Environmental impacts of the war in Ukraine and prospects for a green reconstruction

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Key messages

- Since the Revolution of Dignity and the signing of the European Union-Ukraine Association Agreement in 2014, Ukraine has accelerated its efforts to address environmental challenges and started the green transformation of its economic development.
- This economic and environmental progress has been under attack since the start of the Russian invasion, setting back hopes for a green and sustainable economy in Ukraine.
- The war has caused widespread and severe damage to the environment and inflicted both immediate and longer-term consequences on the human health, ecosystems and the Ukrainian economy and beyond.
- The government is developing a Post-war Recovery and Development Plan that aligns with green economy and low-emission development principles.
- In the short term, Ukraine should focus on eliminating and reducing the immediate risks that the war poses to human health and the environment.
- In the longer term, post-war "green" reconstruction should not be seen as a desirable but optional "extra", but as an economic necessity for a fundamental transformation of Ukraine towards a green and net-zero economy.

Background and key issues

The newly independent Ukraine in 1991 inherited from the Soviet Union an economic structure dominated by energy-, resource- and pollution-intensive sectors, with outdated technologies in the mining and metallurgical sectors, energy-inefficient housing and outdated transport systems. Large shares of Ukraine's electricity supply, steel industry and district heating systems relied heavily on coal and natural gas, imported largely from Russia. As a result, Ukraine's energy- and CO_2-intensity has been the highest among its neighbours and well above that of the European Union member states.[1] Due to the large share of the population exposed to air pollution from heavy industry and rapidly growing transport based on an ageing vehicle fleet, mortality linked to air pollution in Ukraine was high compared with the OECD countries.[2] Ukraine's relatively abundant water resources have been under pressure from industrial, agricultural and household pollution. Agricultural land has continued to degrade while the area covered by forests has decreased.

Since the Revolution of Dignity and the signing of the European Union-Ukraine Association Agreement in 2014, Ukraine has accelerated its efforts to tackle these environmental challenges. The country has taken many steps to restore and preserve its natural capital, to integrate environmental concerns into economic development and to accelerate the transition towards a green and low-carbon economy. A recently adopted "Strategy of the State Environmental Policy of Ukraine for the Period till 2030" and its Action Plan to 2025 set more ambitious targets for pollution reduction and more efficient use of natural resources, and the updated Nationally Determined Contribution commits the country to reduce GHG emissions until 2030.[3] Plans to end coal mining in a socially responsible manner have been launched, accompanied by efforts to improve the energy efficiency of buildings.[4] Ukraine has also made substantial progress in partial liberalisation of gas tariffs and reducing environmentally harmful fossil-fuel subsidies. Comprehensive systems for measuring progress in implementing environmental policies and greening Ukraine's economy have also been established.[5] Ukraine's efforts to shift to a greener economy have been supported by international partners, including the OECD.[6]

Important steps have been taken to reform Ukraine's environmental governance while the reform of environmental legislation has followed closely the EU environmental *acquis* in line with the provisions of the Association Agreement. Efforts have been made to engage sectoral Ministries and businesses in the green transition. An inter-ministerial body to implement the European Green Deal in

[1] EU4Environment (2022 forthcoming), "Towards green transformation of Ukraine: State of Play in 2021 Monitoring progress based on the OECD green growth indicators"

[2] OECD/WHO (2015), Economic cost of the health impact of air pollution in Europe Clean air, health and wealth, https://www.euro.who.int/__data/assets/pdf_file/0004/276772/Economic-cost-health-impact-air-pollution-en.pdf

[3] The updated Nationally Determined Contribution, a non-binding plan to contribute to fulfilling the global goals of the Paris Agreement required cutting Ukraine's greenhouse gas (GHG) emissions by 65% in 2030 compared to 1990 and reaching carbon neutrality by 2060.

[4] Saha D. et al (2022), Economic reasons for a green reconstruction programme for Ukraine reforms, https://www.lowcarbonukraine.com/wp-content/uploads/PB_03_2022_en_Green-reconstruction.pdf and https://voxukraine.org/en/economic-reasons-for-a-green-reconstruction-programme-for-ukraine/

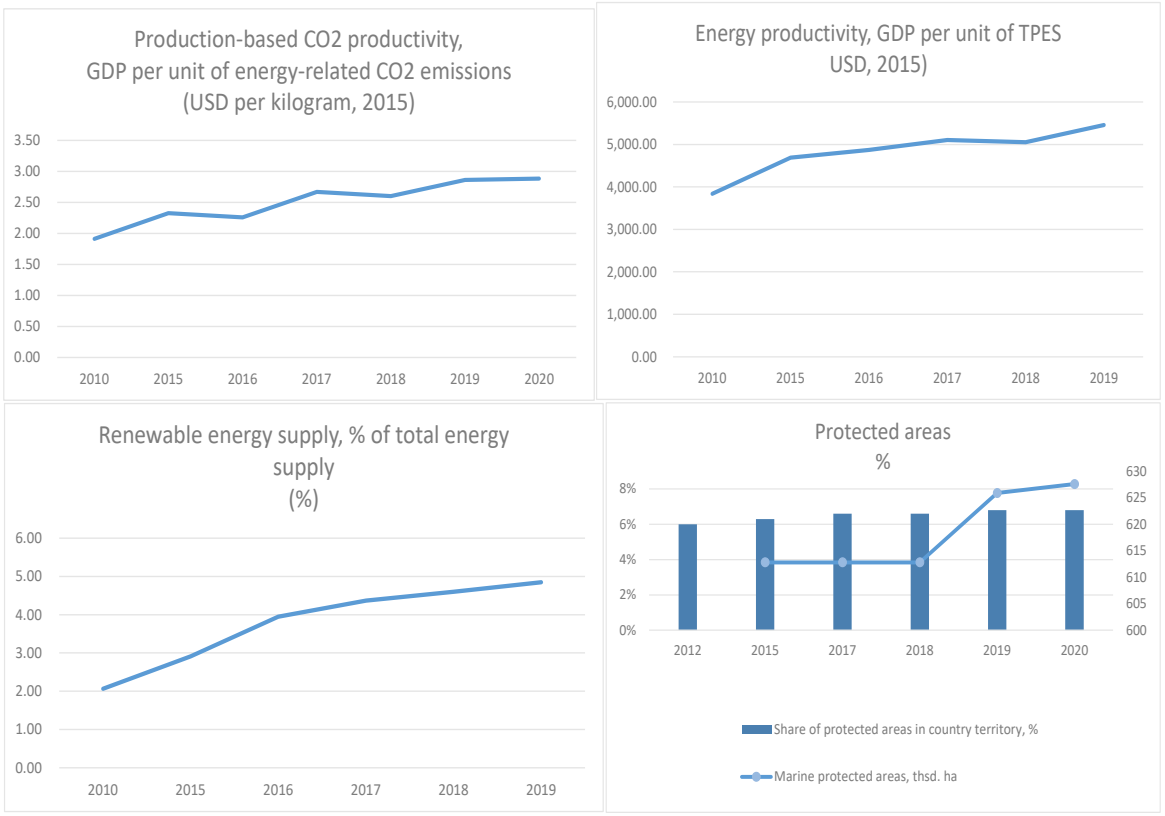
[5] OECD (2021), Fossil-Fuel Subsidies in the EU's Eastern Partner Countries: Estimates and Recent Policy Developments

[6] EU4Environment (2021), Towards a Green Economy in Ukraine: Work in Progress – 2019-20, https://www.eu4environment.org/app/uploads/2021/05/Ukraine-country-profile-2020-21-second-edition.pdf

Ukraine, headed by the Deputy Prime Minister, has been an important mechanism for inter-sectoral co-ordination on the green agenda.

These reform efforts have started to bring tangible results. The energy, CO_2 and water productivity of the economy increased by 51, 42 and 28% respectively, during 2010-19/20, while connection to sewerage networks doubled to 64% of the population.[7] The share of renewables in total primary energy supply more than doubled over this period, as did the share of renewables in final energy consumption, which accounted for 7.4% of the total in 2019. The share of protected areas has been on the rise, reaching nearly 7% of the total country area in 2020 (Figure 1).

Figure 1. Selected green growth indicators



Source: OECD.stat, EU4Environment (2022 forthcoming), *"Towards green transformation of Ukraine: State of Play in 2021 Monitoring progress based on the OECD green growth indicators"*.

This economic and environmental progress has been under attack since the start of the large-scale aggression by Russia, setting back hopes for an independent, green and sustainable Ukraine. Tens of thousands of lives have been lost and the associated humanitarian crisis has led to a large number of besieged and displaced people both within Ukraine and abroad.[8] The economic impacts have also been significant. Recent estimates of the damage to infrastructure, housing and non-residential buildings exceed

[7] EU4Environment (2022, forthcoming), "Towards green transformation of Ukraine: State of Play in 2021. Monitoring progress based on the OECD green growth indicators".

[8] Currently the number of refugees from Ukraine registered for temporary protection or similar national protection schemes in Europe reached 5.1 million. Source : https://data.unhcr.org/en/situations/ukraine

USD 100 billion, with vast destruction of homes, roads and railways, as well as agricultural land and other productive capacity of the country.[9]

What are the impacts?

The environment, natural resource base and infrastructure have not been spared by the war. The shelling of forests, land and marine ecosystems, industrial facilities, transport infrastructure and houses, as well as water, sanitation and waste management infrastructure, has caused widespread and severe damage, with immediate and longer-term consequences for human health and eco-systems (Box 1).

Box 1. Examples of environmental impacts of the war

With a steady barrage of strikes on refineries, chemical plants, energy facilities, industrial depots or pipelines, the country's air, water and soil have been polluted by toxic substances, fires and building collapses, which can cause longer-term health threats like the risk of cancer and respiratory ailments.[10] Many of these issues can be considered transboundary, so the impacts will not only be felt in in Ukraine but **collectively posing serious health risks to the population**. Every day the Ukrainian authorities register incidents of exposure to toxic gasses released from explosions, also beyond its borders.

As a result of damage to water supply infrastructure, an estimated 1.4 million people in Ukraine currently have no access to safe water, and a further 4.6 million people have only limited access. For example, the water supply system from the Dnipro River to the city of Mykolaiv was severely damaged by shelling, cutting access to drinking water for three weeks until basic needs were met by water transported from neighbouring regions. Since 1 June, Ukraine has begun enhanced epidemiological surveillance of cases displaying cholera symptoms.

Military operations have also resulted in dramatically increased amount of waste. This includes the damaged or abandoned military vehicles and equipment, shell fragments, civilian vehicles, building debris or uncollected household or medical waste. Some of this waste is toxic, including shell fragments, medical waste, or building debris containing asbestos, PCB and heavy metals, and will require special handling, transport and disposal.

The nature and ecosystems also suffer. The Ukraine authorities estimate that due to Russia's military activities, 900 protected natural areas of Ukraine have been affected and an estimated 1.2 million hectares, or about 30% of all protected areas of Ukraine, suffer from the effects of war.[11] Forests have been destroyed by fires from shelling and through misuse by the Russian forces, many being littered with destroyed or abandoned military vehicles.

Serious negative impacts are inevitably arising from the use of weaponry which can bring acute and long-term environmental health impacts. Direct public health risks are caused by exposure to

[9] Kyiv School of Economics (2022), Direct damage caused to Ukraine's infrastructure during the war has reached over USD 105.5 billion, https://kse.ua/about-the-school/news/direct-damage-caused-to-ukraine-s-infrastructure-during-the-war-has-reached-over-105-5-billion/

[10] Ministry of the Environmental Protection and Natural Resources (2022), "Digest of the key consequences of Russian aggression on the Ukrainian environment for June 9-15, 2022", https://mepr.gov.ua/news/39320.html

[11] Ministry of the Environmental Protection and Natural resources (2022), "Damage to natural reserves and protected ecosystems, https://mepr.gov.ua/en/news/39144.html

hazardous substances contained in the ammunition remains which leak toxic substances into the soil and affect surface and groundwater quality. Risks come from munitions-linked heavy metals, energetic compounds, such as trinitrotoluene (TNT), hexogen (RDX), and propellants from missiles and rockets.[12] The large numbers of abandoned or damaged military vehicles contain toxic materials which pose the risks for civilians and environment and would require careful handling during collection and disposal.

While environmental damage is evident, its extent is difficult to measure.[13] Pollution caused by military activities goes unreported, as monitoring systems have been disrupted or destroyed, and such damages continue to accumulate. From the first days of the war, the government launched several tools to document the environmental damage. This includes a dashboard with data on the impact of the war on the environment, "EcoZagroza",[14] and the work of the State Environmental Inspection, which recorded over 250 cases of crimes against the environment and over 1200 cases of damage to the environment from the aggression.[15] Special units have been collecting evidence, including photos, video and satellite images and, where possible, air and soil samples for laboratory tests. Work has begun to develop methodologies for calculating the monetary values of the damage to the environment.

What is the outlook?

Post-war reconstruction will be a monumental task and will require comprehensive, well co-ordinated and well-funded effort. Ukraine has already set up the National Council for Recovery from the War, which is preparing a Post-war Recovery and Development Plan for Ukraine. The development of the Plan builds on remarkable co-operation and institutional capacity demonstrated by the Ukrainian authorities at all levels, municipalities, businesses as well as civil society.

The Post-war Recovery and Development Plan is being developed following the green economy and low-emission development principles. A Working Group on "Environmental Safety", which was established to develop proposals for the Plan, identified five priority areas: i) reforming public environmental administration; ii) climate mitigation and adaptation policy; iii) environmental safety and effective waste management; iv) sustainable use of natural resources; and v) conservation of natural ecosystems, preservation of biological diversity and restoration and development of protected areas.

The Plan includes short and long-term priorities, which reflect inputs from an extensive process of stakeholder consultations. The post war development effort should indeed build on Ukrainian stakeholders' ownership, engaging all relevant national and sub-national authorities, experts and representatives of the business sector and citizens. Close co-operation and co-ordination with supporting countries, international organisations and international financial institutions are also needed to mobilise the necessary expertise and financial resources for the reconstruction that are in line with environmental priorities identified above.

[12] PAX (2022), "Environment and Conflict Alert Ukraine: A first glimpse of the toxic toll of Russia's invasion of Ukraine, https://paxforpeace.nl/news/overview/environment-and-conflict-alert-ukraine-a-first-glimpse-of-the-toxic-toll-of-russias-invasion-of-ukraine

[13] Hakim S., Makuch, K. (2022) "Conflicts of Interest: The Environmental Costs of Modern War and Sanctions", https://www.rusi.org/explore-our-research/publications/commentary/conflicts-interest-environmental-costs-modern-war-and-sanctions

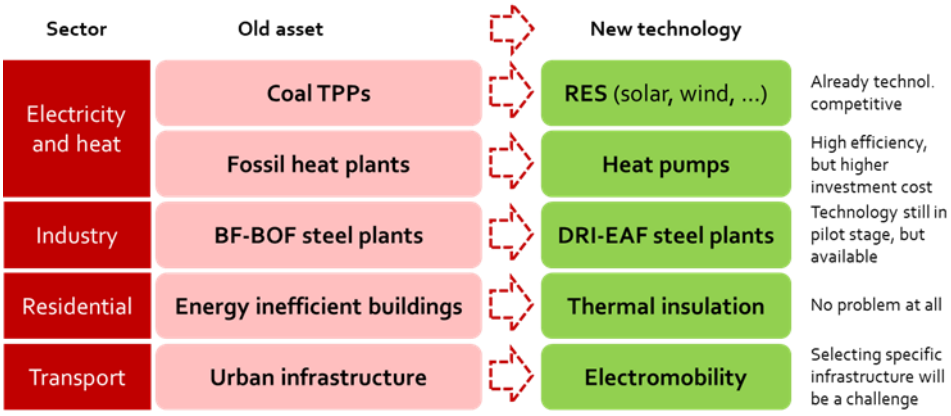
[14] https://ecozagroza.gov.ua/

[15] According the Criminal Code of Ukraine, "the mass destruction of flora and fauna, poisoning of the atmosphere or water resources, as well as other actions that could cause an environmental catastrophe" are a criminal offense.

In the short term, Ukraine should focus on eliminating and reducing immediate risks to human health and the environment from the impacts of the war. Preparing and carrying out a comprehensive environmental clean-up effort, especially related to collection, safe disposal and treatment of the vast amount of military and other waste, will help to reduce immediate health risks. At the same time, there will be an urgent need to repair and re-build more efficient environmental infrastructure to ensure the supply of safe drinking water, adequate sanitation and appropriate collection, storage and treatment of waste. The existing and potential impacts on human health should guide the prioritisation of actions.

In the longer term, the post war economic development process should be used for a fundamental transformation of Ukraine towards a green and net-zero economy. The reconstruction should not recreate the pre-war economy, which was fossil fuel based, energy inefficient and pollution intensive. Priority should be given to adjusting the economic structure by building more energy-efficient and less polluting industries and transport systems. Rebuilding of the housing stock, schools and hospitals should also improve their energy efficiency and use low-carbon materials (Figure 2).[16] It will be important to clearly formulate and explicitly pronounce these objectives of moving away from the reliance on fossil fuels and incorporating long-term green transition and sustainability as the key approaches for all aspect of the post-war economic development. This vision should cover not just the areas most affected by war, but the entire territory of Ukraine.

Figure 2. Examples of "green" reconstruction options for damaged/destroyed assets



Note: TPP refers to thermal power plants, BF-BOF to the conventional blast furnace (basic oxygen furnace, coal-based route of primary steel production) , whereas DRI-EAF refers to a potentially zero-carbon route based on direct iron reduction and electric arc furnaces, using hydrogen and electricity.
Source: Saha D. et al (2022), Economic reasons for a green reconstruction programme for Ukraine reforms.

Environmental protection policies and regulations are also crucial in facilitating green transformation of the economy. They should be made more agile, risk-based, outcomes-focused, data-driven and coherent, with simpler procedures, to ensure that environmental objectives are effectively achieved, and that administrative burden and barriers are minimised.[17] The European Union-Ukraine Association Agreement in 2014 contained a comprehensive list of actions to take in this regard. The most recent decision of the European Council to grant the status of candidate country to Ukraine provides an

[16] Becker, T. *et al* (2022), A Blueprint for the Reconstruction of Ukraine, Centre for Economic Policy Research, London

[17] OECD (2021) Recommendation on Agile Regulation, https://www.oecd.org/mcm/Recommendation-for-Agile-Regulatory-Governance-to-Harness-Innovation.pdf

important opportunity to accelerate progress to align the Ukraine legal framework with the EU *acquis communautaire* and improve regulatory delivery.

To encourage energy and material efficiency and to reduce pollution, an important step will be to reform the construction and operational regulations and standards, especially for large polluters, in line with good practice in the European Union and OECD countries.[18] A wider and comprehensive use of streamlined environmental evaluation procedures, such as Strategic Environmental Assessments of policies, plans and programmes and Environmental Impact Assessments of individual projects can help to consider and develop alternatives with less pressures on the environment. Effective supervision and regulatory delivery are also needed to ensure effectiveness.[19]

Reformed technical regulations should be supported by market-based mechanisms following the OECD Polluter-Pays Principle.[20] Priority should be given to introducing and reforming existing environmentally related taxes and charges, removing environmentally harmful fossil fuel subsidies, introducing emission trading schemes, and other market-based instruments that provide economic incentives to comply with, and where possible go beyond, environmental requirements. OECD analysis and recommendations on the use of market-based instruments should be useful in this regard.

Sustainable finance for coherent and strategic green investment plans will be critical. In this context, financial flows towards reconstruction investment should be duly monitored and analysed to ensure that they also contribute to achieving environmental and green objectives. The use of the EU taxonomy for sustainable activities and the OECD analysis of mobilising green finance and investment can be a useful benchmark. The development of a pipeline of bankable green investment projects can help to mobilise domestic and international private finance and international public funding.[21] Reviewing enabling regulatory environments, appropriately using economic instruments and building the capacity for investment project preparation can all support this objective.

There is a need to continue modernising the environmental institutions at the national and sub-national levels in order to ensure high administrative capacity to plan and implement environmentally sustainable reconstruction efforts.[22] The establishment of *ad hoc* or permanent inter-ministerial and inter-sectoral committees, working groups or task forces with the participation of the environmental authorities should help to ensure that environmental and green growth principles are reflected in coherent sectoral strategies, policies, and action plans. The engagement of civil society is also important for the success of the post-war transformation.

The reconstruction and green transformation of Ukraine will face challenges. For example, there may be pressures to rebuild quickly with existing technologies, especially where the upfront investment

[18] European Commission (2022), Ukraine: Commission presents plans for the Union's immediate response to address Ukraine's financing gap and the longer-term reconstruction: https://ec.europa.eu/commission/presscorner/detail/en/ip_22_3121

[19] OECD (2019), Toolkit for Regulatory Enforcement, https://www.oecd.org/gov/regulatory-policy/oecd-regulatory-enforcement-and-inspections-toolkit-9789264303959-en.htm

[20] OECD (1992) The Polluter-Pays Principle: OECD Analyses and Recommendations, https://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=OCDE/GD(92)81&docLanguage=En

[21] European Commission (2022), EU taxonomy for sustainable activities: What the EU is doing to create an EU-wide classification system for sustainable activities, https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/eu-taxonomy-sustainable-activities_en

[22] European Commission (2022), Ukraine: Commission presents plans for the Union's immediate response to address Ukraine's financing gap and the longer-term reconstruction: https://ec.europa.eu/commission/presscorner/detail/en/ip_22_3121

costs of greener alternatives are thought to be higher. Ukraine may also face difficulties in raising sufficient funds for environmentally sustainable reconstruction, as well as challenges related to transparency and effectiveness of their use. Finally, the lack of qualified staff will affect institutional capacity as many Ukrainian experts have been displaced, many of them permanently.

"Green" reconstruction should not be seen as a desirable but optional "extra", but as an economic necessity for the future development of Ukraine.[23] The green transition will ensure the greater economic efficiency and competitiveness of Ukraine in the European and global markets. The reconstruction offers Ukraine an opportunity to leapfrog to greener technologies, reduce the reliance on fossil fuels, and strive towards a net-zero economy. [24]

What are the key considerations for policy makers?

- In the short term, Ukraine should focus on eliminating and reducing immediate risks to human health and the environment. Preparing and carrying out a comprehensive environmental clean-up effort, especially related to collection, safe disposal and treatment of the vast amount of military and other waste will help to reduce immediate health risks.
- There will also be an urgent need to repair and rebuild more efficient environmental infrastructure that ensures the supply of safe drinking water, adequate sanitation and appropriate collection, storage and treatment of waste. The existing and potential impacts on human health should guide the prioritisation of actions.
- In the longer term, the post-war economic development process should be used for a fundamental transformation of Ukraine towards a green and net-zero economy. The green transition will ensure the greater economic efficiency, stronger competitiveness of Ukraine in the European and global markets and well-being of its people.
- Environmental regulations, standards and technical rules as well as the thorough transformation of regulatory delivery are key to ensure that environmental objectives are effectively met, while decreasing administrative burden and barriers to investment and innovation. This should also involve a wider use of the OECD Polluter-Pays Principle.
- Since significant funds are expected to be available for the reconstruction efforts, the emphasis should be placed on ensuring that the financial flows also contribute to achieving environmental and green objectives.
- Ukraine should also continue modernising the environmental institutions at the national and sub-national levels to ensure high administrative capacity to plan and implement environmentally sustainable reconstruction efforts, and deliver regulation in a transparent, professional, risk-based and outcomes-focused way.

[23] Saha D. et al (2022), Economic reasons for a green reconstruction programme for Ukraine reforms, https://www.lowcarbonukraine.com/wp-content/uploads/PB_03_2022_en_Green-reconstruction.pdf and https://voxukraine.org/en/economic-reasons-for-a-green-reconstruction-programme-for-ukraine/

[24] Becker, T. *et al* (2022), A Blueprint for the Reconstruction of Ukraine, Centre for Economic Policy Research, London