop production, driven by scientific and technological advancements, significantly contributes to the sustainable development of agriculture. Their application enables effective land monitoring, environmental control, and the optimization of agricultural practices and interventions.

Table II.23. Greenhouse gas emissions in the "Agriculture" sector by gas, kt of CO2-eq

Scenario	Gas	2021	2025	2030	2035	2040	2045	2050
WEM	CO_2	0.7	0.5	0.6	0.6	0.7	0.7	0.7
	CH_4	8.1	7.1	8.1	8.6	8.9	9.1	9.3
	N_2O	38.5	29.3	33.7	37.1	38.5	39.9	41.0
WAM	CO_2	0.7	0.5	0.6	0.6	0.7	0.7	0.7
	CH_4	8.1	7.1	8.1	8.6	8.9	9.1	9.3
	N_2O	38.5	29.2	32.7	36.7	38.3	39.7	40.7

Taking into account the historical trends in agricultural development and the uncertainty regarding the end of hostilities, the adoption of these practices and technologies is expected to remain limited. However, even partial utilization of their potential will contribute to reducing greenhouse gas (GHG) emissions in agriculture. Under the WAM scenario, GHG emissions in the agricultural sector are projected to reach 41.4 million tons of CO_2-eq in 2030, 47.8 million tons in 2040, and 50.7 million tons in 2050. Compared to the base year of 1990, emissions are expected to be 47.2% in 2030, 54.5% in 2040, and 57.8% in 2050.

F.3. Greenhouse gas emissions in the LULUCF sector

Due to the Russian invasion of Ukraine which caused extensive devastation on more than 2000 km frontline, obtaining of the reliable data on the LULUCF sector in time of the Ukrainian NECP preparation

was impossible. That is why the development of a reasonable forecast on GHG emissions in this sector has not been conducted. According to estimates by the Ministry of Environmental Protection and Natural Resources, about 3 million hectares of forests have been damaged[46], which is almost one-third of Ukraine's total forest area (10.4 million hectares).

Currently, Ukraine is reviewing its LEDS (Low Emission Development Strategy), and it will include forecasts on LULUCF basing on the most recently obtained assessments. The next Ukrainian BTR will be supplemented with the relevant forecasts and methodology.

F.4. Greenhouse gas emissions in the "Waste" sector

The WAM scenario assumes strict adherence to the recently adopted (in 2022) Law "On Waste Management" and is based on the full implementation of the draft National Waste Management Plan of Ukraine until 2033 and the draft Action Plan for the National Waste Management Plan of Ukraine until 2033, which are expected to be approved in 2024.

Specifically, the WAM scenario envisions reducing the share of municipal solid waste (MSW) landfilling to 30% by 2033 and to 20% by 2050; increasing the share of biogas utilization at landfills to 23% by 2030 and 36% by 2050, respectively; and constructing new waste composting facilities with low specific emission factors for CH_4 and N_2O.

It is important to note that, unlike the WEM scenario, the increase in biogas utilization at MSW landfills under the WAM scenario until 2030 will primarily be achieved through the broader adoption of biogas recovery technologies at MSW landfills rather than flaring. This is because the approval of the "National Waste Management Plan of Ukraine until 2033" and the "Action Plan for the National Waste Management Plan of Ukraine until 2033" will promote the development of new regional MSW landfills while simultaneously decommissioning outdated disposal sites.

Under the WAM scenario, GHG emissions in the waste management sector are projected to decrease steadily, reaching 10.6 million tons of CO2-eq by 2030 (Figure II.18 and Table II.24), which is 15% lower than the 1990 level. Emissions will continue to decline, reaching 7 million tons of CO2-eq by 2050, representing a 44% reduction from 1990 levels.

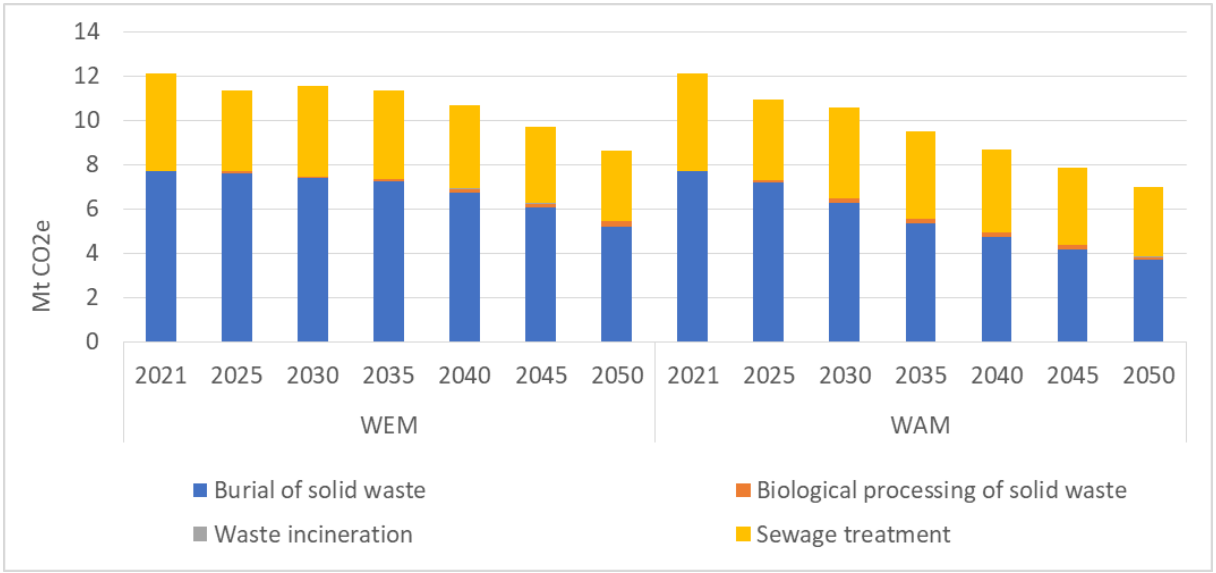


Figure II.18. Greenhouse gas emissions in the "Waste" sector by activity

[46] https://mepr.gov.ua/71-mlrd-dolariv-zbytkiv-ta-180-mln-tonn-vykydiv-na-sor29-ukrayina-nazvala-masshtab-shkody-pryrodi-za-1000-dniv-vijny/

The WAM scenario anticipates significant changes in the structure of emissions in the waste management sector compared to 2020. Landfills will remain the primary source of GHG emissions but their share is expected to decrease from 62% in 2020 to 59% in 2030 and further to 53% by 2050. Conversely, the share of emissions from wastewater management will increase from 38% in 2020 to 45% by 2050.

Table II.24. Greenhouse gas emissions in the "Waste" sector by activity, kt of CO2-eq

Scenario	Activity	2021	2025	2030	2035	2040	2045	2050
WEM	Burial of solid waste	7700	7630	7385	7251	6758	6047	5210
	Biological processing of solid waste	17	58	70	108	147	187	226
	Waste incineration	12	9	12	13	14	15	16
	Sewage treatment	4408	3642	4071	3956	3751	3486	3164
	Total	**12138**	**11338**	**11537**	**11328**	**10671**	**9735**	**8617**
WAM	Burial of solid waste	7700	7203	6283	5342	4724	4181	3689
	Biological processing of solid waste	17	105	208	211	200	183	141
	Waste incineration	12	9	12	13	14	15	16
	Sewage treatment	4408	3642	4071	3956	3751	3486	3164
	Total	**12138**	**10959**	**10574**	**9522**	**8689**	**7865**	**7010**

Similar to the WEM scenario, the only source expected to see a significant increase in emissions is the biological treatment of solid waste, where emissions will rise from 7.5 thousand tons of CO2-eq (0.1% of total sector emissions) in 2020 to 207.9 thousand tons of CO2-eq in 2030. These emissions will then gradually decline to 140.6 thousand tons of CO2-eq (2% of total sector emissions) by 2050. This sharp increase in emissions by 2030 is attributed to the rapid expansion of composting practices for MSW in Ukraine.

The gradual decrease in emissions from biological waste treatment after 2030 is linked to the implementation of modern composting technologies with lower methane and nitrous oxide emission factors. GHG emissions from thermal waste treatment methods (excluding energy recovery) are expected to grow from 0.1% of total waste management sector emissions in 2020 to 0.2% in 2050. Although the absolute value of these emissions will not increase, their share within the sector will rise due to significant reductions in GHG emissions from other sources.

Greenhouse gas emissions in the "Waste" sector by type of gas are presented in the Figure II.19 and Table II.25, the GWP for CH_4 is 25 and for N_2O is 298 according to NIR 2023. The major greenhouse gas being emitted is methane, which share in WAM scenario could decrease from 91% in 2021 to 82.6% in 2050.

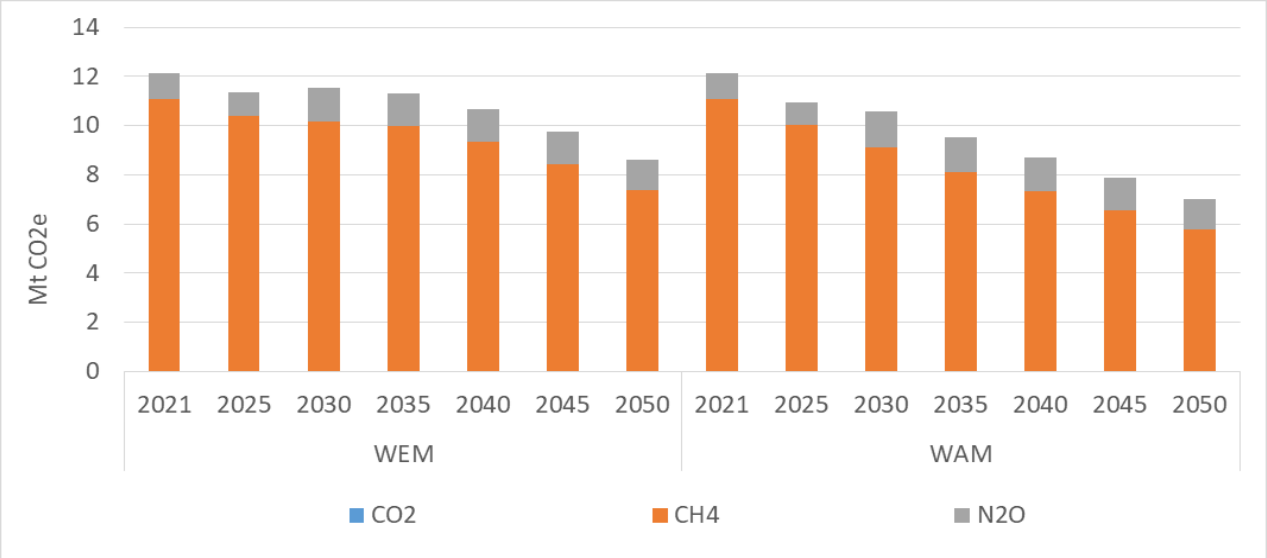


Figure II.19. Greenhouse gas emissions in the "Waste" sector by gas

Table II.25. Greenhouse gas emissions in the "Waste" sector by gas, kt of CO2-eq

Scenario	Gas	2021	2025	2030	2035	2040	2045	2050
WEM	CO_2	5.1	3.4	4.7	5.3	5.8	6.3	6.7
	CH_4	11055.6	10411.0	10157.3	9968.0	9338.9	8435.6	7355.3
	N_2O	1077.1	923.3	1375.2	1354.6	1325.9	1292.9	1254.7
WAM	CO_2	5.1	3.4	4.7	5.3	5.8	6.3	6.7
	CH_4	11055.6	10009.4	9128.5	8113.7	7332.2	6567.7	5789.5
	N_2O	1077.1	945.7	1440.4	1403.4	1351.0	1291.4	1214.2

Key factors influencing GHG emission trends in the waste management sector under the WAM scenario include:

- Rapid reduction in the share of MSW landfilling by 2033, followed by a more moderate decrease until 2050.
- Intensive deployment of biogas utilization technologies at landfills until 2033, with a more gradual increase in biogas utilization rates thereafter.
- Reduction in methane and nitrous oxide emission factors during composting of MSW after 2033.
- Key risks to achieving GHG reductions under the WAM scenario include:
- Slow development of MSW processing infrastructure.
- Low efficiency of biogas utilization technologies at landfills with low biogas yield.
- Implementation of composting technologies and practices for organic MSW components with high specific methane and nitrous oxide emission factors.

F.5. Models and Approaches Used

Description of the models and approaches utilized for making projections along with key underlying assumptions.

F.5.1. Macroeconomic assumptions

The macroeconomic outlook of the NECP is derived from Ukraine's Economic and Social Development Forecast for 2024–2026, as well as the macroeconomic scenario assumptions outlined in the National Plan until 2033. These projections were extended to 2050 by experts from the Institute for Economic Forecasting of the National Academy of Sciences (Table II.26).

Table II.26. Macroeconomic forecast: annual average GDP growth rates by sector, %

	2022	2023-2025	2026-2030	2031-2040	2041-2050
Agriculture, forestry and fisheries	-25.2	0.9	5.3	1.4	0.5
Mining industry	-33.2	7.5	1.8	0.8	0.1
Processing industry	-42.2	5.7	6,7	6.1	4.1
Supply of electricity, gas and steam	-32.5	5.8	4.9	1.9	1.3
Construction	-66.9	17.8	15.0	12.5	3.1
Wholesale and retail trade; repair of cars and motorcycles	-32.2	5.8	5.4	4.6	2.6
Transport, warehousing, postal and courier activities	-40.5	2.1	5.7	4.5	2.5
Other types of economic activity	-14.3	4.9	4.6	4.2	2.8
GDP	-28.8	5.0	5.4	4.6	2.8

Source: Mineconomy, State Institution "Institute for Economics and Forecasting of the National Academy of Sciences of Ukraine"

The macroeconomic scenarios outline the future economic structure, anticipated energy consumption levels, and greenhouse gas emissions. They also define key factors influencing demographic trends.

At the start of 2022, Ukraine's population was 41.2 million (excluding the temporarily occupied Autonomous Republic of Crimea and Sevastopol) or approximately 37.3 million (excluding the temporarily occupied territories of Crimea, Donetsk, and Luhansk regions), with a continuing downward trend.

For the NECP, the most recent demographic projections from the Institute of Demography and Social Research of the National Academy of Sciences of Ukraine were utilized, incorporating official statistics and the assumptions used in the aforementioned macroeconomic forecasts.

These projections take into account various demographic parameters, including life expectancy, mortality rates, fertility rates (average number of children per woman), survival rates, probability of death, birth rates, migration patterns, and other age- and gender-specific factors. The results are summarized in Table II.27, which also includes a forecast of the number of households. It assumes an average household size of 2.9 people in urban areas and 2.7 in rural areas.

Table II.27. Demographic and sectoral forecast

	2022	2025	2030	2035	2040	2045	2050
Number of population, million	37.3	30.4	34.5	33.5	32.4	31.3	30.1
Share of urban population, %	69.7	67.9	71.4	70.7	70.0	69.4	68.8
Forecast of the number of households, million	13.9	11.8	13.5	13.1	12.6	12.2	11.7
Added value in industry, billion UAH 2021	435	589	824	1183	1621	1976	2267
Added value in agriculture, billion UAH 2021	444	456.1	589.2	650.4	673.5	690.4	704.4
Added value in the commercial sector, billion UAH 2021	2060. 7	2400	3025	3780	4593	5392	6016
Passenger circulation, billion pas·km	25.5	27.3	40.1	55.5	73.8	92.7	106.0
Freight turnover, billion t·km	166.8	176.2	214.0	255.9	298.6	336.5	370.3

Source: Institute of Demography and Social Research of the National Academy of Sciences of Ukraine, State Statistics Service, State Institution "Institute for Economics and Forecasting of the National Academy of Sciences of Ukraine"

F.5.2. Assumptions regarding global fuel prices.

The forecast for Ukraine's import prices of key energy resources is based on the International Energy Agency's price projections (World Energy Outlook 2023, Announced Pledges Scenario). As shown in Table II.28, prices for all carbon-intensive energy sources are expected to decline gradually, though not significantly, and not in comparison to the crisis year of 2022.

Table II.28. Forecast of world prices for energy resources

	Unit	2010	2022	2030	2050
Coal	USD/t	122	290	68	53
Crude oil	USD/bbl	103	98	74	60
Natural gas	USD/MMBtu	9.9	32.3	6.5	5.4

Source: International Energy Agency

F.5.3. Carbon Pricing Assumptions

The projected price of GHG emissions varies depending on the scenario. Under the "With Existing Policies and Measures" (WEM) scenario, the CO_2 tax remains at UAH 30/t throughout the period of martial law and possibly until 2025. From 2026, tax indexation is expected, including an increase in the CO_2 tax, which will gradually rise to approximately 1 EUR/t by 2050. However, in the long run, a reform of the CO_2 tax (currently under development) is anticipated, which will involve revising both the tax rate and its scope. As a result, the tax is expected to extend to the transport, agriculture, residential, and commercial sectors.

Additionally, starting in 2026, Ukraine plans to introduce a National GHG Emissions Trading System (ETS) in a pilot phase. Over time, the regulatory framework for Ukraine's ETS is expected to align with the EU ETS. The EU's implementation of the Carbon Border Adjustment Mechanism

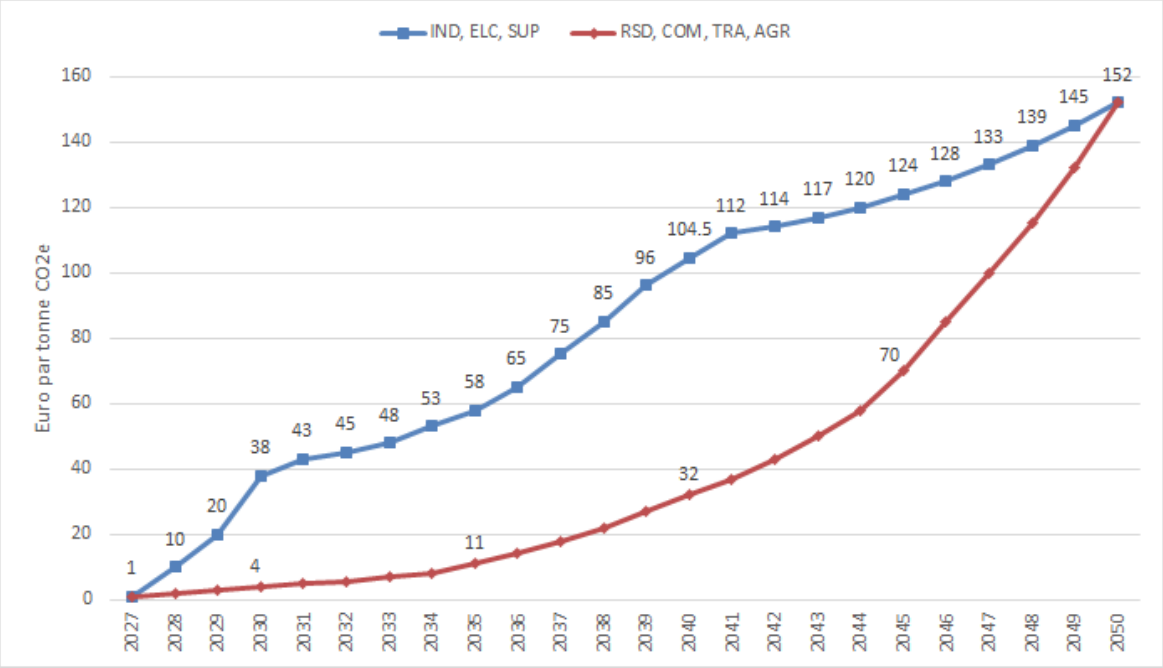
(CBAM) will further encourage Ukraine to accelerate its ETS development and harmonize it with European standards. Consequently, the domestic CO_2 price (a combination of the CO_2 tax and ETS) is expected to rise continuously until 2050.

However, given the ongoing full-scale war as of 2024, which has severely impacted the industrial sector, increased poverty levels, and economic instability, a rapid convergence of Ukraine's CO_2 price with the EU ETS by 2030 is unrealistic. Time will be needed for economic recovery and adaptation to rising carbon and energy prices. Therefore, Ukraine's CO_2 pricing trajectory is expected to lag behind the European carbon market price, which is currently ~65 EUR/t CO_2 (down from ~100 EUR/t CO_2 a year ago).

A more realistic yet ambitious benchmark for Ukraine is the "Announced Commitments" scenario of the International Energy Agency (IEA), which applies to developing countries with net-zero commitments. Under this scenario, the CO_2 price is projected to reach USD 40 (EUR 38) per ton by 2030 and USD 160 (EUR 152) per ton by 2050.

For modeling the "With Additional Policies and Measures" (WAM) scenario within the NECP, particularly in the energy, industrial, and power sectors, the assumed CO_2 price remains UAH 30/t until 2025. From 2026 to 2027, it rises to approximately 1 EUR/t, then follows the IEA trajectory (Figure II.20): EUR 38/t by 2030; EUR 104.5/t by 2040; EUR 152/t by 2050.

Meanwhile, a slower price increase is anticipated for transport, agriculture, and the residential/commercial sectors.



Source: International Energy Agency, State Institution "Institute of Economics and Forecasting of NAS of Ukraine"

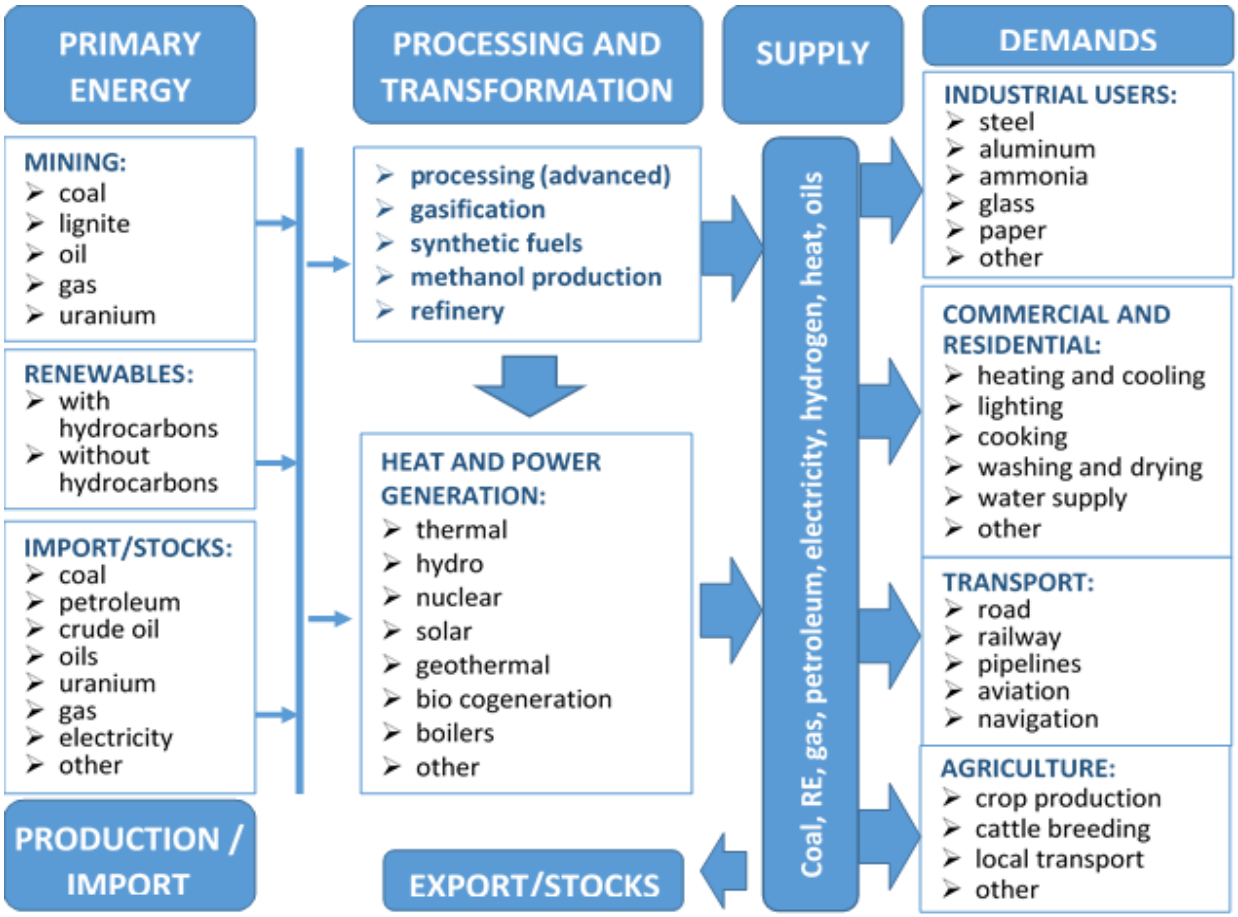
Figure II.20. The projected carbon tax dynamics under the WAM scenario

Following the end of martial law, the NECP will be updated to review CO_2 price assumptions. Once the national ETS is fully operational and the carbon tax reform roadmap is adopted—expected within the next two years—a clearer vision for Ukraine's carbon market and CO_2 price forecasts will emerge.

The modelling framework of NECP of Ukraine consist of several mathematical models such as the TIMES-Ukraine relevant for the Energy and Industrial Processes sectors (according to the IPCC categories), mass balance model for Waste sector and specific simulation tool for the Agriculture.

F.5.4. Methodology for energy system-wide modeling based on TIMES-Ukraine model

The TIMES-Ukraine model is a linear optimization model of the energy system (of the "bottom-up" type), which describes in detail all energy flows in Ukraine[47]. In the TIMES-Ukraine model, the energy system of Ukraine is divided into seven sectors (Figure II.21), which includes all energy flows from the extraction of primary energy resources to their final consumption with intermediate stages of transformation (processing, production of secondary energy resources, etc.), import, export and transportation. This corresponds to the methodological approach of the State of the Union, which, in turn, is harmonized with the relevant methodologies of the European Commission (Eurostat) and the International Energy Agency (IEA).



Source: State Institution "Institute of Economics and Forecasting of NAS of Ukraine"

Figure II.21. The basic structure of the energy system in the TIMES-Ukraine model

TIMES-type models contain a significant number of technologies in different sectors of the energy system, providing information about different types of energy, technologies, etc. Currently, the TIMES-Ukraine model includes almost 2,000 technologies, both existing in Ukraine and those that exist on international markets and can be implemented in Ukraine. The sources of data for cost and technical characteristics are the materials of the IEA, the Danish Energy Agency (DEA), the National Laboratory of Renewable Energy Sources (NREL), specialized associations in Ukraine, scientific institutes, and energy companies. A concise list of promising energy technologies with their parameters is shown in Table II.29.

The TIMES-Ukraine model complies with the methodological recommendations of the Secretariat of the UN Framework Convention on Climate Change regarding the development of energy and

[47] Podolets R.Z., Diachuk O.A. Strategic planning in the fuel and energy complex based on the "TIMES-Ukraine" model: Sci. add. NAS of Ukraine; Institute of Economics and predicted - K., 2011. - 150 p.

environmental forecasts[48]. A recent model is capable of achieving net-zero greenhouse gas emissions across the economy, which has been highlighted in a number of peer-reviewed publications[49,50,51].

The database of the TIMES-Ukraine model is filled with economic and energy data for 2005-2020, as well as estimates of the corresponding data for 2022, taking into account their changes in the future. The main sources of the database are statistical observations of the State Statistics Service, the National Bank of Ukraine, data from Ukrainian ministries and departments, housing and communal enterprises, energy generating and energy supply companies, specialized associations, academic institutions, etc. In addition, data from international organizations (MEA, IAEA, OECD, IMF, World Bank, UN, DEA, etc.) are used in the part of energy and economic development forecasting.

The TIMES-Ukraine model was used to prepare a number of strategic documents approved by the Government of Ukraine in 2016-2021, in particular: National Energy Efficiency Action Plans until 2020 and for 2019-2030; Ukraine's expected Nationally Determined Contribution to the Paris Agreement and its updated version; Strategies for low-carbon development of Ukraine until 2050, Strategies for thermal modernization of buildings in Ukraine until 2050, etc.

In recent years, the Institute of Economics and Forecasting of the National Academy of Sciences of Ukraine has been applying and developing this model in cooperation with US national laboratories, in particular with the Pacific Northwest National Laboratory, the National Renewable Energy Laboratory, Argonne National Laboratory and Lawrence Berkeley National Laboratory as part of the Net Zero World initiative. For example, in December 2023, at COP28 in Dubai, as part of the program of the Ukrainian pavilion, the results of modeling the post-war low-carbon development of the Ukrainian energy industry were presented, which were also presented in the form of a report[52]. Also recently, a joint study was conducted with DIXI group, REKK, Austrian Institute of Technology, and Regulatory Assistance Project on long-term ways of decarbonization of the electricity sector of Ukraine, where the TIMES-Ukraine model was used in combination with the EPMM and Green-X models[53].

[48] The UNFCCC Resource Guide for preparing the National Communications of Non-Annex i Parties. Module 4: Measures to mitigate climate change // United Nations Framework Convention on Climate Change. Retrieved from https://unfccc.int/resource/docs/publications/08_resource_guide4.pdf

[49] Roman Podolets, Oleksandr Diachuk, Andrii Semeniuk, Bohdan Serebrennikov, Galyna Trypolska, Roman Yuhymets, Olha Yevstihnieieva Rebuilding Ukraine with a resilient, carbon-neutral energy system // United Nations Economic Commission for Europe, 2023 https://unece.org/sites/default/files/2023-07/EN_Rebuilding%20Ukraine%20with%20a%20Resilient%20Carbon-Neutral%20Energy%20System_V8.pdf

[50] Maksym Chepeliev, Oleksandr Diachuk, Roman Podolets, and Andrii Semeniuk What is the future of nuclear power in Ukraine? The role of war, techno-economic drivers, and safety considerations // Energy Policy, Volume 178, July 2023. - https://doi.org/10.1016/j.enpol.2023.113612

[51] Maksym Chepeliev, Oleksandr Diachuk, Roman Podolets, Andrii Semeniuk (2023) Can Ukraine go "green" on the post-war recovery path? // Joule, https://doi.org/10.1016/j.joule.2023.02.007

[52] https://cop.climateoffice.org.ua/deep-dive-into-modeling-for-net-zero-world-and-ukraines-national-energy-and-climate-plan/ Clean Energy Roadmap: From Reconstruction to Decarbonization in Ukraine. http://ief.org.ua/wpcontent/uploads/2023/11/NZW-IEF-TIMES-Ukraine-Description_and_Assumption.pdf

[53] https://dixigroup.org/en/analytic/long-term-decarbonisation-pathways-for-ukraines-power-sector/

Table II.29. A concise list of promising technologies for the production of electrical and thermal energy

Technologies	Overnight Capital Cost (CAPEX), €/ kWe							Efficiency (Electric), %	Availability factor, %	Lifetime, years	Heat Rate
	2020	2025	2030	2035	2040	2045	2050				
Thermal Power Plants (TPPs) and Combined Heat and Power Plants (CHP)											
Nuclear											
New Large Units	4400							33	88	60	0.03
Extension of the operational life of existing units of NPPs	254							33	80	30	0.04
New small nuclear reactors (160 MW)	4400							32	90	80	0.04
Nuclear Very High Temperature reactor with Hydrogen production	7650-6885							33	94	60	0.1-0.12 (H2)
Gas											
Combined cycle TPPs	1000							60	50	35	0.15
Combustion turbine TPPs	600							40	50	30	0.15
Steam turbine TPPs	920							42	50	30	0.15
Fast Start Engine TPPs (only as balancing technologies)	1000							50	75	35	–
Combined Cycle + Carbon Capture and Storage TPPs	2450							51	50	35	0.05
Combustion turbine + Carbon Capture and Storage TPPs	2050							34	50	30	0.05
Combined cycle CHPs	800							50	50	35	0.84
Combustion turbine CHPs	920							45	50	35	0.95
Extension of the operational life of existing CHPs	280-650							19-43	50	15	1.1-3.0
Combined Cycle + Carbon Capture and Storage CHPs	2250							45	50	35	0.84
Coal											
Integrated gasification combined cycle (IGCC) TPPs	1800							46	50	35	0.15
Supercritical parameters TPPs	1300							43	50	40	0.15
Subcritical parameters TPPs	1600							39	50	35	0.15
Circulating Fluidized Bed TPPs	1700							43	50	35	0.15
Joint combustion of coal and biomass (subcritical parameters) TPPs	2050							33	50	35	0.15
Extension of the operational life of existing Coal TPPs	950							33-40	34-62	20	0.01-0.19
IGCC + Carbon Capture and Storage TPPs	4400							39	50	35	0.15
Supercritical + Carbon Capture and Storage TPPs	3900							37	50	35	0.15
Subcritical + Carbon Capture and Storage TPPs	4650							33	50	35	0.15
Circulating Fluidized Bed + Carbon Capture and Storage TPPs	4300							28	50	35	0.15
Combined cycle CHPs	1200							40	50	35	0.84
Combustion turbine CHPs	1100							35	50	35	0.90
Combined cycle+ Carbon Capture and Storage CHPs	2650							35	50	35	0.84
Bioenergy											
Wood biomass TPPs	2800	2750	2700	2650	2600	2550	2500	24	50	30	–
Biomass from waste TPPs	2900	2850	2800	2750	2700	2650	2600	23	50	30	0.3
Biogas TPPs	3200	3200	3200	3200	3200	3200	3200	42	50	30	–
Energy crops TPPs	2900	2850	2800	2750	2700	2650	2600	24	50	30	–
Wood biomass+ Carbon Capture and Storage TPPs	3650							24	50	30	–
Biogas + Carbon Capture and Storage TPPs	5350							42	50	30	–
Energy crops + Carbon Capture and Storage TPPs	3750							24	50	30	–
Wood biomass CHPs	3400	2850	2800	2750	2700	2650	2600	20	50	35	2.0
Biomass from industrial waste CHPs	3400	2950	2850	2850	2900	2750	2700	19	50	35	1.9

Technologies	Overnight Capital Cost (CAPEX), €/ kWe							Efficiency (Electric), %	Availability factor, %	Lifetime, years	Heat Rate
	2020	2025	2030	2035	2040	2045	2050				
Biomass from municipal waste CHPs	5400	2950	2900	2850	2800	2750	2700	25	50	35	1.2
Energy crops CHPs	3400	3150	3100	3050	3000	2950	2900	20	50	35	2.0
Wood biomass + Carbon Capture and Storage CHPs	4450							20	50	35	1.5
Energy crops+ Carbon Capture and Storage CHPs	4450							20	50	35	1.5
Wind											
Onshore Wind Power Plants	1100	1075	1050	1000	950	900	850	–	32	30	–
Offshore Wind Power Plants	2120	1960	1800	1700	1680	1660	1640	–	42	30	–
Solar											
PV Plant size (without tracker)	750	725	700	630	560	510	475	–	12.5	25	–
PV Plant size (with tracker)	920	850	800	720	645	590	540	–	14.7	25	–
PV Roof panel	900	875	850	800	750	700	600	–	13.5	25	–
Geothermal											
Geothermal Power Plants	4300-3600							–	35-55	25	–
Hydro											
Small Hydro Power Plants	3250-3080							–	30	40	–
Large Hydro Power Plants	3300-3100							–	33-36	60	
Pump Storage	610							80	27	60	–
Storage technologies, EUR/kWh											
Electric Battery Storages	1042	832	622	508	394	324	255	92	17	25	–
Hydrogen Underground Storage Large	980	750	700	650	600	550	500	100	100	30	–
Hydrogen Tank Storage Large	4600	3600	3400	3200	3000	2800	2500	100	100	22	–
Hydrogen Tank Storage Small	2650	2075	1900	1800	1700	1600	1500	100	100	22	
Seasonal Heat Storage	2700	2600	2562	2434	2312	2197	2087	70	50	20	–
Fuel Cells (Hydrogen)											
Fuel Cells Power Plants	2530	1125	1125	844				50	85	10	–
Fuel Cells Combined Heat and Power Plants	2530	1125	1125	844				50	60	10	0.64
Heat plants											
Hard Coal District Heating Plant	600							40	50	35	–
Anthracite District Heating Plant	600							40	50	35	–
Lignite District Heating Plant	700							40	50	35	–
Gas District Heating Plant (with availability of bio or synthetic methane)	300							71	50	40	–
Wood biomass District Heating Plant	145	142	140	138	136			64	50	35	–
Biomass from industrial waste District Heating Plant	350	320	300	280	270	260	250	62	50	35	–
Electric District Heating Plant	350							90	50	40	–
Air-sourced Heat Pump District Heating Plant	1100							250	50	25	–
Hydrogen District Heating Plant	390							64	50	35	–
Generic boilers											
Gas/Coal Generic industrial boiler plant (bio&synthetic methane ava-le)	59	59	58	58	57	56	56	90	60	40	–
Wood biomass Generic industrial boiler plant	145	142	140	138	136	134	134	83	60	40	–
Biomass from Industrial Waste Generic industrial boiler plant	270	260	250	240	230	220	220	80	60	40	–
Hydrogen Generic industrial boiler plant	145	142	140	138	136	134	134	81	60	35	–
CHP autoproduction											

Technologies	Overnight Capital Cost (CAPEX), €/ kWe							Efficiency (Electric), %	Availability factor, %	Lifetime, years	Heat Rate
	2020	2025	2030	2035	2040	2045	2050				
Hard Coal CHP autoproduction	3600							3-15	15	35	2.7-18
Gas CHP autoproduction (with availability of bio or synthetic methane)	1080							3-15	15	35	4.4-20
Coke Oven Gas CHP autoproduction	1080							3-15	15	35	3.3-26.7
Blast Furnace Gas CHP autoproduction	1080							3-15	15	35	3.3-21
Heavy fuel oil CHP autoproduction	1080							3-15	15	35	20
Municipal Waste CHP autoproduction	2500							3-15	15	35	4-25
Industrial Waste CHP autoproduction	3500							3-15	15	35	12
Wood biomass CHP autoproduction	3500							3-15	15	35	14
Heat utilization and Separate boilers											
Generic Heat utilization	20							11-100	76-100	40	–
Separate steam boilers in Industry	500							81	1	40	–
Other technologies											
Chemical Absorption Direct Air Capture, electric	2.32	2.05	1.86	1.8	1.7	1.6	1.5	0.014-0.007 PJ/kt CO_2	90	25	–
Chemical Absorption Direct Air Capture, gas	2.32	2.05	1.86	1.8	1.7	1.6	1.5	0.014-0.007 PJ/kt CO_2	90	25	–
Methanation	600	500	450	400	350	300	250	75-83 (H2)	95	25	–
Hydrogen DRI production	360	355	350	345	340	333	324	17 PJ H2/Mt DRI	85	40	–
Low carbon Iron ore concentrate production	96							64-75	1	30	–
Electrolyzer Alkaline, *€/ kW*	650	500	450	375	300	275	250	67-75	97	25-35	–
Electrolyzer PEM, *€/ kW*	925	800	650	550	450	425	400	58-71	97	20-30	–
Electrolyzer SOEC, *€/ kW*	4500	3200	1900	1620	1340	1060	780	77.5-83.5	91	10-20	–
Steam methane reforming Large			10.6					77	90	20	–
Steam methane reforming Small			22					69	80	20	–
Solar Methane Steam Reforming Large			9.8					120	90	20	–
Solar Methane Steam Reforming Small			27					60	90	20	–
Biomass Gasification to H2 Large			63.4	47.6				50	90	20	–
Biomass Gasification to H2 Small			111	95				33	71	20	–
Ethanol steam reforming			234					67	90	20	–

Source: State Institution "Institute of Economics and Forecasting of NAS of Ukraine"

F.5.5. Methodology for forecasting GHG emissions in agriculture

In the agriculture sector, greenhouse gas emissions were assessed and projected for the following categories of agricultural activities: "Enteric fermentation," "Manure management," "Rice cultivation," "Agricultural soils," "Soil liming," and "Urea application."

In order to ensure consistency and compliance with the national greenhouse gas inventory, the IPCC 2006 methodology[54] and the coefficients used to estimate greenhouse gas emissions in the "Agriculture" sector Ukraine's National Inventory Report 1990-2022.

The source of data on activities for the period 1990-2022 was the national greenhouse gas inventory database. Greenhouse gas emissions in 2030-2050 were estimated based on projected activity data published in Annex 2 to the National Energy and Climate Plan for the period up to 2030, approved by the Cabinet of Ministers of Ukraine on June 25, 2024, No. 587-r.

Key indicators of planned measures, as well as trends and sustainable development goals for agriculture, were used to model greenhouse gas emissions until 2050 under the WAM scenario. Based on these indicators and taking into account their implementation potential, a forecast of greenhouse gas emission reductions in the relevant categories of agricultural activity was made and applied to the baseline model for the development of the agriculture sector (WEM scenario).

Measures that are appropriate for reducing greenhouse gas emissions in livestock farming are focused on changing qualitative characteristics and do not regulate the number of livestock used in the WEM scenario. Thus protein-concentrated feed (bypass products) is used to regulate the potential for methane formation during intestinal fermentation (enteric fermentation) – the use of up to 20% bypass products from the amount of concentrated feed in the diet of cattle contributes to a more than 10% reduction in methane emissions. The use of bypass products is an economically costly measure and therefore requires substantial state support and incentives. Bypass products are a relatively new direction in the development of livestock feeding systems and have the potential to increase their efficiency.

Manure management practices have significant potential, not only in terms of the possibility of using animal manure in biogas plants for methanogenesis, but also in terms of a set of measures for the collection, transportation, storage, and use of manure. The set of possible measures is determined by the production capacity of livestock complexes, and therefore the trend towards grouping agricultural enterprises by number of animals was the main factor in forecasting greenhouse gas emission reductions.

The focus on the development of regenerative and environmentally friendly agriculture has determined measures to reduce greenhouse gas emissions in crop production.

The intensification of information and telecommunications technologies served as a driver for the optimization of agriculture. Assumptions were made about the effectiveness of these technologies on the quantitative and qualitative indicators of agricultural practices (number of practices used, area of application, fuel consumption, etc.) and the impact of these changes on greenhouse gas emissions.

Organic farming is a symbol of environmentally safe agricultural products and therefore occupies a special place in the strategy for sustainable agricultural development. For the development and implementation of organic farming, there is a need for the necessary amount of organic fertilizers, proper selection of field crops, and soils suitable for this purpose. It was the amount of soils suitable for organic farming with the appropriate infrastructure that served as a regulating factor for modeling.

Based on many years of experience in agriculture, it has been assumed that organic farming cannot fully meet the needs of domestic and foreign markets for crop products, and therefore, it is expected that adjacent

[54] 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H. S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds). Published: IGES, Japan. – URL: https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html

farming will be practiced, based on the use of nitrogen mineral fertilizers, which lead to significant direct and indirect greenhouse gas emissions. By their chemical nature, nitrogen mineral fertilizers consist of nitrogen-containing salts, which are characterized by low stability. This leads to an increase in rates (it is known that 14-15% of nitrogen mineral fertilizers are lost "immediately" during application) and the frequency of their application. New forms of mineral fertilizers with slow or controlled nitrogen release can partially or completely solve the problem of the number of agronomic measures regarding the frequency of fertilizer application and their quantity. The main factor for modelling the application of nitrogen fertilizers with slow or controlled release of the active substance is their economic efficiency and state support for this measure.

F.5.6. Methodology for forecasting GHG emissions in the waste management sector

The assessment of GHG emissions in the waste management sector was carried out in accordance with the principles and methodologies of the 2006 IPCC Guidelines for National GHG Gas Inventories[55](hereinafter referred to as the 2006 IPCC Guidelines), therefore the sources of GHG emissions do not correspond to the types of economic activity, but to the categories recommended in the above-mentioned methodologies (IPCC categories) in the "Waste" sector. Accordingly, emissions from the management of agricultural residues, as well as relevant GHG emission reduction policies, were taken into account either in the LULUCF sector or in the energy sector, if such policies were accompanied by useful energy production. GHG emissions that are accompanied by the beneficial use of energy during waste treatment, such as biogas recovery at landfills, as well as energy production at waste incineration plants and waste incineration in cement production, have been taken into account in the Energy sector, but the effect of reducing GHG emissions as a result of carrying out the corresponding activities were taken into account in the waste management sector. The assessment of GHG emissions in the "Waste" sector was carried out in strict accordance with the methods and taking into account the emission factors used to report[56] Ukraine's national GHG emissions within the framework of obligations under the UN Convention on Climate Change and the Paris Agreement. For example, the assessment of methane emissions due to waste disposal in landfills was carried out using the first-order decay method, as recommended in the 2006 IPCC Guidelines.

General assumptions and methodological principles for determining data on activities in the "Waste" sector: the following indicators and trends were used during modeling in the Waste sector by category, where sector-specific indicators are highlighted in italics:

Disposal of solid waste: population, specific volumes of solid waste generation (domestic waste) per inhabitant, waste management practices (proportion of disposal, reuse, recycling, composting, incineration), coverage of the population by the system of centralized waste collection, construction of new sanitary (deep managed) landfills, composition of landfills, proportion of flaring and biogas recovery at landfills.

In order to ensure the principle of transparency, the model of the mass balance of household waste used during the modeling of GHG emissions in the "Waste" sector is shown in Figure II.22, from which the following basic provisions of mathematical modeling follow:

1. The total amount of generated household waste corresponds to the amount of officially and illegally buried household waste[57]. The initial data for estimating the volume of the household waste generation are: population, coverage of the population by the system of centralized solid waste collection, specific volume of solid waste generation per inhabitant.

2. After estimating the volumes of the household waste generation, these volumes are divided into separate streams of household waste components, the value of which, in turn, is determined on the basis of

[55] https://www.ipcc-nggip.iges.or.jp/public/2006gl/

[56] https://unfccc.int/documents/628276#main-content

[57] Unspecified practices (e.g. home composting, gray recycling, etc.) of household waste management not covered by the centralized collection system are excluded from the mass balance because they do not result in significant GHG emissions.

their component (morphological) composition. These streams are: paper and cardboard, food waste and food industry waste at all stages of production and consumption, waste from green spaces, wood, personal hygiene products, rubber and leather, textiles and non-biodegradable components (including ferrous metals, non-ferrous metals, glass, plastic, dangerous and other inorganic waste). At the same time, household waste that is not covered by the centralized collection system is disposed of in unmanaged shallow landfills.

3. Food waste and food industry waste at all stages of production and consumption and waste from green areas as part of the stream of mixed MSW form a stream for composting (biological treatment), the volume of which is determined by the total share of composting.

4. Glass forms a stream for reuse, the volume of which is determined by the share of reuse.

5. Paper, cardboard and non-biodegradable components (in particular, plastics and metals) form a stream for recycling, the volume of which is determined by the total share of recycling.

6. The rest (remainder) of household waste is divided into two streams: incineration and disposal, which in turn are determined by the share of incineration.

7. The distribution by types of disposal sites is determined by the construction of new sanitary landfills.

Biological processing (composting) of solid waste): population, indicators of the development of the industrial and agricultural sectors, specific volumes of solid waste generation per inhabitant, the share of composting and composting technologies.

Incineration and open burning of waste: GDP growth, industrial sector development indicator, category-specific legislation (ban on incineration of waste without energy use).

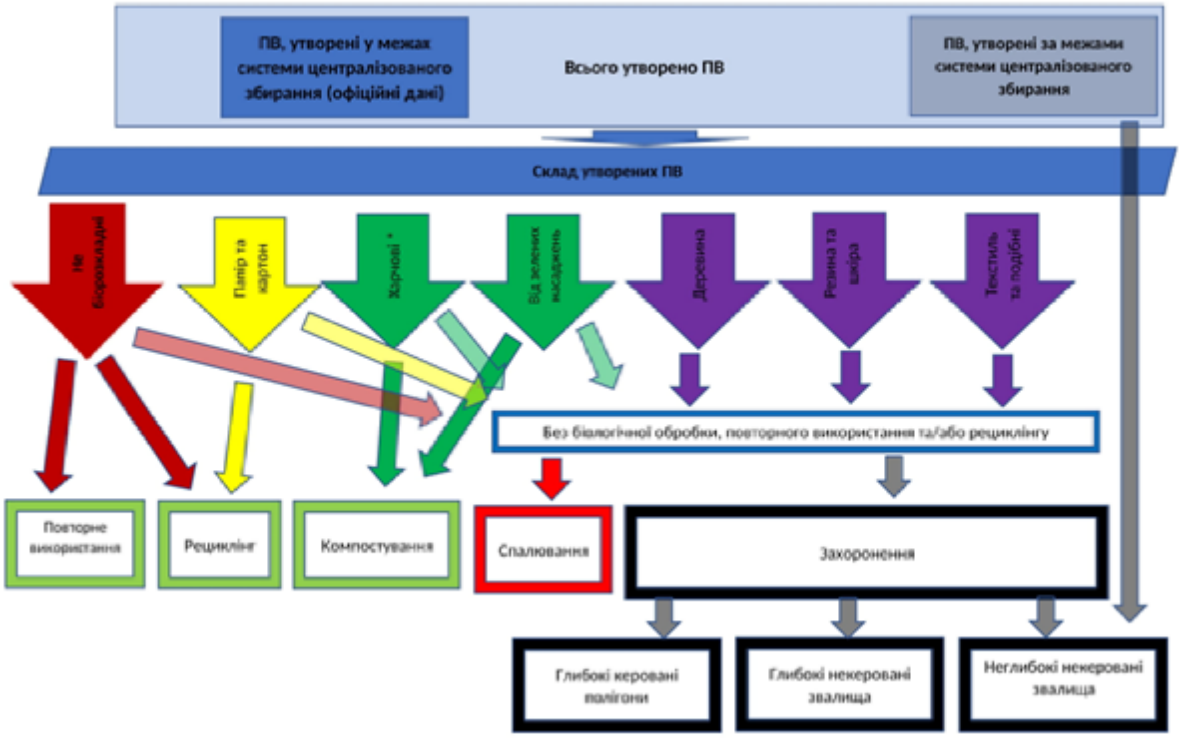
Treatment and discharge of wastewater: population, share of urban and rural population, indicators of sector development (energy, ferrous metallurgy, agriculture, food industry, etc.), share of treatment and discharge; consumption of meat products, dairy products and fruits per inhabitant, development of technologies, share of flaring and recovery of methane formed during wastewater treatment.

It should be noted that the issue of increasing RES waste (including components of solar panels and wind turbines) and their processing methods for the purposes of modeling GHG emissions in the "Waste" sector was not considered, because such emissions are insignificant in the context of forecasting emissions by IPCC emission sources in the "Waste" sector. The question of growing biomass with the aim of its further use for energy purposes was also not considered in the "Waste" sector, because according to the IPCC definitions, such activity is not evaluated in the "Waste" sector.

Adherence to the principle of "Do no significant harm" in the context of the development of waste thermal treatment technologies

The principle "Do No Significant Harm" is the basis for prioritizing the development of this or that technology under the conditions of sustainable development of the country. It is based on the concept that the development of activities that cause a significant negative impact on the environmental goals defined in Article 17 of EU Regulation 2020/852 cannot be encouraged.

Considering that only modern technologies of thermal treatment of waste can comply with the principle of "No significant harm" and taking into account the five-level hierarchy of waste defined in Directive No. 2008/98/EC, in which thermal treatment methods are in the penultimate place in order of priority, in both the WEM and WAM scenarios, waste heat treatment technologies found limited use. Thus, according to the WEM scenario, the share of heat treatment will reach 7% by 2030 and 10% by 2050; and under the WAM scenario – 8% by 2030 and 15% by 2050. These indicators are significantly lower than the corresponding indicators of those European countries that have made significant progress in the transition to a circular economy: for example, the share of thermal treatment of solid household waste in Switzerland is about 48%, in Belgium - 46%; Sweden – 59%; Denmark - 39%, etc.



Note: Food waste and food industry waste at all stages of production and consumption

Figure II.22. General scheme of the mass balance model of household waste (mass flows)

Moreover, it is possible that in the long term, with the further development of thermal treatment technologies, the role of these technologies in the waste management system in Ukraine may be revised in the direction of intensifying their distribution, provided the principle of "Doing no significant harm" is observed.

The target indicators of thermal treatment of solid waste in Ukraine in both WEM and WAM scenarios, on the one hand, were agreed with the normative legal documents in the field of waste management in Ukraine, and on the other hand, correspond to the recommendations provided in the framework of a number of projects of international technical assistance to Ukraine on sustainable and low-carbon development of the waste management system in Ukraine, including:

- the international technical assistance project "Assessment of technological needs in Ukraine" for the waste sector, carried out in 2018-2020 within the framework of GEF funding and implemented by UN Environment and UNEP DTU Partnership.
- the international technical assistance project "Supporting investments in the system of sustainable solid waste management in Ukraine", with the financial support of the Multidonor Account for Ukraine, was implemented by the European Bank for Reconstruction and Development in 2017.

F.5.7. Changes in Methodology

The only biannual reporting document of Ukraine submitted to UNFCCC was the First Biannual Report following provisions of decision 2/CP.17 in the end of 2013. There is not a lot of sense to track all methodology changes since the report has been prepared before the start of russian aggression in 2014, situation in the country, as well as assumptions have changed drastically in 12 years. For example, it contains a projections of GHG by 2030 by the Baseline, Optimistic and Pessimistic scenarios with values ranging from 561.5 Mt CO2-eq in Optimistic and 522 Mt CO2eq in Pessimistic with Baseline being in between. Comparing to the values set in this BTR1, the lowest estimation in the BR1 is 2.1 times higher than value in WEM in 2030.

F.6. Assumptions on Policies and Measures

The following policies and measures were included in the modelling scenarios for NECP development (Tables II.30, II.31, II.32).

Table II.30. Assumptions on Policies and Measures in the NECP scenarios

Dimension	Objectives	Existing policies and measures (WEM scenario)	Planned policies and measures (WAM scenario)
Decarbonization	• Reduction of GHG emissions by 65% compared to 1990 level by 2030 • Climate neutrality of the energy sector of Ukraine by 2050 • Climate neutrality (for the economy as a whole) by 2060 • Decommissioning of coal-fired generation by 2035 • Reducing methane emissions by 30% compared to 2020 level by 2030. • Strengthening the adaptive capacity and resilience of social, economic and environmental systems to climate change • The share of renewable energy sources in the total final energy consumption should be at least 27% in 2030 • The share of RES in the total electricity generation at the level of 25% in 2030 • The share of alternative energy sources (renewable energy sources and secondary energy resources) in the production of thermal energy by installations in the field of heat supply in 2025 – 30%, in 2035 – 40% • Increasing the level of use of alternative fuels (biofuel or its mixture with traditional fuel) and electricity (produced from both traditional and renewable sources) in the transport sector to 50% by 2030	• PM_D_WEM_01 Environmental tax levied on carbon dioxide emissions • PM_D_WEM_02 "Green" tariff for renewable electricity producers • PM_D_WEM_03 Incentive tariff for thermal energy producers from RES • PM_D_WEM_04 Tax benefits for importing RES equipment • PM_D_WEM_05 Market premium mechanism for renewable electricity producers (feed-in premium) • PM_D_WEM_06 Direct electricity purchase and sale contracts between producers and final energy consumers (corporate PPAs) • PM_D_WEM_07 "GreenDIM" Energy Efficiency Fund Program • PM_D_WEM_08 Tax benefits for vehicles equipped with electric motors • PM_D_WEM_09 Stimulating the development of electric charging infrastructure • PM_D_WEM_10 Stimulating the development of low-carbon municipal transport	• PM_D_WAM_01 National Emission Reduction Plan from Large Combustion Plants • PM_D_WAM_02 National GHG Emissions Trading System • PM_D_WAM_03 Action plan for the implementation of Ukraine's climate policy within the framework of participation in the global initiative to reduce methane emissions "Global Methane Pledge" • PM_D_WAM_04 Promoting the development of organic crop production • PM_D_WAM_05 Disseminating the use of information and electronic communication technologies in crop production • PM_D_WAM_06 Demining and reforestation after hostilities • PM_D_WAM_07 Nationwide targeted program of land use and protection • PM_D_WAM_08 Disseminating the practice of household waste components reuse • PM_D_WAM_09 Disseminating the practice of household waste recycling • PM_D_WAM_10 Disseminating the practice of household waste organic components composting • PM_D_WAM_11 Disseminating the practice of thermal treatment of household waste (with obtaining useful energy) • PM_D_WAM_12 Increasing the amount of disposal (recovery and flaring) of biogas at landfills • PM_D_WAM_13 System of auctions for distribution of support quota for RES • PM_D_WAM_14 Guarantees of origin of electricity from RES • PM_D_WAM_15 Mandatory use of liquid biofuel (biocomponents) in the field of transport, which meets sustainability criteria • PM_D_WAM_16 Implementation of unified electronic trade in solid biofuels • PM_D_WAM_17 Development of the energy crops sector • PM_D_WAM_18 Simplification of permit procedures for RES projects • PM_D_WAM_19 State target program for the just transition of coal regions of Ukraine for the period until 2030 • PM_D_WAM_20 Implementation of climate change adaptation measures at the national and local levels

Dimension	Objectives	Existing policies and measures (WEM scenario)	Planned policies and measures (WAM scenario)
Energy efficiency	• Primary energy consumption in 2030 should not exceed 72,224 thousand toe, and final energy consumption should not exceed 42,168 thousand toe. • The total amount of energy saved in the final use for the years 2021-2030 should be at least 17,300 thousand toe. • The expected energy saving in the buildings of state authorities is at least 21.4 toe/year	• PM_EE_WEM_01 Activities of the Energy Efficiency Fund • PM_EE_WEM_02 Decarbonisation and Energy-Efficient Transformation Fund • PM_EE_WEM_03 Energy service in the public sector • PM_EE_WEM_04 Minimum requirements for energy efficiency of buildings • PM_EE_WEM_05 Certification of energy efficiency of buildings • PM_EE_WEM_06 Exemplary role of buildings of state authorities • PM_EE_WEM_07 National database of energy and operational characteristics of buildings • PM_EE_WEM_08 Energy management in state authorities • PM_EE_WEM_09 Energy management in local self-government bodies • PM_EE_WEM_10 Local energy plans • PM_EE_WEM_11 Regional offices for decarbonisation and energy efficiency • PM_EE_WEM_12 Energy-efficient procurement • PM_EE_WEM_13 Energy labeling and ecodesign • PM_EE_WEM_14 Experimental project on creating favorable conditions for ensuring efficient consumption of electricity in Ukraine • PM_EE_WEM_15 Energy audit of large enterprises • PM_EE_WEM_16 Intelligent energy accounting systems • PM_EE_WEM_17 Regulation of the combined production of heat and electricity (cogeneration) • PM_EE_WEM_18 Heat supply schemes • PM_EE_WEM_19 Qualification of cogeneration plants • PM_EE_WEM_20 Provision of thermal energy accounting	• PM_EE_WAM_01 Scheme of obligations on energy efficiency • PM_EE_WAM_02 State targeted economic program to support thermal modernisation of buildings until 2030 • PM_EE_WAM_03 Nearly-zero energy buildings • PM_EE_WAM_04 Assessment of the energy efficiency potential of the gas transportation system, electricity transmission system, gas distribution system, electricity distribution system • PM_EE_WAM_05 Update of the Concept of implementation of state policy in the field of heat supply • PM_EE_WAM_06 Improvement of the model of state regulation in the field of heat supply • PM_EE_WAM_07 Settlement of debts of heat supply enterprises for consumed natural gas • PM_EE_WAM_08 Assessment of the application potential of efficient district heating and highly efficient cogeneration • PM_EE_WAM_09 Guarantees of the origin of electricity produced by a highly efficient cogeneration plant • PM_EE_WAM_10 Stimulation of the development of highly efficient cogeneration • PM_EE_WAM_11 Update of the Concept of implementation of state policy in the field of heat supply • PM_EE_WAM_12 Implementation of the State Targeted Economic Program for the Energy Modernisation of State- or Municipal-Owned Heat Producers for the Period Until 2030

Dimension	Objectives	Existing policies and measures (WEM scenario)	Planned policies and measures (WAM scenario)
Energy security	• Reduction of import dependence (gross imports in TPES) to 33% • Deepening the diversification of sources and routes of supplying energy resources from third countries: - ensuring diversification of supplies at the level of no more than 30% from a single supplier, - reducing the share of a single supplier in the nuclear fuel market to 60% • Increasing the flexibility of the national energy system • Eliminating restrictions or interruptions in the supply of energy resources in order to increase resilience	• PM_ES_WEM_01 Development of routes for the imports of petroleum products and natural gas • PM_ES_WEM_02 Creation of fuel assemblies production capacity to meet at least 50% of the needs of Ukrainian nuclear power plants • PM_ES_WEM_03 Creation of gas reserves (filling of gas storages) • PM_ES_WEM_04 Creation of coal and backup fuel (fuel oil) reserves • PM_ES_WEM_05 Implementation of the first standard of conduct for gas infrastructure facilities (N-1 Standard), standards of conduct for gas suppliers • PM_ES_WEM_06 Fulfillment of the minimum criteria for the security of electricity supply • PM_ES_WEM_07 Creation of a national system for the protection of CIF of the energy sector • PM_ES_WEM_08 Experiment on the construction, repair and other engineering and technical measures for the protection of CIF • PM_ES_WEM_09 Financial reserve for the decommissioning of nuclear installations • PM_ES_WEM_10 Management of spent nuclear fuel and radioactive waste (RAW)	• PM_ES_WAM_01 Incentives for increasing gas production for maximum self-sufficiency • PM_ES_WAM_02 Restoration of oil refining and/or construction of a new refining complex • PM_ES_WAM_03 Creation of fuel assemblies production capacity to meet all the needs of Ukrainian nuclear power plants • PM_ES_WAM_04 Development of uranium production • PM_ES_WAM_05 Creation of minimum stocks of crude oil and petroleum products • PM_ES_WAM_06 Implementation of EU rules on security of electricity and gas supply • PM_ES_WAM_07 Provision of physical, engineering, technical and cyber protection of 100% CIF of the energy sector • PM_ES_WAM_08 Creation of backup power sources of CIF, including using distributed renewable energy generation
Internal energy market (common objectives, policies and measures)	• Full and comprehensive integration with European energy markets • Market-based energy pricing for all categories of consumers • Effective mechanisms of support for vulnerable segments of the population • Achieving performance indicators of wholesale and retail markets	• PM_IM_WEM_01 Current procedures for energy infrastructure development planning • PM_IM_WEM_02 Provision of targeted subsidies for partial compensation of costs of housing and utility services • PM_IM_WEM_03 Regulation and liberalization of retail prices • PM_IM_WEM_04 Universal Service Supplier and Supplier of Last Resort • PM_IM_WEM_05 Ensuring consumer access to important information • PM_IM_WEM_06 Application of tools to facilitate comparison of commercial offers and consumer choice	• PM_IM_WAM_01 Development mechanisms of new • interconnectors • PM_IM_WAM_02 Additional procedures for energy infrastructure development planning • PM_IM_WAM_03 Ensuring the independence of the NEURC • PM_IM_WAM_04 Institutional protection of vulnerable consumers • PM_IM_WAM_05 Application of online services for consumers (eConsumer) • PM_IM_WAM_06 Measures to monitor and overcome energy poverty

Dimension	Objectives	Existing policies and measures (WEM scenario)	Planned policies and measures (WAM scenario)
		• PM_IM_WEM_07 Simplified procedure for supplier switching • PM_IM_WEM_08 Development of organized wholesale energy markets	
Internal energy market: electricity	• Integration of the energy system of Ukraine with ENTSO-E countries • (interconnectivity) at the level of 10% by 2030 • Adequacy and flexibility of the power system • Implementation of smart metering of electricity and smart grids • Reducing the average duration of power outages (SAIDI) to 150 minutes in urban areas and 300 minutes in rural areas (by 2050)	• PM_IME_WEM_01 Stimulating regulation of distribution system operators • PM_IME_WEM_02 Support of active consumers by self-production mechanism (net billing) • PM_IME_WEM_03 Simplification and streamlining of permitting procedures for distributed generation facilities (temporary measures) • PM_IME_WEM_04 Prioritization of RES facilities in dispatching • PM_IME_WEM_05 Compensation for curtailment of RES producers (under the "green" tariff) in re-dispatching • PM_IME_WEM_06 Harmonization of price caps on wholesale market segments • PM_IME_WEM_07 Possibility for RES producers to choose the form of participation in the market and to freely switch between them • PM_IME_WEM_08 Non-discriminatory integration of demand-side management, energy storage and aggregation into the energy system and market • PM_IME_WEM_09 Service quality standards and compensation to consumers for non-compliance • PM_IME_WEM_10 Supply of electricity to protected consumers • PM_IME_WEM_11 Time-differentiated prices for household consumers • PM_IME_WEM_12 Dynamic prices for non-household consumers	• PM_IME_WAM_01 Implementation of smart grids • PM_IME_WAM_02 Development of aggregation • PM_IME_WAM_03 Pilot projects and demand-side management programs • PM_IME_WAM_04 Ensuring the development of energy storage facilities • PM_IME_WAM_05 Stimulation of the development of distributed electricity generation from renewables for the period up to 2030 • PM_IME_WAM_06 Roadmap for Development of Distributed Generation • PM_IME_WAM_07 Tenders for the construction of generating capacity and implementation of demand-side management • PM_IME_WAM_08 Implementation of real-time pricing • PM_IME_WAM_09 Integration of spot markets (market coupling) • PM_IME_WAM_10 Integration (coupling) of the balancing market

Table II.31. Key policies and measures in the Waste sector in WEM scenario

№	Key Policy Name	2021/2022 (Statistical Data)	2030	2050
1	Expansion of Reuse Practices for MSW Components	1.5%* (a, 2022)	8%* (full implementation of current policies and measures)	10%*
2	Expansion of Recycling Practices for MSW	5.5%* (a, 2022)	10%* (partial implementation of current policies and measures)	34%*
3	Expansion of Composting Practices for Organic MSW Components	1.2%* (a, 2022)	5%* (partial implementation of current policies and measures)	16%*
4	Expansion of Thermal Treatment Practices for MSW (with energy recovery)	1.7%* (a, 2022)	7%* (partial implementation of current policies and measures)	10%*
5	Increase in Biogas Utilization (Recovery and Flaring) at MSW Landfills and Dumpsites	9.2%** (b, 2021)	15%**, including: 9% – Recovery 6% – Flaring (No explicit legislative target)	36%**, including: 30% – Recovery 6% – Flaring |

Notes: * Percentage of total waste generated; ** Percentage of total methane generated;
(a, 2022) Analysis of the state of municipal waste management in Ukraine for 2022; according to data from the Ministry of Infrastructure.
(b, 2021) National Inventory of Anthropogenic Emissions by Sources and Removals by Sinks of Greenhouse Gases, greenhouse gas emissions in Ukraine for 1990-2021; according to data from the Ministry of Environmental Protection.

Table II.32. Key policies and measures in the Waste sector in WAM scenario

№	Key Policy Name	2030	2033	2050
1	Expansion of Reuse Practices for MSW Components	8%* (full implementation of planned policy trends)	10%* (full implementation of planned policies)	10%*
2	Expansion of Recycling Practices for MSW	26%* (full implementation of planned policy trends)	34%* (full implementation of planned policies)	35%*
3	Expansion of Composting Practices for Organic MSW Components	12%* (full implementation of planned policy trends)	16%* (full implementation of planned policies)	20%*
4	Expansion of Thermal Treatment Practices for MSW (with energy recovery)	8%* (full implementation of planned policy trends)	10%* (full implementation of planned policies)	15%*
5	Increase in Biogas Utilization (Recovery and Flaring) at MSW Landfills and Dumpsites	23%**, including: 19% – Recovery 4% – Flaring (No explicit legislative target)	29%**, including: 23% – Recovery 6% – Flaring (No explicit legislative target)	36%**, including: 30% – Recovery 6% – Flaring

Notes: * Percentage of total waste generated; ** Percentage of total methane generated

F.7. Sensitivity Analysis

A sensitivity analysis in the waste management sector was conducted during NECP preparation to evaluate the additional GHG emission reduction potential from implementing key principles of the circular economy in Ukraine (minimizing waste and pollutants, maximizing the circulation of products and materials, and restoring natural resources) by 2050, compared to the WAM scenario.

The analysis assumes that the draft "National Waste Management Plan of Ukraine until 2033" and the corresponding "Action Plan for the National Waste Management Plan of Ukraine until 2033" will be fully implemented on time. Thus, from 2024 to 2033, Ukraine's waste management system will develop according to the WAM scenario, laying the foundation for the widespread adoption of circular economy principles. Consequently, by 2050, advanced waste management practices currently successful in some European countries leading in circular economy development will be implemented in Ukraine.

The sensitivity analysis examined the additional GHG reduction potential if the share of MSW landfilling gradually decreases from 30% in 2033 to 1% by 2050. Germany, where less than 2% of total waste is landfilled and approximately 47% of MSW is recycled, served as a benchmark.

Additional measures considered in the sensitivity analysis included increasing the share of biogas utilization at MSW landfills from 29% in 2033 to 60% by 2050 (compared to 36% under the WAM scenario) and increasing the utilization of biogas generated from domestic wastewater treatment from 0% in 2033 to 94% by 2050. The UK, which has the highest rates of biogas utilization from MSW landfills and wastewater treatment among Annex I countries of the UNFCCC, was used as a reference.

The sensitivity analysis revealed the following:

- The gradual implementation of best global practices in waste management could reduce annual GHG emissions in the waste sector by 3.6 million tons of CO2-eq by 2050, or 51% compared to the WAM scenario. Consequently, annual GHG emissions in the waste management sector would reach 3.4 million tons of CO2-eq in 2050, or 28% of the 1990 level.
- The most significant contribution to additional GHG reduction compared to the WAM scenario would come from the development of biogas utilization technologies for domestic wastewater treatment, resulting in approximately 1.7 million tons of CO2-eq reductions by 2050. Intensifying biogas utilization at MSW landfills would reduce emissions by about 1.1 million tons of CO2-eq, while nearly banning MSW landfilling by 2050 would result in a reduction of about 0.8 million tons of CO2-eq.

Detailed results of the sensitivity analysis in the waste management sector are illustrated in Figure II.23.

The sensitivity analysis also indicated that in the long term, as Ukraine progresses towards a circular economy, the contribution of the following emission sources to total GHG emissions in the waste management sector will significantly increase:

- Closed landfills and dumpsites (CH_4 emissions).
- Centralized wastewater treatment facilities and sludge processing (N_2O emissions).
- Decentralized human waste storage facilities (CH_4 emissions).

Therefore, after the implementation of the priority measures outlined in the "Action Plan for the National Waste Management Plan of Ukraine until 2033," it will be necessary to develop and implement additional measures to further reduce GHG emissions from these sources in the waste management sector beyond 2033.

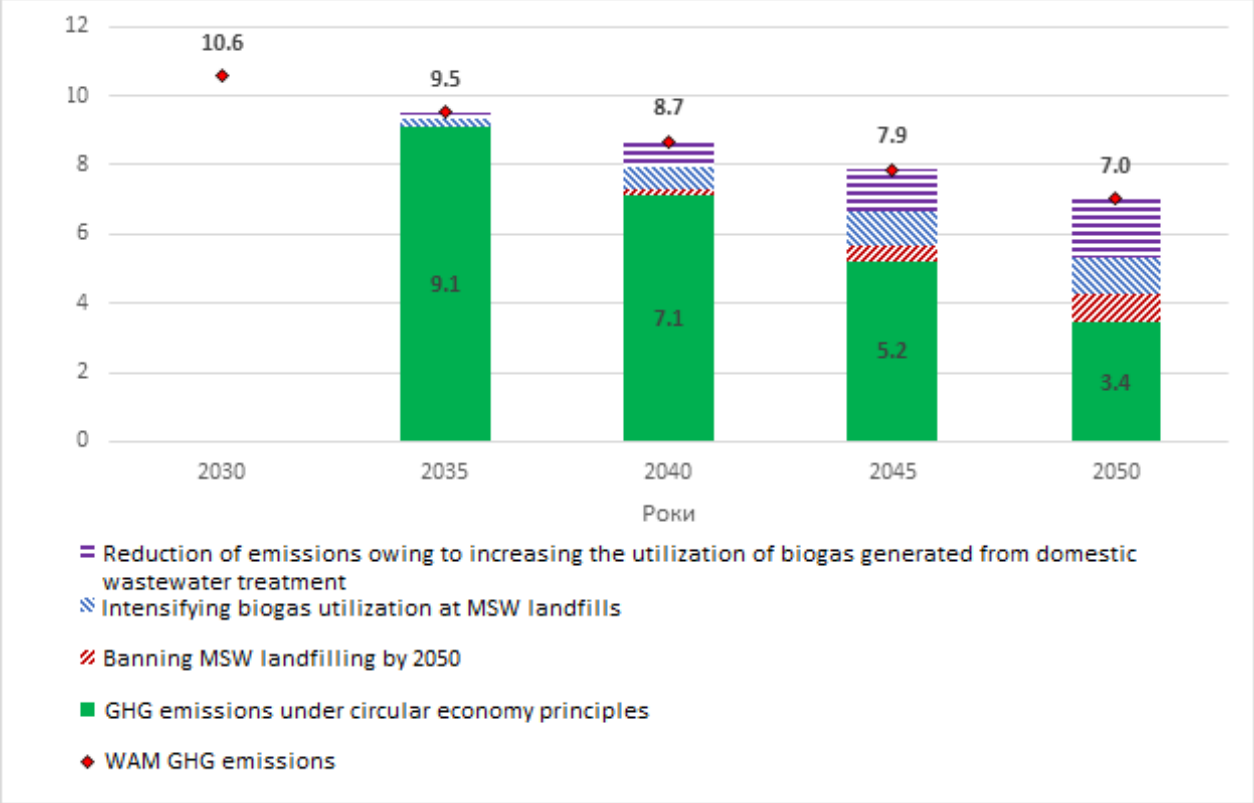


Figure II.23. GHG emissions in the "Waste" sector under implementation of key principles of the circular economy, Mt CO_2-eq

III. INFORMATION RELATED TO CLIMATE CHANGE IMPACTS AND ADAPTATION UNDER ARTICLE 7 OF THE PARIS AGREEMENT

A. NATIONAL CIRCUMSTANCES, INSTITUTIONAL ARRANGEMENTS, AND LEGAL FRAMEWORKS

A.1. National Circumstances

Ukraine is a country located in Eastern Europe. The country's territory is 603700 km2. In the southern part of Ukraine, the country is bordered by the Black Sea and the Sea of Azov. The longest river of Ukraine is the Dnieper River (1095 km), and the biggest lake is Yaplug (149 km2). Most of Ukraine's territory is flat, with an average elevation of about 175 meters above sea level. Mountains are found only in the west (the Carpathians) and the far south (the Crimean Mountains). The lowest point is at the Black Sea level (0 m), and the highest point is Mount Hoverla in the Carpathians, which is 2,061 meters high.

Ukraine has a moderate climate, with cold winters and warm summers. The average winter temperature ranges from -5°C to 2°C, and in summer, it is 18-22°C. During the last several decades, the winter temperature rarely went below 10°C, whereas summers tend to witness tropical nights and heat waves. Ukraine experiences a gradual rise in average temperature (Figure III.1). In 2020, the temperature exceeded the average in 1961-1990 by 2.8°C.

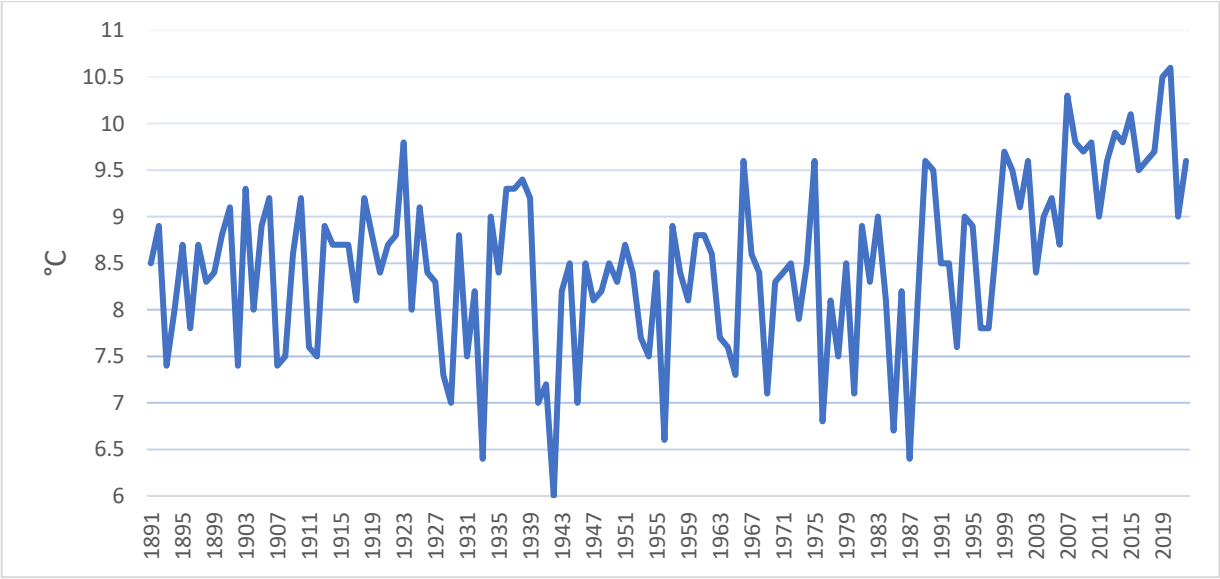


Figure III.1. Average annual temperature in Ukraine, °C

Source: Central Geophysical Observatory named after Borys Sreznevskyi of the State Emergency Service of Ukraine http://cgo-sreznevskyi.kyiv.ua/uk/diialnist/klimatolohichna/klimatychni-danni-po-ukraini

Precipitation occurs throughout the year. The regions with the highest precipitation are the northern and mountainous western areas. The southern and southeastern parts of the country receive very little precipitation during the summer. Ukraine has an extensive network of rivers flowing into the Black Sea, the most prominent of which is the Dnipro River[58].

As of February 2021, the population of Ukraine was estimated at 40.9 million. The full-scale invasion by the Russian Federation in early 2022 triggered large-scale population displacement, with millions of individuals forced to migrate abroad and many others becoming internally displaced persons. This

[58] https://mepr.gov.ua/wp-content/uploads/2023/07/2_Vplyv-zminy-klimatu-v-Ukrayini.pdf

demographic shift has been accompanied by structural unemployment and widespread economic hardships. Additionally, the mobilization of human resources for military engagement has further strained the country's socio-economic fabric. Collectively, these factors have significantly undermined Ukraine's capacity to adapt to climate change, diminishing both institutional and societal adaptive capabilities.

The foundation of Ukraine's economy consists of a diversified industrial sector, agriculture, and services. Prior to the full-scale invasion, the primary sectors were heavy industry, agriculture, and information technology (IT). In 2024, the estimated GDP per capita was USD 5,530.6; nominal GDP stood at USD 186.3 billion; the inflation rate was 13.0%; and the unemployment rate was 10.6%. In 2024, Ukraine's goods exports totalled nearly USD 42 billion. Agricultural products remained the primary driver, accounting for 43% of the total export volume, with corn, sunflower oil, wheat, and rapeseed among the top commodities exported. The metallurgy sector contributed 15.2% of export earnings, mainly from iron ore and steel. Despite ongoing Russian shelling, Ukraine successfully increased its grain shipments abroad. Exports of IT and transport services also played a notable role in the country's overall export performance. Russia's full-scale invasion has caused significant losses to Ukraine's economy. According to the World Bank's estimates, as of early 2025, the total cost of recovery and reconstruction in Ukraine is projected at USD 524 billion over the next decade. Direct damage in Ukraine has reached USD 176 billion. The most severely affected sectors include housing, transport, energy, trade and industry, as well as education. Approximately 13% of the total housing stock has been destroyed or damaged. Around 72% of the total damage is concentrated in all sectors located closest to the front line and in the Kyiv region. In 2024, Ukraine spent 30% of its GDP on defense.

A.2. Institutional Arrangements and Governance

The Ministry of Economy, Environment and Agriculture of Ukraine (Mineconomy) is the central executive body responsible for implementing the national policy on climate change adaptation. Mineconomy reviews and consolidates information from ministries, central and local executive authorities, on the progress of implementing adaptation-related legislation. The bodies ensuring the implementation of the national climate policy are the central and local executive authorities, and local self-government bodies.

A.3. Legal and Policy Frameworks.

The main legal and policy framework includes but is not limited to, the adopted 2030 Strategy for Environmental Safety and Climate Change Adaptation of Ukraine (2021) (hereinafter – the 2030 Strategy), and the Operational Plan for its implementation in 2022-2024. Based on the analysis of the Operational Plan for implementation, it prepares an annual report on the Strategy's implementation, which has been submitted to the Cabinet of Ministers of Ukraine and published on the ministry's official website each year starting in 2023[59].

Strategy for the Development and Implementation of State Climate Change Policy Until 2035[60] (2024) defines the main goals and measures for the implementation of climate policy in Ukraine. The Operational action plan for 2024–2026 includes the development of methodological guidelines for integrating the climate component into state planning documents. The Strategy anticipates conducting vulnerability and risk assessments for vulnerable sectors (population, agriculture, forests, biodiversity, water resources, energy, fisheries, coastal areas, settlements, and tourism). The Strategy presumes the development of regional and local adaptation strategies to incorporate adaptation issues into regional development strategies.

[59] https://mepr.gov.ua/wp-content/uploads/2023/05/Zvit-shhodo-stanu-vykonannya-u-2022-rotsi-Operatsijnogo-planu-realizatsiyi-u-2022-2024-rokah-Strategiyi-ekologichnoyi-bezpeky-ta-adaptatsiyi-do-zminy-klimatu-na-period-do-2030-roku.pdf

[60] https://zakon.rada.gov.ua/laws/show/483-2024-p#Text

Law of Ukraine "On the Basic Principles of State Climate Policy in Ukraine"[61] (2024) establishes the goal of reaching climate neutrality by 2050. It sets long-term goals of including enhancing resilience and reducing risks to public health, ensuring low-carbon and sustainable development, as well as Ukraine's environmental, food, and energy security. The Law outlines the distribution of powers regarding management and regulation in the field of climate policy, including the development of a Climate Change Adaptation Strategy, which assesses risks, identifies priorities and measures, and mechanisms for financing and monitoring its implementation. The Law sets requirements for preparing climate change adaptation plans at the local level. It establishes a national system for tracking and evaluating the achievement of state climate policy goals, implementing measures, and climate change forecasting. It provides mechanisms for scientific support and intergovernmental coordination.

Ukraine prioritizes climate policy and the necessity of adaptation to climate change. However, the full-scale aggression of the russian federation against Ukraine, which started in 2022, diminishes the adaptative capacity of people, ecosystems, and the country in general by causing irreparable damage to soils, water bodies, air, forests, flora and fauna, people, emitting harmful substances, including the ones prohibited by the international conventions.

C. ADAPTATION PRIORITIES AND BARRIERS

Broadly, the 2030 Strategy states that key adaptation priorities in Ukraine are to preserve biodiversity and develop the nature reserve fund in Ukraine, to enhance the adaptive capacity and resilience of social, economic, and environmental systems to climate change, to incorporate climate change adaptation measures into national and regional strategies, as well as river basin management plans, and to raise awareness among representatives of central and local government bodies, and local self-governance authorities about climate change adaptation issues. Based on the priorities, the sets of measures include but are not limited to the development of climate change adaptation plans for vulnerable sectors, streamlining climate change adaptation into strategic planning, continuous disaster risk reduction and management, decreasing people's vulnerability,

Adaptation to climate change faces multiple barriers operating across various levels. These barriers can be categorized as follows:

Lack of Human Capital: A significant barrier is the insufficient institutional capacity at both national and, more critically, regional levels to effectively integrate adaptation measures into policy documents and ensure their implementation. Additionally, the ongoing depopulation due to the war has led to a decline in qualified experts, particularly at the local level. Potential solutions include:

- Targeted capacity-building initiatives, such as short-term educational courses;
- Greater inclusion of underrepresented groups, including women and retired professionals, facilitated through flexible working arrangements;
- Enhanced remuneration in ministries and government agencies to attract and retain skilled personnel, with salaries commensurate with workload and responsibilities.

Insufficient Information and Awareness: There is a general lack of awareness regarding the manifestations of climate change and its impacts. Moreover, the absence of centralized information repositories[62] hinders access to comprehensive data on adaptation strategies. To mitigate this barrier:

[61] https://zakon.rada.gov.ua/laws/show/3991-20#Text

[62] In 2023, such an official centralized resource was created – Ukrainian Climate Office https://ukrainian-climate-office.org/en/about/

- Extensive information campaigns should be conducted, leveraging both online and offline platforms[63];
- Development of centralized, accessible databases containing up-to-date information on climate risks and adaptation practices.

Difficulties in Planning and Implementation: Adaptation efforts are impeded by the absence of measurable indicators, making monitoring and evaluating progress challenging. Furthermore, the planning of complex adaptation measures is constrained by limited information on the required financial resources. Addressing these issues requires:

- Development and integration of clear, quantifiable adaptation indicators;
- Engagement of domestic and international experts equipped with advanced modeling tools to support evidence-based planning financed through international technical assistance projects.

Financial Constraints: Financial limitations constitute a significant barrier to adaptation[64], driven by several factors: Adaptation measures often present lower immediate investment returns than mitigation initiatives; The reallocation of national resources towards defence efforts due to the ongoing war has further constrained funding for climate adaptation.

To overcome these financial barriers:

- Establishment of precise, legislatively mandated funding mechanisms sourced from both domestic and international channels;
- Integration of adaptation financing into national budgetary processes to ensure consistent resource allocation and enable effective planning by ministries and governmental bodies.

Ongoing war: hostilities and the occupation of part of Ukraine's territory have significantly complicated the monitoring and implementation of adaptation measures in many regions. The contamination of territories with explosive materials, deforestation due to hostilities and forest fires resulting from hostilities, and the degradation of lands further exacerbate climate-related threats.

D. ADAPTATION STRATEGIES, POLICIES, PLANS, GOALS, AND ACTIONS

Implementation of Adaptation Actions. Article 7 of the Paris Agreement establishes the global goal of adaptation, aiming to enhance adaptive capacity, strengthen resilience, and reduce vulnerability to climate change. Ukraine, as a Party to the Paris Agreement, undertakes actions that align with the global goal.

Enhancing Adaptive Capacity. Ukraine is undertaking measures to improve capacity building and education. These measures include initiatives to educate stakeholders, including government officials, local communities, and businesses, on climate risks and adaptation practices. Training programs and workshops aim to enhance technical knowledge and adaptive skills. The latter are often developed and conducted by NGOs or initiatives within international technical assistance projects. Ukraine supports climate-related *Research and Development* to improve understanding of vulnerabilities and inform evidence-based decision-making. Academic institutions are at the forefront of scientific research and knowledge transfer to the younger generations. Measures aimed at *Strengthening Resilience* are undertaken using the Ecosystem-Based approach. They include, but are not limited to, the restoration of degraded ecosystems, sustainable land management, and nature-based solutions. The country has a well-developed State Emergency Service, trained and equipped to react to emergencies of all natures.

[63] https://enefcities.org.ua/upload/files/Publications/Analytics/zvit_climateadapt.pdf
[64] https://enefcities.org.ua/upload/files/Publications/Analytics/zvit_climateadapt.pdf

Targeted actions are being taken to reduce the vulnerability of sensitive groups and sectors. In the public health sector, measures to address climate-related health risks, such as heat waves and vector-borne diseases, have been implemented. Policies are designed to support vulnerable groups, including low-income families and internally displaced persons.

Ukraine actively participates in international adaptation initiatives and aligns its efforts with global frameworks:

- Nationally Determined Contributions (NDCs): Ukraine's NDCs outline adaptation priorities and commitments, ensuring consistency with the Paris Agreement's objectives.
- Collaboration with International Partners: Engagement with the UNFCCC, EU, and other global organizations facilitates knowledge exchange, technical support, and access to climate finance.

Adaptation Goals and Plans. In response to the global challenges of climate change, Ukraine has developed and adopted the 2030 Strategy for Environmental Safety and Climate Change Adaptation of Ukraine[65] (2021). The 2030 Strategy and the Operational Plan require the respective Ministries to conduct vulnerability and risk assessments and, based on them, to develop the respective sectoral adaptation strategies. The Strategy identifies the following socio-economic sectors as vulnerable to the impacts of climate change: Biodiversity, Water Resources, Energy, Public health, Forestry, Coastal areas, Fisheries, Agriculture and soils, Territorial communities, Transport and infrastructure, and Tourism. They encompass the adaptation priorities.

In 2024, the Strategy for the Formation and Implementation of State Climate Policy until 2035 and the operational action plan for its implementation in 2024–2026[66].Climate change considerations (and the necessity to adapt) are taken into account in the State Forest Management Strategy of Ukraine until 2035[67]; in the Strategy for the Development of Agriculture and Rural Areas in Ukraine until 2030, and the operational action plan for its implementation in 2025–2027[68].

The APENA 3 project was conducted in Ukraine from 2021 to 2024. It was an EU-funded initiative aimed at creating adaptation strategies for three pilot regions of Ukraine: Lviv, Mykolaiv, and Ivano-Frankivsk. Within the project, the respective vulnerability and risk assessments were conducted, the estimates of the adaptation costs needed, and the proposed adaptation measures for different industries and vulnerable sectors[69]. There are several other regions that have conducted the vulnerability assessments; they include Volyn, Kyiv, Sumy and Chernivtsi regions[70].

There are no particular "numeric" adaptation targets established. The only exception is the Irrigation and Drainage Strategy in Ukraine until 2030[71]. As of 2019, Ukraine had 5,485.3 thousand hectares of reclaimed land, including 2,178.3 thousand hectares of irrigated land and 3,307 thousand hectares of drained land with reclamation infrastructure. The available water management and reclamation infrastructure at that time was sufficient to supply water for irrigation to at least 1.5–1.8 million hectares, drain excess water in spring from over 3 million hectares, and regulate water on more than 1 million hectares. Modernizing this infrastructure would require approximately USD 3 billion in investment, enabling additional irrigation on approximately 1,180,000 hectares. The total area of drainage systems in need of modernization measures is estimated to be around 350,000 hectares.

[65] https://zakon.rada.gov.ua/laws/show/1363-2021-p#Text
[66] https://zakon.rada.gov.ua/laws/show/483-2024-p#Text
[67] https://zakon.rada.gov.ua/laws/show/1777-2021-p#Text
[68] https://zakon.rada.gov.ua/laws/show/1163-2024-p#Text
[69] https://energydep.mkrada.gov.ua/news/пілотний-проєкт-apena-3-адаптація-до-зміни/
[70] https://rp.gov.ua/upload-files/Activity/Collegium/2024/58-3_2024/Zvit_58-3_2024.pdf
[71] https://zakon.rada.gov.ua/laws/show/688-2019-p#Text

Integration of Knowledge: The best available science is and should be integrated into adaptation in Ukraine through engaging scientists in policy-making. In its climate change adaptation activity, Ukraine should focus not only on dealing with the consequences of catastrophes but also on their prevention, as anticipated by the Sendai Framework for Disaster Risk Reduction 2015–2030[72]. For that, contemporary forecasting models are needed, as well as experts able to work with these models, cooperate with partners from other countries (international cooperation), and pass the knowledge to the governmental bodies and local authorities[73].

The gender perspective is only gaining momentum and is only starting to be mainstreamed into policy documents. To date, men and women have equal access to opportunities within adaptation projects, yet access to resources might differ. To substantiate, Ukraine does not have enough gender-disaggregated statistics in many aspects. Additionally, only part of the statistical observations is disclosed due to martial law. Traditional and local knowledge are casually integrated into adaptation, as localities are the primary units implementing the adaptation projects.

Development Priorities: Climate change adaptation must be considered during post-war recovery (preferably, it should be Green and Resilient Recovery) and further development. This anticipates building back better and reconstructing infrastructure, considering climate change risks. Supporting biodiversity is also an important element for the country's development.

Mitigation Co-benefits: Adaptation actions leading to mitigation co-benefits include but are not limited to reforestation, which is crucial for carbon sequestration, or the adoption of new technologies (such as the Internet of Things in irrigation and nutrients application, thermomodernization of buildings, and others) that have mitigation co-benefits. These actions are implemented through national and local programs and projects, which include national and local initiatives.

Integration into Development Efforts: there are several ways in which Ukraine incorporates climate change considerations into the development plans. In particular, Ukraine is making efforts to align its legislation with EU legislation, especially for biodiversity, circular economy, and carbon neutrality[74]. When developing a specific sectoral plan, climate change considerations are taken into account. This is especially the case for strategic planning of industries, such as the Transport, Agriculture, Tourism, and Water sectors[75]. To develop particular sector adaptational strategies and development plans, vulnerability and risk assessment is to be conducted for the sectors defined as vulnerable. The local development plans, such as the Sustainable Energy and Climate Action Plans (SECAPs) will include climate change adaptation. Ukraine also intends to submit its 2 NDC in 2025, which contains an adaptation component.

Nature-Based Solutions: Nature-based solutions are crucial for renewing natural ecosystems in the context of climate change adaptation. Ukraine uses nature-based solutions for various purposes, e.g., to create green areas in cities, towns, and villages, clean water bodies, create shade and regulate the microclimate, pollinate plants, retain water in the ground, fertilize the ground with micro-organisms, conservate forests, and many other aspects. Yet, the value and monetization of nature-based solutions is a subject of further study in Ukraine.

Stakeholder Involvement: Stakeholder involvement, including subnational, community-level, and private-sector initiatives, is crucial in developing and implementing adaptation measures. The private sector plays an important role in financing adaptation projects in Ukraine. For instance, in agriculture,

[72] https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030
[73] https://rp.gov.ua/upload-files/Activity/Collegium/2024/58-3_2024/R_RP_58-3_2024.pdf
[74] https://niss.gov.ua/doslidzhennya/natsionalna-bezpeka/priorytety-klimatychnoyi-polityky-ukrayiny-v-konteksti
[75] https://www.undp.org/uk/ukraine/press-releases/uryad-skhvalyv-novu-stratehiyu-dlya-dosyahnennya-ukrayinoyu-klimatychnoyi-stiykosti-do-2030-roku

many adaptation technologies are already being implemented. They are aimed at increasing resilience to climate change and include new agrotechnologies, the use of resilient crop varieties, water retention techniques, and many others.

In Ukraine, civil society actively mobilizes communities and people's participation. Many NGOs study the best adaptation practices, implement them in their communities, advise local authorities on how to implement these best practices, conduct information campaigns to increase knowledge and local expertise, and actively participate in policy-making on the national level.

Strategies for shaping state policy on climate change are crucial documents that outline Ukraine's approach to climate adaptation. They emphasize integrating scientific knowledge, engaging stakeholders, and adopting nature-based solutions to enhance societal and economic resilience. Implementing these strategies will require a comprehensive approach and collaboration across all levels of government and society.

E. PROGRESS ON IMPLEMENTATION OF ADAPTATION

Implementation Status: Ukraine's progress in implementing climate change adaptation measures is a significant step toward ensuring the country's resilience to the impacts of global climate change. Key aspects of this progress include implementing actions outlined in national programs and integrating adaptation strategies into development policies.

The existing legal framework anticipates implementing the actions. In particular, the 2030 Strategy outlines key action areas to reduce the vulnerability of critical sectors. As part of implementing this Strategy, national adaptation plans containing specific measures to enhance resilience to climate change have to be developed.

The provisions of the Irrigation and Drainage Strategy in Ukraine up to 2030 are not fully implemented due to several reasons. The Russian invasion and hostilities in the Kherson and Zaporizhzhya regions, together with the destruction of the Kakhovka Dam, led to a 78% decrease in irrigated lands compared to 2021, as the Kakhovka reservoir was a primary source of freshwater for irrigation.

Program Development Steps: With the valuable help of international partners, using the best scientific knowledge in Ukraine and internationally, Ukraine prepared the drafts of adaptation strategies for the Ivano-Frankivsk, Lviv, and Mykolaiv regions[76], which were chosen as pilot regions. The drafts of the strategies include an analysis of vulnerabilities and risks for various economic sectors, as well as recommendations for specific adaptation measures, such as early warning systems and protective infrastructure. The strategies have not yet been officially adopted.

Past Communications Implementation: The adaptation measures outlined in the national communications are being implemented to address adaptation needs. As part of its Nationally Determined Contributions (NDCs), Ukraine has also identified a series of actions to enhance resilience to climate change. It includes integrating adaptation actions into local economic and social strategies. The adaptation measures are being implemented to address adaptation needs. In its updated NDC (2022), Ukraine stated that by 2030, the country intends to create a baseline for adaptation to climate change in order to increase resilience and reduce vulnerability to climate change, as foreseen in Article 7 of the Paris Agreement[77]. The 2nd NDC, scheduled to be submitted in 2025, will also contain the section on adaptation.

A partial assessment of the risks and vulnerability of water resources to climate change was conducted through the international project of the UNECE and OSCE and the Dniester component of the project "Climate Change and Security in Eastern Europe, Central Asia and the Southern Caucasus". Strategic Directions for

[76] First Climate Change Adaptation Strategies Presented in Ukraine https://com-east.eu/first-climate-adaptation-strategies-in-ukraine-presented-with-eu-support/

[77] https://unfccc.int/sites/default/files/NDC/2022-06/Ukraine%20NDC_July%2031.pdf

Climate Change Adaptation and an implementation plan were developed, an integrated vulnerability analysis of the Dniester Basin[78] was carried out, climate change scenarios for the Dniester Basin were updated[79].

WWF conducted a project INSURE aimed at the study of nature-based solutions in the water, forestry, and agricultural sectors for Ukraine's post-war recovery and further sustainable development considering climate change[80].

Coordination Activities: Coordination between Mineconomy, other Ministries, and various government agencies and stakeholders is essential for the effective implementation of adaptation measures. Changes in legislation are also critical for the adoption of adaptation strategies.

Acknowledging the condition of climate catastrophe and the fact that no country can tackle climate change risks alone, Ukraine is a party to the United Nations Framework Convention on Climate Change and the Paris Agreement. Ukraine actively participates in international cooperation and projects aimed at enhancing resilience to climate change risks and promoting transboundary collaboration.

Ukraine's prioritization of adaptation measures demonstrates a serious commitment to addressing climate change issues. With the strategies and plans in place, the country can reduce the vulnerability of its economic sectors and enhance overall resilience. However, to achieve success, it is essential to establish measurable targets in adaptation and continue working on integrating the respective measures into all aspects of state policy.

F. MONITORING AND EVALUATION OF ADAPTATION ACTIONS

Achievements Assessment: Ukraine has been actively working to integrate climate adaptation into its national legislation and policy frameworks. The country acknowledges the necessity of building resilience to climate change impacts and has taken steps to embed adaptation considerations into strategic documents.

Approaches Used: The approaches and systems used include, but are not limited to, the regular reporting of ministries and governmental agencies, as anticipated by the 2030 Strategy. The following measures (as KPIs) were undertaken[81]:

- Methodological recommendations have been developed for assessing the risks and vulnerabilities of socio-economic sectors and natural components to climate change[82]. It is interesting to note that some sectors have conducted the respective vulnerability assessments prior to the adoption of the Methodology (eg., forestry[83]).
- Methodological recommendations have been prepared for integrating climate change adaptation issues into the economic and social development programs of regions, districts, and cities, as well as into regional development strategies and their implementation plans and action plans for climate change adaptation that local self-government authorities may approve.
- Amendments have been made to the Law of Ukraine "On Environmental Protection" to include climate change issues within its scope. A program document by the Cabinet of Ministers of Ukraine has been developed to manage invasive alien species of flora and fauna in Ukraine until 2030, considering climate change adaptation. On December 17, 2021, the President of Ukraine issued Decree No. 668, approving the Biosafety and Biosecurity Strategy. Among its key directions is introducing a practical

[78] https://www.osce.org/files/f/documents/0/6/366726.pdf
[79] https://dniester-commission.org/ru/climate-change/
[80] https://nbs.wwf.ua/wp-content/uploads/2023/02/politychnyj-poliloh-i-rekomendatsii_insure_ukr.pdf
[81] https://mepr.gov.ua/wp-content/uploads/2023/05/Zvit-shhodo-stanu-vykonannya-u-2022-rotsi-Operatsijnogo-planu-realizatsiyi-u-2022-2024-rokah-Strategiyi-ekologichnoyi-bezpeky-ta-adaptatsiyi-do-zminy-klimatu-na-period-do-2030-roku.pdf
[82] https://mepr.gov.ua/wp-content/uploads/2023/06/386nd1.pdf
[83] https://www.sfi-ukraine.org.ua/wp-content/uploads/2023/11/buksha_climate-change_report_31-01-2022-ukr.pdf

and functional mechanism for managing invasive alien species, including preventing their introduction, controlling their entry or introduction into natural ecosystems, removing them, and mitigating (minimizing) their negative impacts. On July 7, 2022, the Cabinet of Ministers of Ukraine issued Order No. 573 approving the Action Plan for implementing the Biosafety and Biosecurity Strategy for 2022–2025, which, among other measures, provides for organizing informational, scientific-methodological support and establishing a legal mechanism for managing invasive alien species.

- An analysis of the interconnections between migration, climate change, and the environment has been conducted[84].

Ukraine has already gained experience implementing adaptation measures, which can be used to improve the existing policies. Many adaptation actions are implemented locally, being "registered" as environmental actions. Many of them are presented in the Environmental Passports of Regions[85].

Flood risk management plans[86] have been developed and implemented following the European Directive 2007/60/EC. They include the management plans for rivers Dniester, Don, Danube, Southern Bug, rivers of Crimea, the Azov Sea region, and the Black Sea region.

Transparency in Planning/Implementation: Development of strategic documents in the realm of climate change adaptation in Ukraine and the implementation of adaptation measures in Ukraine are undertaken with the active involvement of civil society. Thus, the processes are fully transparent. For instance, while preparing the 2030 Strategy draft, a working group of more than 150 representatives of ministries, scientific institutions, NGOs, business associations, and experts in various fields was created. Nine meetings of the Working Group were held in November 2020 - February 2021. Work on the document included the creation of the public register of proposals.

Adaptation actions are aligned with national and subnational policies. For instance, implementing adaptation measures in agriculture contributes to ensuring food security. Adaptation measures in energy help ensure a reliable energy supply (unless other factors interfere). Adaptation measures in public health help maintain people's well-being and prevent disease spread.

The Accounting Chamber of Ukraine assessed the effectiveness of the adaptation measures undertaken in Ukraine in late 2024[87], and the findings are publicly available.

Stakeholder Engagement & Ownership: The legislative process design in Ukraine anticipates the active involvement of the major stakeholders during the public consultation phase and consultation with other ministries and agencies. NGOs actively contribute their views regarding many matters, including climate change adaptation. In Ukraine, 363 towns and amalgamated communities have joined the Covenant of Mayors, with some of them having adaptation components in their development plans[88] (they were not mandatory until 2020). Overall, climate-related targets of the communities still mainly focus on mitigation rather than on adaptation[89].

Sustainability Results Assessment: Despite the ongoing full-scale invasion, Ukraine prioritizes climate policy as one of the key reforms in the realm of the environment. For instance, the country adopted the Strategy for the Development and Implementation of State Climate Change Policy Until 2035[90] (2024) and the Operational Plan until 2026. Ukraine intends to include an adaptation component

[84] https://ukraine.iom.int/sites/g/files/tmzbdl1861/files/documents/policy-brief-ukr-1.pdf
[85] https://mepr.gov.ua/diyalnist/napryamky/ekologichnyj-monitoryng/ekologichni-pasporty/
[86] https://ips.ligazakon.net/document/KR220895
[87] https://rp.gov.ua/upload-files/Activity/Collegium/2024/58-3_2024/Zvit_58-3_2024.pdf
[88] https://com-east.eu/uk/
[89] https://enefcities.org.ua/upload/files/Publications/Analytics/zvit_climateadapt.pdf
[90] https://zakon.rada.gov.ua/laws/show/483-2024-p#Text

in its post-war recovery plans[91]. A regulatory and legal framework has been developed to ensure disaster prevention, including the Civil Protection Code of Ukraine and civil protection plans approved by the Cabinet of Ministers of Ukraine, updated annually[92]. The Accounting Chamber of Ukraine states that Ukraine is making progress in implementing measures to reduce the risk of catastrophes. The results of adaptation measures must ensure their sustainability. Yet, the measures and indicators are to be revised as climate change aggravates in Ukraine.

G. INFORMATION RELATED TO AVERTING LOSS AND DAMAGE

In Ukraine, the impact of climate change has become more pronounced in recent years. The phenomena with the highest impacts include but are not limited to the growing frequency and duration of droughts, heatwaves, floods, and wildfires. Droughts affect many ecosystems and aspects of life, but first of all, the agricultural output, forestry, and water sectors. Between 1918 and 2018, Ukraine experienced more than 70 droughts, and their occurrence has become increasingly frequent, with a drought occurring every year lately.

Droughts used to occur mainly in southern and eastern Ukraine, but lately, they have been observed even in Western Ukraine. Heat waves are observed almost every year, and every summer sets a new record for observations in some regions (except the summer of 2010, which was recorded as having the highest temperatures), adversely affecting human health. For instance, the summer of 2024 was 2.6℃ above the climatic norm. Irrigation is one of the most effective measures to maintain agricultural output; yet, the war (through the hostilities in Zaporizhzhya and Kherson regions) and the destruction of the Kahkovka dam resulted in the loss of 78% of the irrigation area in Ukraine (compared to 2021), as Kahkovka Reservoir was a major source of fresh water for irrigation in the southern part of Ukraine[93].

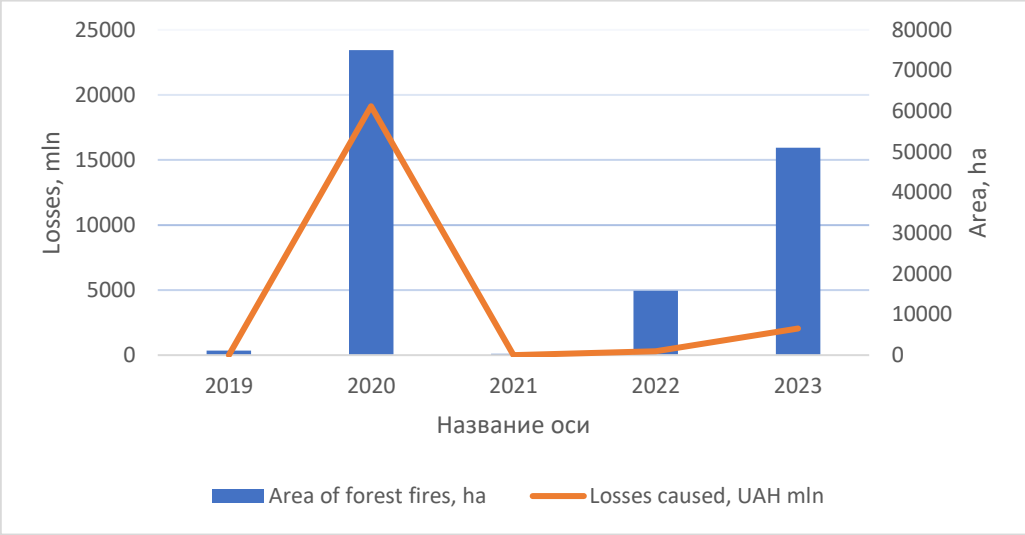
Floods occur mostly in Western Ukraine. For instance, one of the most significant floods occurred in 2017 due to heavy rain and snow, resulting in a high rise in water levels in rivers, especially the Borzhava River, and leading to human fatalities. A comparable magnitude of flooding occurred in 1998 in Ukraine. The flood of 2020 in Western Ukraine damaged more than 14 thousand buildings and ruined 500 km of roads.

In 2008, due to intense rainfall, another flood occurred in Western Ukraine, resulting in estimated losses of USD 618-825 million.

Based on data from the State Emergency Service of Ukraine (SESU), in 2023, 30 natural emergencies occurred, compared to 65 in 2022[94]. The Ministry of Finance of Ukraine states that the distribution of material losses caused by natural disasters is highly variable and shows no correlation with the number of natural disasters, but natural disasters cause the highest losses compared to other disasters. An analysis of averaged statistical data on direct material damages indicates a trend of increasing losses per natural emergency, rising from UAH 9.3 million to UAH 20.9 million[95]. The lowest losses (UAH 103 million) due to natural disasters were observed in 2011, while the highest losses (UAH 1,625.8 million) were recorded in 2019[96]. Over the last 20 years, agricultural losses in Ukraine have reached USD 2 billion, equivalent to 12% of the country's average GDP[97]. The losses of harvest due to droughts reach 10-70%[98].

[91] https://mepr.gov.ua/pershi-v-ukrayini-strategiyi-adaptatsiyi-do-zminy-klimatu-sogodni-prezentuvaly-v-kyyevi/
[92] https://rp.gov.ua/upload-files/Activity/Collegium/2024/58-3_2024/Zvit_58-3_2024.pdf
[93] Infographic Guide *Agrobusiness of Ukraine 2023/2024* https://agribusinessinukraine.com
[94] https://dsns.gov.ua/upload/1/6/6/4/2/7/0/an-kmu-ns-12-2022publzvit.pdf
[95] https://mof.gov.ua/storage/files/Інформація%20про%20фіскальні%20ризики%20та%20їх%20вплив%20на%20показники%20держбюджету%20у%202021%20році.pdf
[96] https://mof.gov.ua/storage/files/Інф_фіск_ризики_вплив_держбюджет_2022.pdf
[97] https://kse.ua/wp-content/uploads/2024/03/CSA_en.pdf
[98] https://rp.gov.ua/upload-files/Activity/Collegium/2024/58-3_2024/Zvit_58-3_2024.pdf

Between 2019 and 2023, 6,861 forest fires occurred, covering an area of 1,433 km², resulting in damages totalling UAH 21.5 billion (Figure III.2).



Source: https://rp.gov.ua/upload-files/Activity/Collegium/2024/58-3_2024/Zvit_58-3_2024.pdf

Figure III.2 Areas of forest fires and losses caused in Ukraine in 2019-2023

We observe, and we expect, a significant increase in mean temperature. The average annual temperature in Ukraine increased by 1.2 °C over the last 30 years, by 1.7 °C from 2010 to 2019. Studies indicate that by 2100, with a continued rise in emissions, temperatures could increase to over 4°C[99], followed by growing climate aridity[100]. Climate change leads to an increased frequency and intensity of natural extreme events, such as droughts, heatwaves, wildfires, storms, and changes in precipitation patterns, as well as floods. Winters are milder, with fewer snowfalls[101]. Almost every year, the country or its territories experience summers with record temperatures. Ukraine is a country already facing a water crisis, and the problem of water stress is projected to worsen in the future[102]. The number of days with extreme heat may increase by 20-26 in southern regions by 2050[103]. Climate change affects water resources. Ukraine observes a decrease in annual precipitation by 1.5-12%[104]. A decrease in winter precipitation can lead to the depletion of aquifers and a reduction in river levels. It poses additional risks to agriculture, biodiversity, and water supply systems.

Climate change has a significant impact on human health and vulnerable sectors. In agriculture in Ukraine alone, droughts lead to productivity losses of many crops[105], and volatility in crop production

[99] Pillai,Madhavi M.; Golub,Elena Strukova; Lokshin,Michael M.; Rakovych,Oksana; Ha,Thanh Phuong. Ukraine - Building Climate Resilience in Agriculture and Forestry (English). Washington, D.C. : World Bank Group. http://documents.worldbank.org/curated/en/893671643276478711/Ukraine-Building-Climate-Resilience-in-Agriculture-and-Forestry

[100] Букша, І. (2022). *Стан оцінювання загроз та адаптаційних заходів у лісовому господарстві України у зв'язку зі зміною клімату* [Forest Policy Report SFI/2022] https://www.sfi-ukraine.org.ua/wp-content/uploads/2023/11/buksha_climate-change_report_31-01-2022-ukr.pdf

[101] Martynyuk, M. (2023). Assessment of the impact of climate change on crop production in Ukraine: Adaptation mechanisms for mitigating the consequences. Scientific Horizons, 26(11), 145-154. doi: 10.48077/scihor11.2023.145.

[102] https://www.wri.org/applications/aqueduct/water-risk-atlas/#/?advanced=false&basemap=hydro&indicator=drr_cat&lat=43.97067917972948&lng=36.553710401058204&mapMode=view&month=1&opacity=0.5&ponderation=DEF&predefined=false&projection=absolute&scenario=optimistic&scope=baseline&timeScale=annual&year=baseline&zoom=5

[103] https://ua.boell.org/en/2020/06/09/yak-proyavlyaetsya-zmina-klimatu-v-ukraini

[104] https://dspace.organic-platform.org/xmlui/bitstream/handle/data/423/38_Биков%20М._APD_Зміна%20клімату%20та%20сільське%20господарство%20в%20Україні.%20Що%20варто%20знати%20фермерам.pdf?sequence=1&isAllowed=y

[105] Schierhorn, F., Hofmann, M., Gagalyuk, T. et al. Machine learning reveals complex effects of climatic means and weather extremes on wheat yields during different plant developmental stages. Climatic Change 169, 39 (2021). https://doi.org/10.1007/s10584-021-03272-0

due to climate change would increase. On one hand, warmer weather may extend the vegetation period for crops; on the other hand, droughts cause significant harvest losses[106]. Extreme weather events adversely affect the infrastructure, including road surfaces, buildings, bridges, and dams. Extremely high temperatures can alter the capacity of the electricity transmission and distribution networks, leading to overload and increased temperatures in the cooling ponds of nuclear and thermal power plants, which in turn decrease their efficiency.

Several approaches, methodologies, and tools are used to assess the impacts of climate change in Ukraine. They include, but are not limited to, regular monitoring of weather conditions and environmental situations; climate modeling to forecast climate change and its consequences; and vulnerability and risk assessment to assess risks for vulnerable sectors.

Ukraine invests in infrastructure resilience at both national and regional levels, such as rebuilding water drainage systems in cities and towns, restoring energy grids, greening, and others. Due to the ongoing war, the possibilities for wider infrastructure development are limited; yet, these considerations are to be fully considered during the Green and Resilient Reconstruction after the war. Ukraine undertakes *Disaster Risk Reduction* measures to mitigate the impacts of extreme weather events. Early warning systems, emergency response frameworks, and community preparedness programs are vital. In particular, separate monitoring systems operate at sectoral and regional levels, as well as at other levels, functioning as independent systems that include elements of monitoring and forecasting emergencies. The environmental monitoring system, which has existed since 1998 and was updated in 2024[107], includes a response to environmental emergencies. The State Emergency Service of Ukraine tracks the implementation of Flood Risk Management Plans[108].

Stakeholders in Ukraine are working on developing regional adaptation strategies. The concrete measures include but are not limited to the enhancement of early warning systems, strengthening of infrastructure (especially protective constructions, improving the water drainage systems, development of irrigation systems for agriculture), improved water bodies management, awareness raising, implementing numerous adaptation technologies in critical sectors such as agriculture and developing the insurance system for climate change-induced losses.

Mineconomy coordinates climate change activities at the national level. It is responsible for developing adaptation policies and strategies and monitoring their implementation. In 2020, the Interagency Commission on Climate Change and Ozone Layer Protection[109] was established. At the regional level, communities are required to adopt SECAPs (Sustainable Energy and Climate Action Plans) that include an adaptation component. The requirements for forming the adaptation component aim to enhance the capacity of local authorities in climate change management.

[106] https://www.worldbank.org/en/news/press-release/2022/02/09/new-world-bank-study-analyzes-climate-change-impact-in-ukraine

[107] Resolution No. 684 of the Cabinet of Ministers of Ukraine dated June 13, 2024 On the Approval of the Procedure for the Functioning of the State Environmental Monitoring System and Its Subsystems. The Resolution enters into force simultaneously with the Law of Ukraine No. 2973-IX of March 20, 2023, "On Amendments to Certain Legislative Acts of Ukraine Regarding the State Environmental Monitoring System, Environmental Information, and Information Support for Environmental Management".

[108] Approved by the Resolution of the Cabinet of Ministers of Ukraine No. 895-r dated October 8, 2022 https://dsns.gov.ua/upload/1/6/6/3/1/2/5/r0895.pdf

[109] https://mepr.gov.ua/gromadyanam/zv-yazky-z-gromadskistyu/komisiyi-organizatsijni-komitety-naukovo-tehnichni-rady-ekspertni-grupy-mindovkillya/mizhvidomcha-komisiya-z-pytan-zminy-klimatu-ta-zberezhennya-ozonovogo-sharu/nakaz-mindovkillya-pro-zatverdzhennya-personalnogo-skladu-mizhvidomchoyi-komisiyi-z-pytan-zminy-klimatu-ta-zberezhennya-ozonovogo-sharu/

H. COOPERATION, GOOD PRACTICES, EXPERIENCE, AND LESSONS LEARNED

Sharing Information & Best Practices: In Ukraine, international cooperation with donors' funds and international organizations is crucial in enhancing the legislative and institutional framework and ensuring technology transfer. For instance, in 2021-2022, Ukraine significantly benefitted from cooperation with the Global Environmental Fund (GEF), the UN Development Program (UNDP), the UN Environmental Program (UNEP), Food and Agriculture Organization (FAO), World Wild Fund (WWF), Global Water Partnership (GWP), the Covenant of Mayors, the World Bank, Gesellschaft für Internazionalle Zusammenarbeit (GIZ) and others. Several international projects have been implemented, such as Technology Needs Assessment (containing adaptation components in agriculture and water sectors); APENA 3 (aimed at conducting the vulnerability and risk assessment of the three selected regions in Ukraine and developing the drafts of the regions adaptation strategies); UNDP and GIZ activities are focused on enhancing the capacity building and legislative support; Covenant of Mayors enables the increase of capacity building at the level of local stakeholders and ensuring internal cooperation between them. The World Bank has contributed to the detailed study of climate change impacts and agriculture in Ukraine. Ukraine established the Ukrainian Climate Office as a hub addressing various climate-related topics and sharing information with multiple stakeholders.

Strengthening Scientific Research & Knowledge Sharing: The activities in the realm of adaptation are supported by the strong scientific base embodied in the Hydrometeorological Institute and Central Geophysical Observatory named after B. Sreznevskyi, Ukrainian Research Institute of Forestry and Forest Melioration named after H. Vysotsky, Institute of Water Problems and Land Reclamation of Agrarian Academy of Sciences of Ukraine, Institute of Problems of Mathematical Machines and Systems of the National Academy of Sciences of Ukraine, N.G. Kholodny Institute of Botany, Kyiv National University of Construction and Architecture, T. Shevchenko National University of Kyiv, the National University of Kyiv-Mohyla Academy, I. Franko National University of Lviv and many other research institutions within the Academies of Sciences of Ukraine and the Universities. Ukraine has a pro-active civil society and non-governmental organizations with strong expertise in climate-related aspects.

IV. INFORMATION ON FINANCIAL, TECHNOLOGY DEVELOPMENT AND TRANSFER AND CAPACITY BUILDING SUPPORT NEEDED AND RECEIVED UNDER ARTICLES 9–11 OF THE PARIS AGREEMENT

A. NATIONAL CIRCUMSTANCES, INSTITUTIONAL ARRANGEMENTS AND COUNTRY-DRIVEN STRATEGIES

A.1. A description of the systems and processes used to identify, track and report support needed and received, including a description of the challenges and limitations:

A wide range of official sources and expert estimates are used to report on the support required and received. To keep track of changes in legislation and national policies, as well as participation in international initiatives, the official websites of government agencies are monitored and consultations with their representatives are held within the working group.

To calculate the flow of funding received, was used:

- OECD database climate-related development finance datasets - recipient perspective[110];
- statistics of the Ministry of Finance of Ukraine on Cooperation in Attracting Financing from the International Financial Institutions [111], as well as the portal of the register of IFI projects[112] and the Unified Portfolio of Public Investment Projects database (list of priority public investment projects)[113];
- map of donor projects from the Ukrainian Climate Office;[114]
- expert estimates.

The key challenges and limitations for reporting on financial support needed and received are the lack of systematic information on the needs, commitments, content and progress of decarbonization investment projects, also poor reporting on the use, impact and expected results of climate finance. Additional difficulties are caused by underdeveloped institutional coordination and stakeholder engagement.

A.2. Information on country priorities and strategies and on any aspects of the Party's NDC under Article 4 of the Paris Agreement that need support

Despite the extremely difficult geopolitical and macroeconomic circumstances caused by the full-scale invasion of the Russian Federation, Ukraine continues to move towards its declared goals and commitments of decarbonization. To this end, it is developing international cooperation and domestic institutions accordingly.

Joining international initiatives

The Paris Agreement. Ukraine was one of the first countries to ratify the Paris Agreement (July 14, 2016). The Agreement entered into force on November 4, 2016, thirty days after its ratification. Ukraine's first Intended Nationally Determined Contribution (INDC) was approved by the government on September 16, 2015, and this INDC was the first for Ukraine after the entry into force of the Paris Agreement. According to the first NDC, Ukraine committed itself to not exceeding 60% of its 1990 greenhouse gas emissions by 2030. Ukraine's updated NDC to the Paris Agreement, approved by the government on July 30, 2021,

[110] OECD. climate finance data. URL: https://webfs.oecd.org/climate/recipientperspective/

[111] Ministry of Finance of Ukraine. Cooperation in attracting financing from the international financial institutions. URL: https://mof.gov.ua/uk/spivrobitnictvo-shhodo-zaluchannja-finansuvannja-mfo

[112] Ministry of Finance of Ukraine. IFIs projects portal. URL: https://proifi.gov.ua/?p=index

[113] Ministry of Finance of Ukraine. Unified portfolio of public investment projects (list of priority public investment projects). URL: https://mof.gov.ua/uk/unified_portfolio_of_public_investment_projects_list_of_priority_public_investment_projects-749

[114] Ukrainian climate office. Donors projects. URL: https://ukrainian-climate-office.org/en/projects/

strengthened Ukraine's contribution to the fight against global climate change and set a target of reducing total greenhouse gas emissions in Ukraine by 65% of 1990 levels.

In addition, Ukraine joined the sustainable development initiative in 2019 with the signing of the Presidential Decree "On the Sustainable Development Goals of Ukraine for the period up to 2030". At the political level, Ukraine expresses its support for the European Green Deal, the main goal of which is to achieve climate neutrality on the European continent by 2050.

At the national level, the financing of the commitments undertaken is based on the following institutional framework:

At the international level, the conclusion of international agreements on attracting financial assistance on a bilateral basis plays an important role. An example in this regard is the "Financing Agreement between the Government of Ukraine and the European Commission, acting on behalf of the European Union [Climate Action Package for a Stable Economy: (CASE) in Ukraine ENI/2020/042-818][115].

Internal Legislation and policies

Legislation. Below is a list of the main legal acts regulating finance in areas related to the decarbonization process.

The Law of Ukraine "On Environmental Protection" regulates relations in the field of protection, use and reproduction of natural resources and ecology. It contains requirements for the activities of enterprises in terms of their impact on the environment, conservation of natural resources, the genetic fund of wildlife, landscapes, etc.

The Law of Ukraine "On Waste" regulates the basic conditions, requirements and rules for environmentally friendly waste management and utilization. It contains requirements for the activities of enterprises in terms of planning the expenditure of their financial resources to comply with legal requirements for emissions and affects the assessment of their creditworthiness in terms of ESG impact.

The Subsoil Code of Ukraine is a source of legal information for companies engaged in the extraction of mineral resources in Ukraine. It establishes rights and obligations for such companies and affects the assessment of their creditworthiness in terms of ESG impact.

The Law of Ukraine "On the Permitting System in the Field of Economic Activity" establishes general rules for obtaining permits by a business entity, such as licenses for the use of water bodies, timber cutting, and mining. It is important for the company in terms of organizational issues: license terms, time periods lost for obtaining such permits, etc., which affects the assessment of the creditworthiness of companies.

The *Law of Ukraine "On Environmental Impact Assessment"* is one of the laws that established the Unified Environmental Impact Assessment Register. Thus, all business entities that have an impact as defined by this law in their activities must submit certain reports to the register. Such reports are submitted both upon establishment and upon changes in the company. For example, if a company has bought an old plant where it intends to produce metal products, the company must register the above change in the register before starting production.

Also, the *Forest Code of Ukraine, the Water Code of Ukraine, the Law of Ukraine "On Protection of Atmospheric Air"* are the legal framework for companies that emit air emissions (e.g., carbon monoxide, carbon dioxide) in their activities and a number of others establish obligations for companies to minimize their environmental impact and affect the assessment of their creditworthiness in terms of ESG impact.

[115] Action Document for Climate package for a sustainable economy: (CASE) in Ukraine. URL: https://neighbourhood-enlargement.ec.europa.eu/system/files/2020-07/c_2020_5161_f1_annex_en_v1_p1_1088976.pdf ; https://zakon.rada.gov.ua/laws/show/984_017-20#Text

The *Law of Ukraine "On the Basic Principles (Strategy) of the State Environmental Policy of Ukraine for the Period up to 2030"* defines the main directions of environmental protection development, including: development of economic relations between enterprises in the direction of green finance, involvement of international organizations for greening production, introduction of new rules in production to protect nature.

Amendments to the Law of Ukraine "On Capital Markets and Organized Commodity Markets" in June 2020 (the Law itself came into force in August 2020) opened up the possibility of using green bonds as a separate type of securities and established rules for market participants. According to Article 18 of this Law, green bonds are bonds whose issue and terms of placement provide for the use of the funds raised exclusively to finance environmental programs or a separate stage thereof.

In the field ***of national policies***, the following were implemented during the reporting period:

- *National Economic Strategy for the period until 2030* (approved by the Cabinet of Ministers of Ukraine in March 2021), declaring that the country plans to achieve climate neutrality no later than 2060.
- Decision of the National Securities Regulatory Commission (NSSMC) On approval of the "Recommendations on the implementation or financing of environmental projects through the issuance of green bonds" (adopted on 07.07.2021).[116] The guidelines contain key features of green bonds and requirements for projects that can be financed with the funds raised, which are in line with the European Union Green Bond Standard (EU GBS) and the International Capital Markets Association Green Bond Principles (GBP). In general, the development of a regulatory framework and standards for the use of green bonds is ongoing, but it can be said that in the long run Ukraine will be guided by the EU Green Bond Standard.

In addition, the NSSMC approved in February 2022 the *Concept for the Introduction and Development of the Green Bond Market*, which is aimed at reducing the energy intensity of the national economy, and approved an annex to the Corporate Governance Code and issued recommendations for the implementation or financing of environmental projects through the issuance of green bonds.

- The National Bank of Ukraine (NBU), which is the state regulator supervising Ukrainian banks and non-banks, is working to build ESG capacity in the financial sector by promoting ESG principles among market participants, improving banks' risk management systems, and increasing information transparency. Although banks are beginning to consider climate risks in their business continuity plans, they still lack full integration of ESG into their market risk and credit risk systems.

In 2021, the NBU approved the *Sustainable Finance Policy*, which is to be implemented by 2025[117]. In 2021 NBU also became a member of Sustainable Banking Network (SBN)[118] and partner of International finance corporation (IFC)[119] for the implementation of the *Sustainable Finance Development Project* in Ukraine. This project should provide sustainable finance standards and recommendations for the integration of environmental, social and governance standards into the activities of financial institutions. It is part of the IFC *"Green Finance Program"* and the IFC *"Investment Facilitation through Integrated Environmental, Social and Governance Standards in Europe and Central*

[116] The NSSMC approved Recommendations on the implementation or financing of environmental projects by issuing green bonds at its meeting on 07.07.2021. URL: https://www.nssmc.gov.ua/en/komisiia-skhvalyla-rekomendatsii-shchodo-rozvytku-zelenykh-oblihatsii-v-ukraini/

[117] The NBU's policy of sustainable financial development. National bank of Ukraine. URL: https://bank.gov.ua/ua/news/all/politika-natsionalnogo-banku-ukrayini-schodo-rozvitku-stalogo-finansuvannya-na-period-do- 2025-року

[118]The NBU and IFC will join forces to develop green finance. National bank of Ukraine. URL: https://bank.gov.ua/uk/news/all/natsionalniy-bank-ta-ifc-spilno-pratsyuvatimut-nad-rozvitkom-zelenogo-finansuvannya

[119]National banks of Ukraine and Georgia present their vision of green finance development at the Sustainable Banking Network meeting. National bank of Ukraine. URL: https://bank.gov.ua/uk/news/all/natsionalni-banki-ukrayini-ta-gruziyi-prezentuvali-svoye-bachennya-rozvitku-zelenih-finansiv-pid-chas-zustrichi-uchasnikiv -mereji-stalogo-bankingu

Asia Program", which are implemented in partnership with the Austrian Federal Ministry of Finance and the Swiss State Secretariat for Economic Affairs SECO.

On the way to fulfilling its decarbonization commitments, Ukraine has changed its tax regulations. From 2022, the carbon tax was increased from 10 to 30 UAH per ton CO_2. This required changes to the legislation.

At the level of national policies, a number of other energy efficiency and environmental protection policies are also currently influencing the decarbonization processes in Ukraine. In particular, such key legislative and regulatory acts are: Concept and Action plan for state climate change policy implementation until 2030; Low emission development strategy of Ukraine till 2050; Law of Ukraine "On basics of monitoring, reporting and verification of GHG emissions"; Law of Ukraine "On ozone depleting substances and fluorinated greenhouse gases"; Energy Strategy of Ukraine until 2035; National Transport Strategy of Ukraine until 2030; National Waste Management Strategy of Ukraine until 2030; National Economic Strategy until 2030.

An important milestone of climate finance institutions development was the creation in May 2023 of the *State Fund for Decarbonization and Energy Efficient Transformation* as part of a special fund of the State Budget of Ukraine. It will interact with the *"Decarbonization Fund of Ukraine"*. The tasks of the "Decarbonization Fund of Ukraine" will include financing state target programs; implementing financial and credit mechanisms in the field of energy efficiency, increasing the use of renewable energy sources and alternative fuels and reducing carbon emissions; providing production and scientific and technical services. Local authorities, municipal associations, utility companies and Ukrainian companies can join the Fund's programs.

The Fund's instruments provide interest rates compensation on loans from commercial state-owned-banks and implementing energy efficient projects; preferential loans for specific projects; reducing the cost of financial leasing and factoring services.

B. UNDERLYING ASSUMPTIONS, DEFINITIONS AND METHODOLOGIES

The methodological basis for the presentation and structuring of the collected data was the Guidelines of the United Nations Framework Convention on Climate Change (UNFCCC) for the preparation of the Biennial Transparency Report and in accordance with Article 13 of the Paris Agreement (Decision 18/CMA.1).

B.1. Convert domestic currency into United States dollars

The national currency UAH exchange rate as of 02.12.2024 is 41.5847 to USD and 43.9010 to EUR; ECB exchange rate as of 02.12.2024 - 1.00 EURO = 1.0507 USD. It should be noted that during the reporting period 2021-2022, and especially later, as a result of a full-scale war, the national currency UAH (UAH) experienced a significant devaluation. To understand the amount of assistance provided, it is advisable to rely on the UAH exchange rate in Table IV.1 for the relevant period.

Table IV.1 – UAH to USD and EURO exchange rate[120]

Date	UAH/USD	UAH/EURO
01.01.2021	28.2746	34.7396
03.01.2022	27.2782	30.9226
01.01.2023	36.5686	39.0370
01.01.2024	38.0020	41.9960
01.12.2024	41.5847	43.9010

[120] National bank of Ukraine. URL: https://bank.gov.ua/en/markets/exchangerates

The amount of financing received is mostly shown in USD, as part of the report on financing received is based on OECD data, where it is stated as "in 2022 dollars", i.e. at the exchange rate for 2022 to the relevant currency, taking into account all factors. In certain specified cases, where applicable, funding amounts are also presented in EURO.

B.2 Estimate the amount of support needed

The amount of financial support required depends on a number of factors and timelines. In general terms, in March 2021, the Cabinet of Ministers of Ukraine approved the National Economic Strategy for the period up to 2030, according to which the country plans to achieve climate neutrality no later than 2060. To achieve this goal, Ukraine plans to attract about EUR 102 billion in capital investments by 2030. A more detailed overview of the required financing by factor and sector is presented in Section 4.3.

It should also be noted that the known projects do not currently reflect a complete picture of the prospects and needs for financing, as they do not contain comprehensive information, and on the other hand, they are subject to sudden changes in an uncertain environment.

B.3. Determine the reporting year or time frame

The data on aid funding received and committed in the report are for 2021-2022. In some cases, to understand the dynamics of the process, the report may provide more recent data when appropriate. Forecasts and needs assessment are current as of the date of publication of the report (December 2024).

B.4. Identify support as coming from specific sources

In general, the available data on the funding received, in particular from the official website of the IFIs and the OECD, allow us to identify all open official financial assistance projects by source of origin. However, some private projects may remain unidentified, which requires improvement of the system for monitoring international capital flows.

B.5. Determine support as committed, received or needed

Where possible, the report indicates the nature of the assistance received as committed, received or needed. The amounts of agreements reported in the report are considered to be donor commitments. Almost all donors are highly reliable organizations, as are their commitments. However, some of the amounts shown may not yet have been received, as it is difficult to determine exactly how much of the commitment has already been funded, as discussed in section 4.1.1.

The data on financial support needs are based on the assessment of experts of the Government of Ukraine, including relevant ministries responsible for specific areas of decarbonization.

B.6. Identify and report the status of the supported activity (planned, ongoing or completed)

The data presented in this report on the amount of funding and relevant projects are based on official statistics. With the exception of projects marked as "planned", the rest of the data in the statistics may not reflect the actual status of the agreement. This means that the funds may not have yet been disbursed under the agreement presented in the report, as the financing has not actually started and the project is actually still "Planned". In particular, this is likely to be the case for projects labeled "In Progress". However, this status also means that the project activities are underway and the funding is being received or has been received in full, but the project is still ongoing, otherwise the project should be labeled as "Completed". To the extent possible, the annexes indicate the current official status of the project in terms of the three statuses (planned, ongoing or completed). If the status is not indicated, it should be assumed that the financing will be completed with a high probability.

B.7. Identify and report the channel (bilateral, regional or multilateral)

Ukraine receives significant amounts of assistance from bilateral, regional or multilateral sources. Wherever possible, the relevant characteristics of the sources are provided in the report and annexes. However, it should be borne in mind that funding may also be received from unspecified organizations or private donors.

B.8. Identify and report the type of support (mitigation, adaptation or cross-cutting)

Since the main statistics on the funding received is based on OECD data, which contains a project classification by the nature of its climate impact (mitigation, adaptation or cross-cutting), such information is provided in the report and annexes. At the same time, in the information on projects implemented outside the OECD information system, the nature of their impact is assessed by experts. For this purpose, it is assumed that financing projects that increase the resilience of Ukraine's economy to the effects of climate change contributes to adaptation, and those that can directly or indirectly reduce GHG emissions contribute to mitigation.

B.9. Identify and report the financial instrument (grant, concessional loan, non-concessional loan, equity, guarantee or other)

The report may include the following types of financial instruments:

- grant - irrevocable, gratuitous provision of financing for specific purposes and under certain other conditions;
- loan - repayable financing at market interest rate and other possible conditions;
- concessional loan - repayable financing at a reduced interest rate compared to the market rate for similar projects and/or more favorable terms and conditions
- equity investments - financing in exchange for participation in the share capital, which gives the owner ownership rights to a project or organization;
- other instruments - debt instruments other than those described above.

B.10. Identify and report sectors and subsectors

In order to report of received finance OECD classification of sectors and subsectors was used. Meanwhile to report about finance needed the broad sector groupings level classification was used.

B.11. Report on the use, impact and estimated results of the support needed and received

This part of the report is challenging due to the lack of detailed project information. In general, projects and funding programs can have varying degrees of direct or indirect impact, with quantitative and/or qualitative results available. Going forward, efforts should be made to improve the presentation of information on financial projects, including an obligation to provide information on the identification of expected impacts and an assessment of the results of possible environmental impacts, including greenhouse gas emission reductions, in terms of mitigation and/or adaptation.

B.12. Identify and report support as contributing to technology development and transfer and capacity-building

In line with OECD data, the annexes indicate whether the project includes technology transfer and capacity building. However, this part of the report is somewhat difficult due to the lack of detailed information about the projects. In the future, efforts should be made to improve the presentation of information on financial projects by including a commitment to provide information on technology development and transfer and capacity-building.

B.13. Avoid double counting in reporting information on support needed and received

In order to avoid double counting of investment projects, an expert assessment was used. According to the analysis of the experts, there is a high probability of double counting of a small number of projects, since they may be presented differently in the OECD and government data and have different amounts of funding indicated, taking into account the status of project implementation. Therefore, the most promising source of information (OECD data) was chosen as the basis for the report in the annexes, and the rest of the data on financial projects was accepted only if the experts were sure that there was no double counting. Double counting in determining the required funding is unlikely, as it is based on the calculations of the expert group agreed with the Government.

C. INFORMATION ON FINANCIAL SUPPORT NEEDED UNDER ARTICLE 9 OF THE PARIS AGREEMENT

Obtaining adequate financial support is crucial for Ukraine to fulfill its emissions reduction commitments. According to officially published estimations, the amount of capital investments until 2030, necessary for the implementation of the NDC by Ukraine is 102 billion euro.[121] The financing needs by sector are presented in Table IV.2.

Table IV.2. Investments required to achieve the NDC2 target in 2021-2030 [122]

Sector	Capital investments, billion euros
1) Energy & Industrial processes (excluding consumer spending)	93
a) agriculture	2
b) energy production and heat	26
c) industry	37
d) buildings (excluding consumer spending)	16
- heating	16
- including thermal modernization of buildings	13
e) production and transportation of energy resources	8
f) transport (excluding consumer spending)	3
- private cars	3
2) Agriculture	2.3
3) Land management, land use change and forestry	3
4) Waste	2
Total	**102**

These calculations, in particular for sectors such as energy production and heat, industry, buildings, transport and agriculture, need to be updated due to changes in GHG emissions ambitions. At the same time, this will not change the distribution of needs between sectors.

C.1. Sectors for which Ukraine wishes to attract international finance, including existing barriers to attracting international finance

The most critical for Ukraine is to attract financing to the power generation and heating sector, which accounts for more than 28.9% of financing needs and is responsible for 30% of GHG emissions. The second largest sector in terms of financing needs is the industry sector, with 23.0%. It is responsible for 22.7% of CO2 emissions. Next, the financing needs of the energy efficiency of buildings and transportation sectors

[121] Updated Nationally Determined Contribution of Ukraine to the Paris Agreement. URL: https://unfccc.int/sites/default/files/NDC/2022-06/Ukraine%20NDC_July%2031.pdf

[122] Analytical Review Updated Nationally Determined Contribution of Ukraine to the Paris Agreement. July 2021. URL: https://mepr.gov.ua/wp-content/uploads/2023/07/Analitychnyj-oglyad-NVV-lypen-2021.pdf

are almost equally distributed (21.2% and 20.9%, respectively) (Figure IV.1). At the same time, they account for more than 19% of GHG emissions (buildings - 8.5%, and transport - 10.6%). Attracting financial support to these sectors will help to reduce the role of these sectors in the production of emissions.

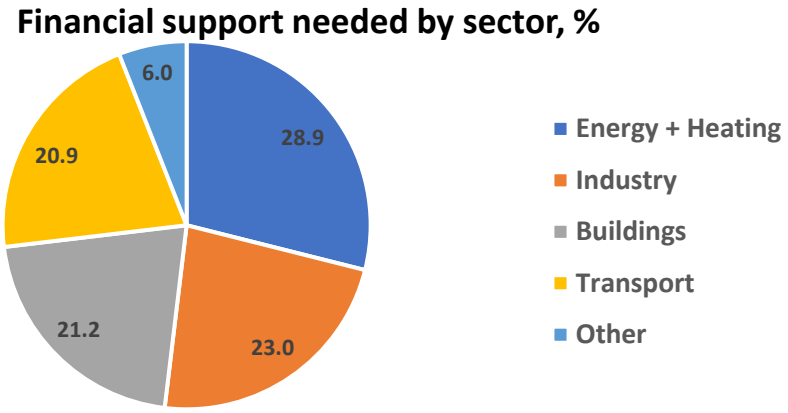


Figure IV.1. Financial support needed by Ukraine in sectors[123]

C.2. Description of how the support will contribute to Ukraine NDC and to the long-term goals of the Paris Agreement

According to the NDC2 calculations it is forecasted a total investment in the heat and power sector of EUR 26 billion by 2030, with EUR 20 billion allocated to renewable energy sources. Of this, 80% (EUR 16 billion) is earmarked for new electricity generation facilities, and 20% (EUR 4 billion) for increasing biomass usage in boiler plants and Central Heat Plants. Additionally, EUR 5 billion is needed for new gas-fired power plants and modernizing existing thermal plants.[124] As the sector's targets have been adjusted and the ambition for renewables lowered, the required investment may decline, necessitating further detailed modeling.

The EU cooperates with Ukraine in the framework of the European Neighborhood Policy and its eastern regional dimension, the Eastern Partnership, with the objective to bring Ukraine closer to the EU. In 2020 a Financing Agreement was concluded between the Government of Ukraine and the European Commission, acting on behalf of the European Union (Climate Action Package for a Stable Economy – CASE, ENI/ 2020/042-818), which provides for financing of 1 billion euros with a implementation period of 60 months[125].

D. INFORMATION ON FINANCIAL SUPPORT RECEIVED UNDER ARTICLE 9 OF THE PARIS AGREEMENT

International funding

According to the OECD, in 2021, 147 climate-related projects were implemented in Ukraine, with funding amounting to USD 1,105.7 million. THE TOTAL AMOUNT OF FUNDING WAS USD 1,105.7 MILLION. In 2022, the number of projects increased to 171, but funding decreased to USD 684.6 million. (Table IV.3).

[123] Analytical Review Updated Nationally Determined Contribution of Ukraine to the Paris Agreement. July 2021. URL: https://mepr.gov.ua/wp-content/uploads/2023/07/Analitychnyj-oglyad-NVV-lypen-2021.pdf

[124] Implementation of the National Plan for Reduction of Emissions from from Large Combustion Plants (NERP): What technologies are needed to generate electricity in Ukraine in 2033? URL: https://www.lowcarbonukraine.com/en/frontpage-en

[125] Action Document for Climate package for a sustainable economy: (CASE) in Ukraine. URL: https://neighbourhood-enlargement.ec.europa.eu/system/files/2020-07/c_2020_5161_f1_annex_en_v1_p1_1088976.pdf ; https://zakon.rada.gov.ua/laws/show/984_017-20#Text

Table IV.3. General information on the financing of climate projects included in the OECD database in 2021-2022.[126]

Indicator	2021	2022
Number of ongoing projects.	147	171
Total amount of financing, thousand USD: among them (% to overall funding): - Grants - Debt instruments	1 105,7 11,2 88,8	684,6 50,2 49,8

Along with the reduction in funding, there were changes in its direction. Thus, the share of projects with a climate component decreased by 40.4 percentage points, the share of funding without a clearly defined climate component (not targeted) increased by 28 percentage points, and funding with a significant climate component increased by 12.1 percentage points (Figure IV.2)

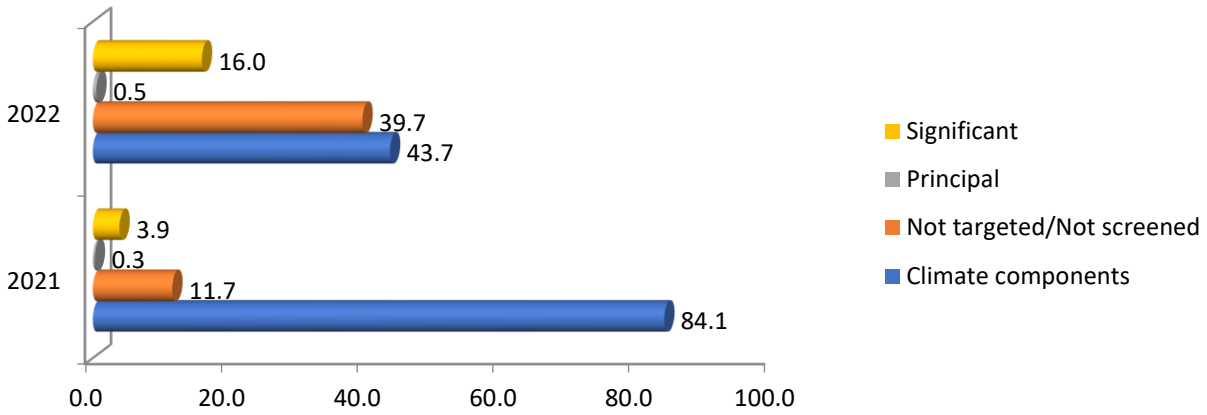


Figure IV.2. Climate-related development finance (Commitment) 2021-2022, %[127]

Changes in the amount of funding, its focus, and the form of provision are primarily related to the outbreak of a large-scale war and, under these circumstances, changes in support priorities. Given the significant damage caused to Ukraine's energy system by missile and drone attacks, the country's energy sector has become a priority for both the state and international partners (Figure IV.3)

[126] OECD. URL: https://webfs.oecd.org/climate/RecipientPerspective/
[127] OECD. URL: https://webfs.oecd.org/climate/RecipientPerspective/

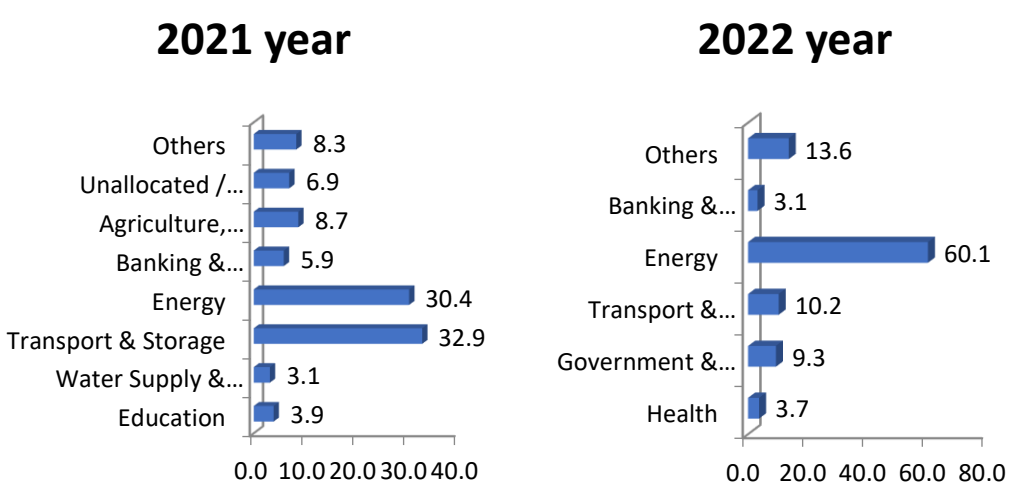


Figure IV.3. Climate-related development finance (Commitment) by sector, 2021-2022, %

Funding for climate-related projects in the energy sector of Ukraine increased by 29.7 percentage points, while funding for projects in other sectors was significantly reduced. This reorientation is a forced step given that since the beginning of the large-scale aggression in Ukraine, 80% of DTEK's generation, all of Centrenergo's generation, and all hydro generation have been destroyed, and 2 hydroelectric power plants have been put out of commission[128]. The estimated losses incurred by Ukraine's energy infrastructure are estimated at around USD 12.5 billion.

The largest financial donors of climate projects in Ukraine are international financial organizations, including the European Bank for Reconstruction and Development and the International Bank for Reconstruction and Development. The governments of European and other developed countries are also actively involved in supporting climate projects (Figure IV.3).

With their support, Ukraine not only implements individual projects but also creates the legislative and institutional framework for the country's transition to EU environmental standards, and conducts scientific and pedagogical training of personnel at both the national and regional levels. An example of comprehensive support from international partners for Ukraine in its efforts to build a new climate-neutral economy is the current Financing Agreement between the Government of Ukraine and the European Commission, acting on behalf of the European Union ([Climate Action Package for a Sustainable Economy: (CASE) in Ukraine ENI/2020/042-818)[129].

This agreement, among other things, provides for: the implementation of measures that effectively support progress towards climate-neutral, clean and resource-efficient energy production and use in Ukraine; climate change mitigation through the operation of a climate innovation resource and advisory center; feasibility studies for the application of climate innovation technologies and project development; greening of vehicles and support for more reliable monitoring and accounting of greenhouse gases and substances that deplete the ozone layer.

[128] All about blackouts: why they happen, what they are, and what to do in case of a power outage. URL: https://yasno.com.ua/news/b2c_news/where_is_the_light

[129]УГОДА про фінансування між Урядом України та Європейською Комісією, що діє від імені Європейського Союзу [Кліматичний пакет для стабільної економіки: (CASE) в Україні ENI/2020/042-818. URL: https://zakon.rada.gov.ua/laws/show/984_017-20#Text

Table IV.4 – Climate-related development finance (Commitment) in terms of international donors, 2021-2022, %

Provider (detailed)	2021	2022
Australia	0.01	0.02
Austria	0	1.61
Czechia	0.01	0.03
Denmark	1.77	1.89
European Investment Bank	17.3	
European Bank for Reconstruction and Development	44.36	28.47
Finland	0.2	
Food and Agriculture Organisation	0	0
Germany	12.59	27.62
Hungary	0.02	
International Bank for Reconstruction and Development	22.46	15.27
Japan	0.33	4.66
Korea	0.01	0.01
Lithuania	0.01	0.001
Poland	0.07	0.32
Slovak Republic	0	
Sweden	0.32	1.32
Switzerland	0.32	1.01
United States	0.48	5.22
Children's Investment Fund Foundation (Private donor)		0.03
Global Environment Facility General Trust Fund		0.04
Italy		0.06
Latvia		0.005
Netherlands		11.06
Norway		0.46
Spain		0.02

As part of attracting technical assistance to ensure the implementation of the Paris Agreement, Ukraine actively cooperates with the following international institutions: United Nations Development Programme (UNDP), United Nations Environment Programme (UNEP), United Nations Industrial Development Organization (UNIDO), United Nations Educational (UNE), Scientific and Cultural Organization (UNESCO), Organization for Security and Cooperation in Europe (OSCE), North Atlantic Treaty Organization (NATO), World Trade Organization (WTO), European Bank for Reconstruction and Development (EBRD), World Bank (WB), European Investment Bank (EIB), European Environment Agency (EEA), Global Environment Facility (GEF), etc.

Special financing program Ukraine Facility. Pillar II of the Ukraine Facility outlines the establishment of a dedicated EUR 9.3 billion specific Ukraine Investment Framework aimed to mobilise investments for the reconstruction and modernisation of Ukraine. The Program relay on providing guarantees (for a maximum amount to EUR 7.8 billion) and EUR 1.5 billion designated for blending operations and grants, and technical assistance. These allocations do not preclude each other. At least 20% of overall investment (Pillar I and Pillar II) should be directed on green projects.[130]

Domestic investments

Macroeconomic instability and hostilities have naturally led to a reduction in environmental spending, which in 2022 decreased by UAH 14.2 billion compared to 2021 (Table IV.5). There is a

[130] Investment Guide Ukraine 2024, May. Ministry of Economy. URL: https://greendealukraina.org/assets/images/literature/41-ukraine-investment-guide-2024.pdf

tendency for current environmental protection expenditures to prevail over capital investments, which is largely due to the impact of high military risks on the activities of business entities.

Table IV.5 – Environmental protection costs for 2020-2023[131]

Indicators	2020	2021	2022	2023
Environmental protection costs, UAH million	41332.2	44804.9	30572.9	37597.7
Capital investments in environmental protection, *UAH million*	13239.7	14113.7	6446.0	8284.0
Share of capital investments in total environmental protection costs, %.	32.0	31.5	21.1	22.0
Share of capital repairs in capital investments, %.	12.8	12.4	14.0	9.5
Current expenditures on environmental protection, UAH million	28092.6	30691.2	24126.9	29313.6
Share of current expenses in total environmental protection expenses, %.	68.0	68.5	78.9	78.0

The lion's share of environmental expenditures is focused on the following areas: air protection and climate change, wastewater treatment, waste management, and protection and rehabilitation of soil, groundwater, and surface water (Table IV.6).

Table IV.6 – Structure of environmental protection costs in 2020-2023, %.[132]

Indicators	2020	2021	2022	2023
Air protection and climate change issues	19.3	18.0	12.9	9.7
Waste water treatment	29.8	29.5	35.4	37.1
Waste management	34.1	34.0	38.5	38.6
Protection and rehabilitation of soil, groundwater and surface water	10.0	10.0	6.3	8.3
Reduction of noise and vibration impact	1.2	0.7	0.2	0.0
Biodiversity conservation and protection of natural areas	3.2	5.0	3.9	3.5
Radiation safety	1.2	1.6	1.4	1.7
Environmental research and development activities	0.3	0.3	0.3	0.3
Other areas of environmental protection activities	0.8	1.0	1.1	0.8

Green bond issues

As of September 2024, only two large green bond issues have been made in Ukraine. At the same time, according to expert estimates, the potential of the green finance market in Ukraine is USD 73 billion by 2030. Of this, almost half - USD 36 billion - is the potential of the green bond market.[133]

Government programs and investments

Ukraine also has an Energy Efficiency Program for Residential Buildings, which is financed from the authorized capital of the Energy Efficiency Fund (Table IV.7), which is formed at the expense of the State Budget of Ukraine, as well as contributions from the European Union and the German Government, and is implemented in cooperation with IFC, GIZ, and UNDP.

Table IV.7. Selected performance indicators of the Energy Efficiency Fund [134]

Indicators	2020	2021	2022
Total number of received Applications for Participation, pcs.	299	551	31
Total number of approved Applications for Participation, units.	222	515	78
Total value of projects received in the Applications for Participation, UAH million	2133.3	5060	316
Amount of grants issued by the EEF and MDTF, UAH million	7	146	583
Annual reduction of CO2 emissions from implemented projects, thousand tons	0.0000006	5.9	17.6

[131] State *Statistics Service* of *Ukraine. URL: https://stat.gov.ua/en*

[132] State *Statistics Service* of *Ukraine. URL: https://stat.gov.ua/en*

[133]The Government approved the Concept for the introduction and development of the green bond market in Ukraine. URL: https://www.kmu.gov.ua/news/uryad-shvaliv-koncepciyu-zaprovadzhennya-ta-rozvitku-rinku-zelenih-obligacij-v-ukrayini

[134] Report on the activities of the State Institution "Energy Efficiency Fund" for the relevant years. URL: https://eefund.org.ua/pro-fond/zvitnist-fondu-energoefektyvnosti/

In 2023, the Energy Efficiency Fund was supported by the creation of the State Fund for Decarbonization and Energy Efficient Transformation, which in 2024 accumulated UAH 759 million from the CO2 tax. The second institution that uses funds from the CO2 tax is the Joint Stock Company "Decarbonization Fund of Ukraine" (established in 2012). The Fund's toolkit is focused on compensation of interest on loans from commercial banks owned by the state and taken out for energy efficiency projects, as well as on providing preferential loans for certain projects from the Decarbonization Fund itself. In 2024, the Fund provided UAH 400 million for energy efficiency projects.

Information on the most significant financial support provided under Article 9 of the Paris Agreement in 2021-2022 by officials and multilateral channels presented in Tables IV.8- IV.11.

Table IV.8 Information on financial support provided under Article 9 of the Paris Agreement in year 2021 (in thousands)

Provider	Title of the project programme, activity or other	Amount (climate-specific)	Channel	Funding source	Financial instrument	Type of support	Sector	Subsector	Additional information
Germany	Municipal climate protection program (Chernivtsi) - ph. 2	23858,63	CG	ODA	DI	A	I.4. Water Supply & Sanitation	Water supply and sanitation - large systems	
Germany	Supporting structural change in the Ukrainian coal regions	33481,01	Public corporations	ODA	G	M	II.3. Energy	Energy policy and administrative management	The cooperation is intended to increase the visibility of German energy policy in Ukraine and to help this policy achieve a better public image. The interests of German industry are incorporated into the cooperation, particularly with the aim of introducing German know-how and technologies for a sustainable energy supply to the cooperation country Ukraine. At the same time, the cooperation provides German companies with information about the sector and access to energy policy decision-makers in the partner country
Germany	Energy efficiency in municipalities	28231,79	CG	ODA	DI	M	II.3. Energy	Energy conservation and demand-side efficiency	Energy Efficiency in Municipalities
Germany	Accelerating NDC and promoting sustainable bioenergy, Agri and Land-Use practices in Ukraine	19374,76	EBRD	ODA	G	M	IV.1. General Environment Protection	Environmental policy and administrative management	In light of Ukraine's new greenhouse gas (GHG) emissions reduction target of 65%, the Project offers timely support to help the country navigate the complex institutional, stakeholder and financing require-ments to catalyse and maintain political momentum for NDC implementation. Specifically, the Project fo-cuses on enhancing capacities and plans of key Government stakeholders to implement the NDC priority actions while mobilising climate finance and carbon market resources for its delivery. In addition, the Pro-gramme provides technical and financial support to increase the uptake of investments in sustainable bio-energy, agri and land-use practices, contributing to national energy and M targets. The Ministry of Environment Protection and Natural Resources (MEPR) is the key political partner, ensuring that the pro-gramme is aligned and consistent with Ukraine's climate action priorities.
Denmark	DSIF - Ukraine - Zaporizhzhia wastewater and sludge treatment project	8629,473	Local Government	ODA	G	M	I.4. Water Supply & Sanitation	Sanitation - large systems	To improve the environmental situation in Zaporizhzhia and in downstream rivers and localities, with reduced odour problems, reduced quantities of sludge deposits, and a stable effluent quality in accordance with Ukrainian and EU standards.
Germany	Developing the social infrastructure (USIF VIII)	7396,728	CG	ODA	G	M	I.5. Government & Civil Society	Democratic participation and civil society	Developing the social infrastructure (USIF VIII)
Germany	Developing the social infrastructure (USIF VIII)	7106,66	CG	ODA	G	M	I.2. Health	Basic health infrastructure	Developing the social infrastructure (USIF VIII)

Provider	Title of the project programme, activity or other	Amount (climate-specific)	Channel	Funding source	Financial instrument	Type of support	Sector	Subsector	Additional information
Denmark	DSIF - Ukraine - Kremenchuk district heating renovation project	5819,167	Public corporations	ODA	G	M	II.3. Energy	District heating and cooling	The overall Project objective is to maintain the life, health and environment in the Rakovka district of the city of Kremenchuk by securing reliable and affordable heating and hot-tap water.
Denmark	Ukraine-Denmark Energy Partnership Programme (UDEPP, 2021-2026)	4582,021	CG	ODA	G	M	II.3. Energy	Energy policy and administrative management	The programme focuses on reducing CO2 emissions by developing long-term energy planning through annual Ukraine Energy Outlooks and on strengthening Ukraine's energy efficiency and district heating by utilizing surplus heat and by modernizing its district heating network. The Ukraine Energy Outlook will provide guidance on how Ukraine can achieve its climate goals of carbon neutrality by 2050 and phase out of coal by 2040.The Danish Energy Agency is implementing partner and will continue its close partnership with the Ministry of Energy of Ukraine (developed during the previous phase) and start cooperation with a new partner, Mindevelopment, within the area of district heating. This follows a great Ukrainian interest in the Danish district heating system. Energy experts from the Danish Energy Agency will contribute with advice, technical assistance and peer-to-peer learning in several areas. This includes energy efficiency in industry, strategic energy planning and long-term modelling of scenarios that can show pathways to a green transformation of Ukraine's energy system with focus on renewable energy and energy efficiency. The collaboration will focus on strengthening the environment for sustainable energy solutions and technologies based on Danish expertise and technical assistance, as well as opening up opportunities for companies working with green energy. The overall goal of the support is: Ukraine realizes its Nationally Determined Contribution (NDC) goals and achieves SDG7 and SDG13 targets.The intended impact is: Reduced greenhouse gas emissions and improved security of supply, though improved system planning, market development and increased sustainable energy and district heating modernization.The objective is that: The enabling environment for investment in sustainable energy and district heating is strengthened, assisting Ukraine in achieving its energy efficiency, renewable energy, and energy independence targets and modernising district heating.
Germany	Ukrainian Editorial Department	4370,276	Public corporations	ODA	G	Cr	I.5. Government & Civil Society	Media and free flow of information	Radio and online services in Ukrainian language - Information on politics, economics, environment, current topics

A – Adaptation; Cr – Cross-Cutting; M – Mitigation; G – Grant; DI – Debt instrument; CG – Central Government; OMI – Other multilateral institutions

Table IV.9 Climate-specific financial support provided under Article 9 of the Paris Agreement in year 2021-3: a, b, c multilateral channels (USD in thousands)

Institution	Amount of climate-specific inflows	Title of the project, programmer, activity or other	Channel	Funding source	Financial instrument	Type of support	Sector	Subsector	Additional information
EBRD	115508,8	UKRAINE ROAD CORRIDORS	Government		DI	A	II.1. Transport & Storage	Road transport	Provision of a sovereign loan of up to EUR 450 million to Ukraine to be on-lent to Ukravtodor, the State Road Agency of Ukraine, consisting of three tranches (the project): * Tranche 1 of up to EUR 100 million to finance the rehabilitation of the M-05 Kyiv-Odesa road section in Cherkasy region, * Tranche 2 of up to EUR 160 million to finance the construction of a northern section of the bypass around the city of Lviv, * Tranche 3 of up to EUR 190 million to finance the rehabilitation of the M-05 Kyiv-Odesa road sections in Kirovohrad, Mykolaiv and Odesa regions.
EU institutions (EIB)	27937,95	PSI INVESTMENT LOAN	Private sector in recipient country		DI	Cr	III.1. Agriculture, Forestry, Fishing	Food crop production	
EU institutions (EIB)	27937,95	PSI INVESTMENT LOANPSI INVESTMENT LOAN	Private sector in recipient country		DI	Cr	III.1. Agriculture, Forestry, Fishing	Food crop production	
IBRD	8584,085	IMPROVING POWER SYSTEM RESILIENCE FOR EUROPEAN POWER GRID INTEGRATION	Recipient Government		DI	A	II.1. Transport & Storage	Transport policy and administrative management	-
IBRD	4432,686	UKRAINE IMPROVING HIGHER EDUCATION FOR RESULTS PROJECT	Recipient Government		DI	A	I.1. Education	Education policy and administrative management	
EBRD	930,2944	DFF - NYVA PEREYASLAVSHCHYNY	Private sector in recipient country		DI	A	III.1. Agriculture, Forestry, Fishing	Livestock	The provision of a long-term loan of up to US$ 12.5 million to Nyva Pereyaslavshchyny LLC to finance the expansion of its pig breeding capacities , the construction of a meat-processing factory, bio-waste recycling facility and related working capital financing.
EBRD	1519,624	DFF - KOKHAVYNSKA PAPER	Private sector in recipient country		DI	Cr	III.2. Industry, Mining, Construction	Forest industries	Senior secured loan of up to EUR 13.8 million in two committed tranches to Kokhavynska Paper Factory PrJSC (hereinafter the Company), one of the Ukrainian leading producers of base paper and sanitary tissue products manufactured from waste paper.

Institution	Amount of climate-specific inflows	Title of the project, programmer, activity or other	Channel	Funding source	Financial instrument	Type of support	Sector	Subsector	Additional information
EU institutions (EIB)	798,22	PSI INVESTMENT LOAN	Private sector in recipient country		DI	Cr	III.1. Agriculture, Forestry, Fishing	Food crop production	
Food and Agriculture Organisation	20,34962	TCPF: TECHNICAL SUPPORT FOR STRATEGIC PROGRAMMING	Food and Agricultural Organisation		G	A	III.1. Agriculture, Forestry, Fishing	Agricultural policy and administrative management	TCPF: Technical Support for Strategic Programming
EBRD	4588,236	DFF - GRAIN ALLIANCE	Private sector in recipient country		DI	M	III.1. Agriculture, Forestry, Fishing	Food crop production	

A – Adaptation; Cr – Cross-Cutting; M – Mitigation; G – Grant; DI – Debt instrument; CG – Central Government; OMI – Other multilateral institutions

Table IV.10 Information on financial support provided under Article 9 of the Paris Agreement in year 2022 (in thousands)

Provider	Title of the project programme, activity or other	Amount (climate-specific)	Channel	Funding source	Financial instrument	Type of support	Sector	Subsector	Additional information
Germany	UKRAINE ENERGY SUPPORT FUND	53365,23	OMI	ODA	G	M	II.3. Energy	Energy generation, renewable sources - multiple technologies	Russia's war of aggression on Ukraine is causing devastation in the Ukrainian energy sector. Especially since the beginning of October 2022, there have been massive waves of attacks by Russia on the civilian infrastructure. Among other things, thermal and hydroelectric power plants as well as electricity transmission have been severely damaged. As a result, many people are without electricity and heating. At the request of the European Commission and in agreement with the Ukrainian Ministry of Energy, the Secretariat of the Energy Community has set up the Ukraine Energy Support Fund to mitigate the impact of the Russian invasion of Ukraine on the energy sector. The Ukraine Energy Support Fund is designed as a basket funding, so that different donors can participate. The Secretariat of the Energy Community acts as trustee of the donor funds for the Ukrainian Ministry of Energy. The Ukraine Energy Support Fund finances energy sources (e.g. fuel) and technical equipment (spare parts, equipment, etc.) for Ukrainian energy companies as final beneficiaries, which are necessary for the stable continued operation of the Ukrainian energy infrastructure in the current war context. The Ukrainian Ministry of Energy, supported by an international consulting company, decides on the financing applications of the Ukrainian energy companies. The Secretariat of the European Energy Community disburses the funds from the Ukraine Energy Support Fund directly to the suppliers of the energy sources or technical equipment. The Federal Ministry for Economic Affairs and Climate Protection (BMWK) supports the Ukraine Energy Support Fund with EUR 99.5 million through KfW. The German government is thus making an important contribution to supporting Ukraine, particularly in maintaining the Ukrainian energy sector in the current situation.

Provider	Title of the project programme, activity or other	Amount (climate-specific)	Channel	Funding source	Financial instrument	Type of support	Sector	Subsector	Additional information
Germany	UKRAINE ENERGY SUPPORT FUND	51272,48	OMI	ODA	G	M	II.3. Energy	Electric power transmission and distribution (centralised grids)	Russia's war of aggression on Ukraine is causing devastation in the Ukrainian energy sector. Especially since the beginning of October 2022, there have been massive waves of attacks by Russia on the civilian infrastructure. Among other things, thermal and hydroelectric power plants as well as electricity transmission have been severely damaged. As a result, many people are without electricity and heating. At the request of the European Commission and in agreement with the Ukrainian Ministry of Energy, the Secretariat of the Energy Community has set up the Ukraine Energy Support Fund to mitigate the impact of the Russian invasion of Ukraine on the energy sector. The Ukraine Energy Support Fund is designed as a basket funding, so that different donors can participate. The Secretariat of the Energy Community acts as trustee of the donor funds for the Ukrainian Ministry of Energy. The Ukraine Energy Support Fund finances energy sources (e.g. fuel) and technical equipment (spare parts, equipment, etc.) for Ukrainian energy companies as final beneficiaries, which are necessary for the stable continued operation of the Ukrainian energy infrastructure in the current war context. The Ukrainian Ministry of Energy, supported by an international consulting company, decides on the financing applications of the Ukrainian energy companies. The Secretariat of the European Energy Community disburses the funds from the Ukraine Energy Support Fund directly to the suppliers of the energy sources or technical equipment. The Federal Ministry for Economic Affairs and Climate Protection (BMWK) supports the Ukraine Energy Support Fund with EUR 99.5 million through KfW. The German government is thus making an important contribution to supporting Ukraine, particularly in maintaining the Ukrainian energy sector in the current situation.
Germany	ENERGY EFFICIENCY IN TRANSMISSION - MODERNISATION OF SUBSTATIONS II	34178,15	CG	ODA	DI	M	II.3. Energy	Electric power transmission and distribution (centralised grids)	In global comparison, Ukraine is considered to be one of the most energy-intensive countries. This leads to a M of competitiveness of companies and negatively affects the employment situation within Ukraine. One important reason for the inefficiency is the usage of obsolete and inefficient technology in the electricity sector. The losses of electricity within the Ukrainian power grid sum up to 12% (2015). This is twice the amount compared to the EU-average. The country holds the membership status of the European Energy Community and aims at synchronizing its transmission network with the European grid Continental Europe Synchronous Area (CESA) in order to intensify participation in the European electricity trading market. Within the scope of the so-called Substation Automation Program, all substations of the transmission network are scheduled to be modernized until 2027. As a result, the amount of the operational costs as well as the losses in the network shall be reduced which, in turn, is favourable in terms of the approximation towards adherence of European standards. The objective of the measure is to contribute significantly to a stable and more efficient electricity supply within the Ukrainian power grid, particularly within the South-Western power grid. Through this Financial Cooperation measure, all nine substations of the South-Western power grid shall be modernized resulting in a higher energy-efficiency of the substation and preparing them for automatized control. The cumulative costs for this measure aggregate EUR 44.4 Mio., financed through a Financial Cooperation loan of EUR 32.5 Mio., Gs in a volume of EUR 3.1 Mio. and a co-financing of the project executing agency UKRENERGO.

Provider	Title of the project programme, activity or other	Amount (climate-specific)	Channel	Funding source	Financial instrument	Type of support	Sector	Subsector	Additional information
Germany	JUST TRANSITON IN THE UKRAINIAN COAL REGIONS AND GREEN ENERGY RECOVERY	21032,71	Public corporations	ODA	G	M	II.3. Energy	Energy policy and administrative management	Ukraine is shaping the structural change associated with the phase-out of coal at national, regional and local level, involving civil society and applying appropriate funding instruments, using the concepts of Just Transition and Green Recovery, socially and economically viable, as well as energy-economic and ecologically sustainable, thus contributing to a climate-neutral economy.
Germany	STRENGTHENING UKR MUNICIPAL ADMINISTRATIONS I (ÖP)	17246,82	CG	ODA	G	A	I.4. Water Supply & Sanitation	Water supply and sanitation - large systems	Ukraine has been directly affected by the Corona crisis and its repercussions. Rising unemployment, wage losses and the loss of payments from abroad associated with the return of Ukrainians pose major challenges for Ukrainian municipalities. In KfW's first partner cities, for example, it is already becoming apparent that municipal utilities will have to cope with a large loss of payments from consumers. The aim of the module is therefore to strengthen Ukrainian municipal administrations. Key measures to achieve this goal are the rehabilitation and new construction of municipal infrastructure as part of microprojects. The approach is based on the anchor city principle, which relies on partner cities that have experience in KfW's FC procedures. The module is an urgent project according to point 4.7 of the FC/TC guidelines. The target group is the population of the municipalities to be included in the project, their municipal energy suppliers and, in particular, the Ukrainians employed in the project. With the beginning of the Russian invasion of Ukraine on February 24, 2022, the needs of the project have shifted. Instead of several project cities, only one anchor city, namely Chernivtsi, in western Ukraine is to be selected. This will allow urgent repair work to be carried out on the water supply and sanitation systems in Chernivtsi, whose population has doubled due to the influx of internally displaced persons. Based on the concrete needs and possibilities on site, rehabilitation work in the sector of drinking water supply and sewage disposal is to be financed instead of the originally planned micro-projects. The project executing agency is the municipal water utility, Chernivtsi Vodokanal (CVK), a long-standing partner of FC. The project is implemented with the help of a qualified international implementation consultant, who is also financed from the G funds.
Austria	EBRD UKRAINE STABILISATION AND SUSTAINABLE GROWTH MULTI-DONOR ACCOUNT (MDA)	10516,35	EBRD	ODA	G	M	I.5. Government & Civil Society	Public sector policy and administrative management	The Ukraine MDA provides crucial policy, governance and ad-hoc technical assistance support to Government Ministries, Financial Services and Businesses as part of the response to the War in Ukraine. A special focus of this MDA is supporting the Ukraine Reform Architecture a technical assistance support window to the Government of Ukraine fostering EU Acquis alignment in preparation for EU ascension. Austria has placed a soft earmarking on the implementation of energy efficiency measures.
Denmark	NEW DEMOCRACY FUND 2023-2026	7066,638	Donor country-based NGO	ODA	G	Cr	I.5. Government & Civil Society	Democratic participation and civil society	An independent, diverse, resilient and responsive civil society in the ENC promoting a culture of democracy and human rights by engaging in regional networking and peer-to-peer exchange of experiences amongst civil society actors in the ENC and Danish CSOs working with youth, media, culture, labour market, green transition, and gender. Objective Track 1:That diverse, increasingly resilient and responsive civil society actor working with youth, media, culture, labour market, and just and green transition employ a human rights-based approach to expand the civic space

Provider	Title of the project programme, activity or other	Amount (climate-specific)	Channel	Funding source	Financial instrument	Type of support	Sector	Subsector	Additional information
									and increase the engagement and participation of citizens through peer-to-peer exchanges and regional networks Objective Track 2:The civil society actors from the ENC are increasing their capability to engage in democratic organisation and dialogue, taking advantage of positive political developments and/or protecting their work in case of shrinking civic space Objective Track 3:That civil society actors in Denmark and the ENC engage in sustainable, cooperation and effectively collaborate to promote democratic dialogue, hold duty-bearers to account and ensure that the voice of the rights holders is
Denmark	UKRAINIAN DANISH YOUTH HOUSE (UDYH) 2023-2026 UNGDOMSHUS DKI OG DUF	2826,655	Donor country-based NGO	ODA	G	M	I.5. Government & Civil Society	Democratic participation and civil society	The project will contribute primarily to object 1 of the Strategic Framework of 'furthering the development of democracy and human rights': Youth have strengthened their ability to organise, practice and promote democratic culture and participation in Ukrainian society and are actively involved in Ukrainian-Danish exchange to increase the European cohesion among the youth
Germany	REFINANCING FOR THE EE INVESTMENTS OF UKRAINIAN SMES VIA THE FINANCIAL S	2681,67	CG	ODA	DI	M	II.4. Banking & Financial Services	Formal sector financial intermediaries	Both phases of the project Refinancing for the EE investments of Ukrainian SMEs via the financial sector (BDF III and IV) are an extension of KfW's cooperation with the Business Development Fund (BDF). The aim of the project is the sustainable and needs-based introduction of the financial product EE-loan for small and medium-sized enterprises as well as private entrepreneurs at the financial institutions. This contributes to the promotion of investments targeted at the reduction of energy consumption and/or CO2 emissions for final borrowers. The direct target group of the project are private financial institutions supporting a sustainable introduction of the EE-loan product. The indirect target group are SMEs and private entrepreneurs who make investments with the aim to increase the energy efficiency. BDF can transfer these funds to the financial institutions in local currency due to the (partial) exchange rate hedging financed by EU funds.

A – Adaptation; Cr – Cross-Cutting; M – Mitigation; G – Grant; DI – Debt instrument; CG – Central Government; OMI – Other multilateral institutions

Table IV.11 Climate-specific financial support provided under Article 9 of the Paris Agreement in year 2022: multilateral channels (USD in thousands)

Institution	Amount of climate-specific inflows	Title of the project, programmer, activity or other	Channel	Financial instrument	Type of support	Sector	Subsector	Additional information
IBRD	50008	Financing of recovery from economic emergency Ukraine supplemental development policy loan	Recipient Government	DI	M	II.1. Transport & Storage	Water transport	

Institution	Amount of climate-specific inflows	Title of the project, programmer, activity or other	Channel	Financial instrument	Type of support	Sector	Subsector	Additional information
EBRD	157745,3	Ukrenergo transmission network emergency restoration	Recipient Government	DI	M	II.3. Energy	Electric power transmission and distribution (centralised grids)	The provision of up to EUR 300 million sovereign-guaranteed loan to the National Energy Company Ukrenergo ('Ukrenergo' or the 'Company') aimed at restoring the Ukrainian power transmission grid that was severely damaged by Russian bombings. The loan consists of up to EUR 150m for procurement of equipment to implement emergency repairs of Ukrainian power transmission system and up to EUR 150m of capital structure support (the 'Project'). The EBRD loan is supported by the donor 'funded guarantee' of up to 50% to be provided by the United States through its contribution to the EBRD Crisis Response Special Fund (the 'Crisis Fund'). Furthermore, the loan is also going to be complemented by an investment G of up to EUR 72m to be provided by the Netherlands via the Crisis Fund.
EBRD	14722,89	FIF - EAP SMEC - UKRGASBANK SME LOAN	Private sector in recipient country	DI	M	II.4. Banking & Financial Services	Formal sector financial intermediaries	A three-year senior unsecured loan of up to €25 million in hryvna equivalent to be provided to Ukrgasbank to enable the bank's support to eligible MSMEs under SME Competitiveness Programme in the EU's Eastern Partnership. The loan will be available for disbursement in three tranches as either deliverable or synthetic hryvna-denominated facility. In addition to long-term financing, eligible sub-borrowers will receive technical assistance funded by the European Union and G support in the form of investment incentives upon the completion of their investment projects.
EBRD	13144,66	REGIONAL TFP: UKRGASBANK	Private sector in recipient country	DI	M	III.3.a. Trade Policies & Regulations	Trade facilitation	A facility under the Trade Facilitation Programme (TFP) for PJSC 'Ukrgasbank' ('UGB'), Ukraine.
IBRD	12752,04	Financing of recovery from economic emergency Ukraine supplemental development policy loan	Recipient Government	DI	M	II.1. Transport & Storage	Water transport	
IBRD	7144	Financing of recovery from economic emergency Ukraine supplemental development policy loan	Recipient Government	DI	M	II.1. Transport & Storage	Water transport	
IBRD	6675,75	Health enhancement and lifesaving (HEAL) Ukraine project	Recipient Government	DI	Cr	I.2. Health	Health policy and administrative management	
IBRD	4641	Financing of recovery from economic emergency Ukraine supplemental development policy loan	Recipient Government	DI	M	I.5. Government & Civil Society	Public sector policy and administrative management	
EBRD	3491,429	RLF - GRAIN ALLIANCE LOGISTICS	Private sector in recipient country	DI	M	III.1. Agriculture, Forestry, Fishing	Food crop production	Provision of a senior secured loan of up to EUR 10 million to Transped s.r.o., a Slovakian subsidiary (the 'Borrower') of the Grain Alliance Group (the 'Group'). The Loan will be provided under the Resilience and Livelihoods Framework. The proceeds of the Loan will be used to finance the upgrade and expansion of storage and transhipment capacity of the grain terminal and purchase of trucks and locomotives in Slovakia, as well as purchase of grain hoppers in Ukraine (the 'Project').
IBRD	2600,00	Financing of recovery from economic emergency Ukraine supplemental development policy loan	Recipient Government	DI	M	I.5. Government & Civil Society	Public sector policy and administrative management	

A – Adaptation; Cr – Cross-Cutting; M – Mitigation; G – Grant; DI – Debt instrument; CG – Central Government; OMI – Other multilateral institutions

E. INFORMATION ON TECHNOLOGY DEVELOPMENT AND TRANSFER SUPPORT NEEDED UNDER ARTICLE 10 OF THE PARIS AGREEMENT

Ukraine set up ambitious goals in terms of low-carbon and climate-neutral development, that are spelled out in various strategy documents, including National Economic Strategy for the period up to 2030, Energy strategy of Ukraine till 2050, National Energy and Climate Plan, Nationally Determined Contributions etc.

Achieving those goals requires developing and deploying a wide range of technologies. However, limited domestic technological and R&D capacities make Ukraine in need of specific support in enhancing international cooperation in technology and knowledge transfer, R&D to strengthen its domestic capacities and technologies[135]. In addition, the ongoing full-scale invasion of russia into Ukraine created new challenges related to sustainable development climate, e.g soil pollution, destruction of renewable energy generation, increase of different types of waste. Dealing with those issues requires additional support in technology transfer.

In 2024, Ukraine identified following climate related technologies to be developed and deployed during the next years [136], [137]:

- Electricity and heat generation and transmission systems
- Fuel bases, transportation and utilization systems
- Technologies for the development and use of new fuels, renewables etc.
- Energy efficiency and energy saving, energy markets
- Environmentally balanced energy security
- New resource-saving, energy-saving and environmentally friendly processes for obtaining competitive substances and materials and products from them
- Environmentally balanced and efficient land use
- technologies for overcoming negative impacts on environment
- Technologies for monitoring the ecological state of natural and artificial ecosystems
- Innovative technologies for the conservation and sustainable use of natural (mineral, raw material, land, soil, water and biotic) resources
- Circular economy technologies.

There is an urgent need in Ukraine to rebuild more diversified energy system and increase electricity generation as most of facilities were damaged or occupied, including renewable energy generations, grids, power lines etc. Given the impact of the war and building climate neutral economy, there is also a need in technologies of energy distribution (smart, micro grids etc), hydrogen technologies, small modular reactors, energy storage etc.

In 2019-2020 the Technology needs assessment was performed in cooperation with UNEP, GEF, Ministry of Environment and Natural Resources of Ukraine[138]. The project focused on mitigation and adaptation technologies for agriculture and waste and water management (Table IV.12).

Table IV.12 – Key technologies studied in TNA project

Sector	Key technologies prioritized for Adaptations	Key technologies prioritized for Mitigation
Agri-culture	- Drip irrigation with conservation agriculture practices - Agroforestry practices (shelterbelt reconstruction) - Integrated Pest and Disease Management	- Organic agriculture - Biogas production from animal waste - Conservation tillage technologies (low-till, no-till, strip-till, etc.)

[135] https://unfccc.int/sites/default/files/NDC/2022-06/Ukraine%20NDC_July%2031.pdf
[136] https://www.kmu.gov.ua/npas/deiaki-pytannia-vyznachennia-serednostrokovykh-priorytetnykh-napriamiv-innovatsiinoi-s78750724
[137] https://zakon.rada.gov.ua/laws/show/476-2024-%D0%BF#Text
[138] https://tech-action.unepccc.org/country/ukraine/

Sector	Key technologies prioritized for Adaptations	Key technologies prioritized for Mitigation
	- Development of an agrometeorological early warning system	- Production and use of solid biofuels from agricultural residues - ICT in agriculture to reduce greenhouse gas emissions
Water Mana-gement	- Climate-smart irrigation - Drought risk assessment and mapping - Flood hazard assessment and mapping	
Waste Mana-gement		- Methane capture at landfills and waste dumps for energy production - Waste sorting - Closure of old waste dumps with methane destruction (flaring, bio-covers, passive vents, etc.) - Aerobic biological treatment (composting) of food and green residuals - Mechanical-biological treatment of waste with biogas and energy production - Anaerobic treatment (digestion) of sewage sludge - Mechanical-biological treatment of waste for alternative fuel production for the cement industry

F. INFORMATION ON TECHNOLOGY DEVELOPMENT AND TRANSFER SUPPORT RECEIVED UNDER ARTICLE 10 OF THE PARIS AGREEMENT

According to the UN Climate Technology Center and Network, Ukraine had not requested technical assistance within the Technology Mechanism. Therefore, the data on technology support came mainly from UNFCC BTR reporting, the OECD Climate-related development finance dataset, and data on international technical assistance collected by the Ukrainian government.

During 2021-2022, Ukraine got support in deployment of climate related technologies, mainly in renewable energy sector, energy efficiency and ecology footprint of municipal infrastructure, waste and pollution management etc. (see Table IV.14).

As for renewable energy technologies, the most of them are related to wind and solar power (Table IV.13). According to the official data on renewable energy sector, wind power was among leaders in 2021-2022 by new installed capacities, following households solar panel generation.

Table IV.13 – New renewable energy capacities in Ukraine, 2015-2022 (in megawatts)

	Total MWt	Small HPP	SPP, households	SPP, industrial	Biomass PP	Biogas PP	WPP
2015	32	7	2	20	0	3	0
2016	136	3	15	99	4	3	12
2017	291	5	34	211	0	14	27
2018	849	4	106	646	12	13	68
2019	4659	5	396	3537	44	40	637
2020	1574	3	226	1169	22	10	144
2021	1158	4	426	306	43	20	359
2022	314	1	206	16	3	6	82

Source: https://map.ua-energy.org/uk/resources/02f06812-5ab4-49e0-8fa7-e70337f81988/?fbclid=IwAR1sxU4hXF3W-8YMUvYV18N4E6JsR8f2ouE1MMz2rUqYFVMsLaPv4QEvXLg

The renewable energy sector is dominated by private companies and the share of foreign investors increased to 35% at the beginning of 2022. The largest investors, who brought financing and technologies, are from China, USA, UK, Germany, the Netherlands, France, Belgum, Spain, Canada Turkey and so on[139].

[139] https://razumkov.org.ua/statti/sektor-vidnovlyuvanoyi-energetyky-ukrayiny-do-pid-chas-ta-pislya-viyny

Table IV.14. Technology transfer support received by Ukraine (selected)

Title of activity, programme, project or other	Programme/project description	Time frame	Recipient entity	Implementing entity	Type of support	Sector	Status of activity
Small Modular Reactor (SMR) Licensing Gap Analysis Technical Assistance, Mitigation	The objective of the TA is to support the State Nuclear Regulatory Inspectorate of Ukraine (SNRIU) in identifying gaps in its existing nuclear regulations as it relates to small modular reactor technologies. The grant is anticipated to mobilize $2.857 billion in financing.	2022	Government (State Nuclear Regulatory Inspectorate of Ukraine)	USA	Mitigation	Energy	ongoing
Supporting structural change in the Ukrainian coal regions	The cooperation is intended to increase the visibility of German energy policy in Ukraine and to help this policy achieve a better public image. The interests of German industry are incorporated into the cooperation, particularly with the aim of introducing German know-how and technologies for a sustainable energy supply to the cooperation country Ukraine. The cooperation provides German companies with information about the sector and access to energy policy decision-makers in the partner country	2021-2025	Ministry of energy, Ministry of regional development, local authorities	GIZ, Germany	adaptation	Energy	ongoing
Monitoring of atmospheric air in Boryslav city	The aim of the project is to monitor air quality and microclimate in the area of former oil and ozokerite mining in the residential part of Boryslav and subsequent identification and adoption of measures to reduce negative impacts.	2021-22	Boryslav town council	Slovak Agency for International Development Cooperation, Slovak Republic	Cross-cutting	General environmental protection Environmental research	completed
Reducing losses of water resources	The project aims to reduce water losses and prevent water losses due to damage to underground water pipes and to purchase special equipment to identify these damages.	2021-	Local Government	Slovak Agency for International Development Cooperation, Slovak Republic	mitigation	Water resources conservation (including data collection	completed
Clean drinking water – healthy children	The aim of the project is to provide quality drinking water to 5 educational institutions under the administration of the City of Vavra through the installation of the integrated water purification system.	2021	Local Government (Varva town)	Slovak Agency for International Development Cooperation, Slovak Republic	Mitigation	Water and sanitation	completed
Good Drinking Water for City of Kherson	The aim of the project is to support the quality of life and health of Kherson residents through the sharing of experience in the modernization of water management systems and the use of modern technologies in water management, through the sustainable development of outdated infrastructure.	2021	Local Government (Kherson)	Slovak Agency for International Development Cooperation, Slovak Republic	Cross-cutting	Water and sanitation	completed
Smog alarm Ukraine: Expertise and law in the civic campaigns for air protection	Protecting the environment from pollution and respecting fundamental freedoms and human rights to a clean and safe environment. a set of public air quality monitoring devices "Air Fresh Max Environment OS" was transferred to Ukraine to collect, accumulate, analyze and publish data on the state and quality of atmospheric air at the place of its installation in order to spread the practices and network of public air quality monitoring in Ukraine and implement the goal and action plan of the project "Smog Alarm Ukraine: Expertise and law in the civic campaigns for air protection"	2021	University and NGOs (Ivano-Frankivsk)	Czechia	Mitigation	General Environment Protection	completed

Title of activity, programme, project or other	Programme/project description	Time frame	Recipient entity	Implementing entity	Type of support	Sector	Status of activity
Disaster prevention and preparedness	Material aid given for disaster prevention to Ukraine from the Ministry of Environment's jurisdiction	2022	Ministry of Environmental Protection and Natural Resources	Estonia	Cross-cutting	General Environment Protection	completed
Increasing the capacity of Ukrainian rescuers to prevent and control fire accidents	Increasing the capacity of Ukrainian rescuers to prevent and control fire accidents	2022	State Emergency Service of Ukraine	Estonia	Cross-cutting	Forestry	completed

G. INFORMATION ON CAPACITY-BUILDING SUPPORT NEEDED UNDER ARTICLE 11 OF THE PARIS AGREEMENT

The current needs of Ukraine in capacity building are inextricably linked with the impact of full-scale invasion of russia to Ukraine and Ukrainian ambitious goals on climate neutrality and low emission development. RDNA3 emphasized that the needs included low-carbon and climate-resilient standards.

The following needs which may require capacity building support to be addressed in the near future are[140]:

- decarbonization efforts to meet the requirements under the EU accession and to increase energy security, that entails the transposition of the Clean Energy Package, correction of institutional and market-related breaches, and the adoption of the REPowerEU approach to increase energy security. Introducing right policies will help attract support from donors, financiers, and investors to accelerate the restoration and reconstruction.
- the restoration and building back better of on-farm irrigation technology and equipment support to the established Water users organizations (WUO) in the areas of Kyivska, Cherkaska, Poltavska, Vinnytska, Dnipropetrovska, Mykolaivska, and Odeska. A prior focus is required for technical infrastructure inventory and design of modernization projects, equipment for water management planning, accounting, and irrigation monitoring including training of the WUOs;
- heating sector reform and compliance with the EU policy. It includes developing new laws to ensure that use of new technology is more efficient and cost-effective with special focus on boiler houses, combined heat and power plants, replacing gas as a main fuel source in the industrial and heating sectors by developing biofuels (including biomass and biogases) and hydrogen.

H. INFORMATION ON CAPACITY-BUILDING SUPPORT RECEIVED UNDER ARTICLE 11 OF THE PARIS AGREEMENT

Ukraine has been receiving capacity-building for a long time. Many international organizations and donors are active in this type of support, including GIZ, International Climate Initiative (IKI), UNDP, WWF, EBRD, OECD, while funding come mainly from German Federal Ministries, the EU, Japan, Denmark, etc. In addition to targeted bilateral projects, Ukraine is a beneficiary of the EU supported climate-related Eastern partnership initiatives, e.g. EU4Climate, EU4Environment etc. The comprehensive list of capacity building projects is provided by the Ukrainian Climate Office. According to it, there are 42 capacity-building projects as of March 2025. During the reporting period of 2021-2022, Ukraine had been receiving capacity building support from 17 major projects related to climate policy development and implementation, climate-friendly energy efficiency, green investments framework, sustainable bioenergy, agri and land-use practices as well just transition, emission trading system and market readiness.

During 2019-2023, the EU also supported the project “Strengthening the capacity of regional and local administrations for implementation and enforcement of EU environmental and climate change legislation and development of infrastructure projects (APENA-3 project)”, which was aimed at strengthening capacity of regional authorities to develop and implement regional policies on adaptation to climate change and regional state administrations and local self-government bodies to implement new

[140] https://ukraine.un.org/sites/default/files/2024-02/UA%20RDNA3%20report%20EN.pdf

legislation that meets EU standards on environmental impact assessment, waste management and climate change. The project supported operation of the Ukrainian Climate Office141, which aims to provide training and capacity-development programs for government officials and civil servants to enhance their understanding of climate science, policies and practices as well as educational institutions in developing a climate curriculum to foster a climate-literate society.

In 2022, the project "Bilateral Component of Capacity Development for Climate Policy in Eastern, Southeastern Europe, Southern Caucasus and Central Asia, Phase III" has been launched to enhance the capabilities of government entities at all levels to support in formulating evidence-based climate policies as well as establishment of Ukrainian climate office[142]. The project is co-funded by the EU and the International Climate Initiative. It is implemented by the GIZ and was commissioned by the German Federal Ministry for Economic Affairs and Climate Action as well as the Foreign Office. The main beneficiary in Ukraine is the Ministry of Environment protection and natural resources.

Another key capacity building providers is the Germany Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection. It funded the best available technologies (BATs) for Ukraine project, which has been launched in 2019, is being implemented by GIZ in 2019-2026. The project supports Ukraine in introducing a system for preventing and reducing industrial emissions. Creating the statutory framework is a complex process that covers issues ranging from transposing the IED into Ukrainian law to adopting technical solutions.[143] In 2024, the Ministry of Environmental protection of Ukraine developed a draft of state targeted program proposal to support companies in deployment BATs. At the same time GIZ announced a pilot co-financing program for Ukrainian industry, under which it provides grant support to enterprises to implement BAT and reduce industrial pollution.

The second important project of the Germany Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection "The Support of the national energy efficiency fund and of a climate-friendly reform agenda (S2I)" plays an important role in capacity building and energy policy of Ukraine. The project started in 2018 and will be completed in 2025. It is also implemented by GIZ. The project supports the Ukrainian Government in setting up and improving functioning of the National Energy Efficiency Fund as well as promotion of the implementation of energy efficient measures in the residential sector144.

Another Germany funded and GIZ managed project «Support for the establishment of an emissions trading scheme (ETS) in Ukraine» contributes to capacity building in the establishment of the monitoring, reporting and verification (MRV) system145

In recent years, Germany launched several projects with capacity building component. The first is a 4-year project "Supporting Ukraine in the implementation of the Paris Agreement and Adaptation to the impact of climate change in the Black See Region (PAABS)", which is implemented by GIZ since 2024. One of the goals is to improve capacities and mechanisms for effective implementation of the PA and climate policies as well as improve capacities of CO2 and air pollutants companies to reduce the

[141] https://ukrainian-climate-office.org/en/about/
[142] https://iki-ukraine.org/project/capacities-for-climate-action-c4ca-ukrainian-climate-office/
[143] https://ukrainian-climate-office.org/en/project/best-available-techniques-bat-for-ukraine/
[144] https://ukrainian-climate-office.org/en/project/support-of-the-national-energy-efficiency-fund-and-of-a-climate-friendly-reform-agenda-s2i/
[145] https://www.international-climate-initiative.com/en/project/supporting-the-implementation-of-an-emissions-trading-scheme-in-ukraine-17-i-259-ukr-g-ets-entwicklung/

consumption of resources, energy and other environmental impacts, and to make available the best adaptation practices for uptake across Ukraine and the Black Sea Region.

The second one is a 8-years multidonor regional project "Promoting Green Deal Readiness in the Eastern Partnership Countries" launched in mid of 2022. It is focused on preparing the Eastern Partnership countries (including Ukraine) for the European Green Deal and aims to adapt agriculture and other sectors of the economy to climate change, new environmental requirements, and the spread of green finance.

The United Nations Development Programme (UNDP) provided support to the Government of Ukraine through improving the national greenhouse gas inventories, and conducting a gender analysis of the national climate policy perspectives. Under the EU/UNDP EU4Climate Project, UNDP is currently assisting the Mineconomy in developing the NDC Roadmap and Financial strategy, alongside an Investment Plan that will run until 2030 to enable successful implementation of the revised NDC.

UNDP also provided support the Ukrainian parliament members and the relevant parliament committees with quality analytical support in drafting legislation, organizing stakeholder consultations and roundtables for partners, developing communication products, and involving stakeholders in the discussion of sustainable energy and the environment issues. The project was implemented during 2018-2022[146].

As for industry-oriented initiatives, the UN Food and Agriculture Organization implemented the Climate-smart agriculture project in 2020-2022[147]. The FAO provides technical support for climate change adaptation, working with civil society to mitigate soil erosion and degradation, contributing to building resilience and boosting development in conflict-affected regions by supporting the economic recovery of farmers and rural communities etc.

Besides, many other countries supported Ukraine in climate-related capacity building actions (Table IV.15)

[146] https://www.undp.org/ukraine/projects/support-parliament-ukraine-sustainable-energy-and-environment
[147] https://ukrainian-climate-office.org/en/project/climate-smart-agriculture-csa/

Table IV.15. Selected Capacity building support received in the form of technical assistance

Title of activity, programme, project or other	Programme/project description	Time frame	Recipient entity	Implementing entity /country	Type of support	Sector	Status of Activity
EU4Climate / East Europe	The EU4Climate project supports the governments of Eastern European partner countries in implementing the Paris Agreement through mitigating climate change and transitioning towards a low-emissions and climate-resilient economy. The four key objectives are (i) enhancing countries' capacity to develop and implement climate policies aligned with their Paris Agreement commitments, (ii) enhancing transparency on emissions and climate action, (iii) mainstreaming climate aspects in sector specific policies, and (iv) advancing the implementation of climate-related provisions of bilateral agreements with the EU and in the Energy Community Treaty framework.	2019-2024	Government	UNDP	Cross-cutting	Government	completed
Strengthening the capacity of regional and local administrations for implementation and enforcement of EU environmental and climate change legislation and development of infrastructure projects	The main expected results, to be achieved by the project are as follows: – Further implementation of the AA and other relevant international obligations of Ukraine in environment and climate change sector; – Institutional capacity of regional and local authorities is improved for better implementation and enforcement of the new legislation aligned with the EU legislation in the areas of EIA, SEA, and waste management; – The respective know-how and European best practice are introduced and implemented in Ukrainian institutions to improve their performance, taking into account the organizational, managerial, technical, and other issues relevant to the sector performance; – Public relations, communication, and advocacy capacity is improved; – Civil society and business stakeholders are involved in the implementation of new legislation aligned with the EU legislation in the areas of EIA, SEA, and waste management, and in the development of climate adaptation plans, in particular through visible and effective public consultation mechanisms; – 3 Regional waste management plans with SEA; – 3 mature waste management investment projects with EIA; – 3 regional climate adaptation strategies.	2020-2024	Local governments	ENVIROPLAN S.A. Consultants and Engineers, Egis International, Egis Structures & Environment, Centre for Renewable Energy Sources and Savings (CRES) /EU	Cross-cutting	Government and civil society Waste management	completed
Ukraine-Denmark energy partnership programme	The programme focuses on reducing CO2 emissions by developing long-term energy planning through annual Ukraine Energy Outlooks and on strengthening Ukraine's energy efficiency and district heating by utilizing surplus heat and by modernizing its district heating network. The Ukraine Energy Outlook will provide guidance on how Ukraine can achieve its climate goals of carbon neutrality by 2050 and phase out of coal by 2040.The Danish Energy Agency is implementing partner and will continue its close partnership with the Ministry of Energy of Ukraine (developed during the previous phase) and start cooperation with a new partner, Mindevelopment, within the area of district heating. Energy experts from the Danish Energy Agency will contribute with advice, technical assistance and peer-to-peer learning in several areas. This includes energy efficiency in industry, strategic energy planning and long-term modelling of scenarios that can show pathways to a green transformation of Ukraine's energy system with focus on renewable energy and energy efficiency. The collaboration will focus on strengthening the environment for sustainable energy solutions and technologies based on Danish expertise and technical assistance, as well as opening up opportunities for companies working with green energy. The overall goal of the support is: Ukraine	2021-2026	Government (Ministry of Energy of Ukraine)	Danish Energy Agency	Cross-cutting	Energy policy and administrative management	ongoing

Title of activity, programme, project or other	Programme/project description	Time frame	Recipient entity	Implementing entity /country	Type of support	Sector	Status of Activity
	realizes its Nationally Determined Contribution (NDC) goals and achieves SDG7 and SDG13 targets.						
WWF Ukraine INSURE Climate Project - -	The long-term goal of the project "INSURE: Moving Nature Based Climate Solutions into Ukraine's Reform Agenda" proposed by WWF CEE and WWF Ukraine is to achieve integration of nature-based climate solutions into Ukraine's policy reform agenda by establishing the necessary knowledge base and stakeholder support while building the capacity of key drivers of change. This will create an enabling framework for climate change adaptation and mitigation measures by public and the private sector actors that are working with nature, not against it, such as wetland restoration for flood and drought management or increasing the resilience and carbon sequestration of forests. The outcome will be a reduction in net carbon emissions of the country and a more resilient society and economy less impacted by the negative effects of climate change. .	2021-2023	WWF Ukraine	Swedish International Development Cooperation Agency	Adaptation	General environmental protection	completed
Green Transition - Regional Eastern Europe	This project aims to support an increased understanding among partners of EU requirements and the potential gains of strengthened strategic planning for reaching the EU Green Deal targets. This would enable, over time, countries to mobilize increased financial support from EU and other donors/financers and hence scale-up needed investments. Importantly, the project approach is to build capacities by complementing and building on current support in the sector and facilitate a strengthened sector and donor coordination. The project will support: - a comprehensive assessment of the state of affairs in environment, climate, energy and other EU Green Deal related areas in Armenia, Georgia, Republic of Moldova, and Ukraine. The assessment will cover institutional, legal and policy gaps in relation to the EU Green Deal Acquis; - development of country-specific roadmaps, which are specific to the Green Deal and are based on the implementation gaps/challenges (as in the item above).	2022-2026	Government	Stockholm Environment Institute Swedish International Development Cooperation Agency	Adaptation	General environmental protection	ongoing
Support to SDG Office	The intervention aims at establishing a well-conceived and tested system for mainstreaming Sustainable Development Goals (SDGs) into policy-documents and tracking government-funded SDG Target-related activities in Ukraine.	2021-2024	Government	UNDP	Cross-cutting	Government and civil society	completed
Naturskyddsförening en framework	The overall objective of the initiative is "A strong global environmental movement with tools to contribute to concrete changes for sustainable development The contributes to both strategic areas of the strategy, ie. 1) Strengthening civil society's capacity in developing countries and 2) Promoting a favorable social climate for civil society in developing countries.	2017-2021	Government	Naturskyddsförening en	Cross-cutting	General environmental protection	completed
NIR ITP Sustainability Impact Accelerator	The main purpose of the program is to offer flexible and context-specific capacity development initiatives for infrastructure at local institutions, with the overall goal of accelerating sustainable investments in infrastructure. Capacity development requests from local institutions will be captured in collaboration with partners to Team Sweden, which include the Swedish Export Credit Agency (EKN), the Swedish Export Credit Corporation (SEK), Swedfund and Business Sweden. SIA will focus on infrastructure investments in renewable energy, access to qualitative and reliable	2020-2026	Private sector	International Council of Swedish Industry	Cross-cutting	Energy education/ training	ongoing

Title of activity, programme, project or other	Programme/project description	Time frame	Recipient entity	Implementing entity /country	Type of support	Sector	Status of Activity
	energy, sustainable energy use and control, expansion of railways and sustainable urban public transport.						
SSNC CSO agreement	The Swedish Society for Nature Conservation contributes together with partner organizations to a fair, equal and inclusive global change with reduced climate impact, strengthened biodiversity, reduced poverty and increased space for civil society.	2022-2026	Civil society	Swedish Society for Nature Conservation	Cross-cutting	General environmental protection	ongoing
Establishment and Development of Farmers' Organizations	Expenses for Priority Sectors/Regions in Agriculture/General	2021	Private sector	Japan	Adaptation	agriculture	completed
Technology for Solid Waste Management with Recycling Promotion for Sound Material-Cycle Society	Expenses for Priority Sectors/Regions in Urban Sanitation	2021-2022	Local government	Japan	Cross-cutting	Water and sanitation	completed
Operation and Maintenance of Sewerage System (B)	Expenses for Priority Sectors/Regions in Sewerage	2022	Local government / Utility companies	Japan	Adaptation	Water and sanitation	completed
Promotion of Hydrogen Energy Use -Energy Policy Towards Hydrogen-Based CO_2 Free Society	Expenses for Priority Sectors/Regions in New/Renewable Energy	2022	Government	Japan	Mitigation	Energy	completed
Strengthening of Community Health System for Infectious Diseases Control (D)	Expenses for Priority Sectors/Regions in Health/Health Care	2022	Local government	Japan	Adaptation	Other (Health and population)	completed
Expenses for Other Operations in Health/Health Care	Expenses for Other Operations in Health/Health Care	2022	Local government	Japan	Adaptation	Other (Health and population)	completed
Capacity Development for Municipal Waste Management	Expenses for Priority Sectors/Regions in Urban Sanitation	2022	Local government	Japan	Cross-cutting	Water and sanitation	completed
Road Maintenance	Expenses for Priority Sectors/Regions in Roads	2022	Local government / private sector	Japan	Adaptation	Transport	completed
Promotion of appropriate treatment technology for the treatment and disposal of hazardous waste_	Expenses for Priority Sectors/Regions in Urban Sanitation	2022	Private sector/ government	Japan	Cross-cutting	Water and sanitation	completed
Scholarship Ukraine	Study programme aimed at architecture and urbanism, agriculture and landscaping	2021-2022	Universities	Slovakia	Adaptation		completed

Title of activity, programme, project or other	Programme/project description	Time frame	Recipient entity	Implementing entity /country	Type of support	Sector	Status of Activity
Clean Zhovkva 2.0: energy efficient and ecological water treatment	The project's goal has two closely interrelated levels: firstly, it focuses on increasing the competitiveness of the partner and the applicant companies on the market (especially Ukrainian one), particularly by ensuring adequate technical (software and hardware) equipment for the professional processing of the project documentation of environmental constructions according to EU standards, by training the employees to work with such equipment and increasing employment in partner company. Secondly, it focuses on intensifying cooperation with the city of Zhovkva through the preparation (in very close cooperation with a partner company in Ukraine) of the specific project documentation for the zoning decision of the environmental construction called ""Clean Zhovkva - Sewerage and WWTP"". At the same time, this activity will serve as a model activity to initiate cooperation with other smaller cities in Ukraine with similar problems with water infrastructure.	2021	Municipal sector (utilities)	Slovakia	Cross-cutting	Water and sanitation	completed
Good Drinking Water for City of Kherson-	The aim of the project is to support the quality of life and health of Kherson residents through the sharing of experience in the modernization of water management systems and the use of modern technologies in water management, through the sustainable development of outdated infrastructure.	2021	Public company (municipal)	Slovakia	Cross-cutting	Water and sanitation	completed
Feasibility study - biomass logistics center for energy purposes in Kherson region	Feasibility study of the construction of a logistics center for the procurement of biomass for the energy needs of the city of Kherson through a central heat supply system based on the use of local biomass resources. It is necessary to map in detail the region's potential, hold meetings with biomass producers and develop a concept for biomass collection, logistics and storage for energy purposes.	2021	Private sector	Slovakia	Mitigation	Energy	completed
Feasibility study - Building of charging station network for electric vehicles	The aim of the project is to carry out a feasibility study describing the ways of realizing the network of charging stations for electric vehicles. The study will include the know-how of the company gained from the experience of a number of successfully implemented projects in Slovakia. It will provide the user with a complete overview of technical procedures, project solutions and implementation cases according to national standards and internationally recognized standard ZE Ready, which the company was the first and so far the only one in Slovakia.	2021	private sector	Slovakia	Cross-cutting	Transport	completed
SmartAGRO	SmartAGRO is a smart precise fertilization planning platform, helping to implement the best precise agriculture (PA) practices that match each crop's fertilization necessity and soil type. PA by SmartAGRO will reduce the amount of fertilizers by at least 8%, leading to a reduction of GHG emissions and mitigating climate changes. It will be implemented in Ukraine fields, positively impacting farm productivity and economics through higher or equal yields with lower production costs	2022	University: National University of Life and Environmental Sciences of Ukrai**ne**	Estonia	Cross-cutting	Agricultural development	completed