Unlocking Ukraine's Green Potential:

Carbon Markets as Catalysts for Ukraine's Green Recovery

June 2025

Ukrainian Sustainable Fund

MERCY CORPS

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Glossary of terms

Article 6.2 – a provision of the Paris Agreement that that allows countries to cooperate by transferring internationally recognized mitigation outcomes (ITMOs) to meet their climate targets, promoting global collaboration on emissions reductions.

Baseline emissions – a reference emissions scenario against which actual emissions reductions are measured for crediting purposes.

Carbon Border Adjustment Mechanism (CBAM) – a policy tool that imposes a carbon-related cost on imports reflecting the difference between domestic and origin-country carbon pricing to prevent carbon leakage.

Carbon credit – a certificate showing that one metric ton of greenhouse gas emissions has been reduced or removed from the atmosphere, which can then be bought, sold, or used to offset emissions in carbon markets.

Carbon intensity – the amount of greenhouse gases produced per unit of economic activity (e.g. GDP) or energy output, often expressed as CO2e per dollar or per kilowatt-hour.

Carbon leakage – the relocation of emissions-intensive production to countries with less stringent carbon regulations, thus undermining the environmental benefits of stricter domestic regulations.

Carbon lock-in – a situation in which existing fossil-fuel infrastructure and investment patterns reinforce ongoing carbon emissions, thereby inhibiting the transition to lower-emission alternatives.

Carbon markets – market-based systems (including both compliance-based and voluntary frameworks) where carbon credits are bought and sold to encourage emission reductions.

Carbon pricing – a policy approach that assigns a cost to greenhouse gas emissions, typically through carbon taxes or emissions trading systems, based on the "polluter pays" principle.

Carbon sequestration – a process of capturing and storing atmospheric CO_2 in forests, soils or geological formations.

Carbon tax – a carbon pricing mechanism that sets a price that emitters must pay for each ton of their GHG emissions.

Climate finance – a subset of green finance referring to finance that aims to address climate change through mitigation or adaptation.

Co-benefits – additional social or environmental benefits such as community health or biodiversity delivered by carbon-reduction projects alongside emissions cuts.

Compliance carbon market – a system regulated by mandatory national, regional or international carbon reduction regimes in which certain industries trade carbon credits as permits for allowable GHG emissions.

Green finance – financial activities aimed at increasing the level of capital flows from the public, private and not-for-profit sectors to sustainable development priorities.

Greenhouse gases (GHG) – gases that trap heat in the atmosphere and contribute to global warming, including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and industrial gases such as CFCs, HFCs, and PFCs, typically measured in CO_2 equivalents (CO_2e).

Internationally Transferred Mitigation Outcome (ITMO) – a unit representing an emissions reduction that can be traded bilaterally between states (see Article 6.2).

Measurement, Reporting and Verification (MRV) – a process for quantifying and reporting the amount of GHG emissions reduced by a specific mitigation activity; a crucial component of carbon markets.

Nationally Determined Contributions (NDCs) – commitments by each state to reduce national emissions and adapt to the impacts of climate change under the Paris Agreement.

Net zero transition – The process of shifting economies, industries, and societies toward balancing the amount of greenhouse gases emitted with the amount removed from the atmosphere, in a bid to reach "net zero" emissions.

Paris Agreement – a global climate accord adopted in 2015, where nearly all countries committed to limit global warming to well below 2°C, pursue efforts toward 1.5°C, and regularly set national targets to reduce greenhouse gas emissions.

REDD+ – a UN-backed program that helps developing countries cut emissions by preventing deforestation and degradation, and by supporting conservation and enhancement of forest carbon storage capacity.

Voluntary carbon market (VCM) – a market in which companies and individuals voluntarily buy carbon credits from clean energy or reforestation projects, among others, to offset their greenhouse gas emissions, independent of government mandates.

Executive Summary

This paper explores how voluntary carbon markets (VCMs) can help drive Ukraine's postwar recovery and energy transition by unlocking green finance for renewable energy and sustainable recovery projects.

The full-scale war has severely damaged Ukraine's environment and energy infrastructure, disrupted climate progress and increased the country's reliance on fossil fuels. Moreover, the loss of energy facilities has been disproportionate – most of the country's damaged and destroyed fossil fuel plants are in government-controlled areas, while most renewable capacity has been lost in the occupied territories. This creates a worrisome scenario in which bringing traditional power plants rapidly up to full capacity leads to carbon lock-in.

VCMs and similar instruments can help reverse this trajectory by making sustainable energy investments more financially viable. Unlike compliance markets, which currently face regulatory hurdles and additional costs under the current context, VCMs provide a faster, more flexible path to attracting financing for Ukraine's sustainable recovery.

This paper shows how carbon finance can support Ukraine's postwar recovery through such opportunities as financing renewable energy systems, agriculture-based biofuel production and reforestation. These efforts advance decarbonization, attract international green finance, and connect local project developers with global capital, including via Article 6.2 of the Paris Agreement.

We highlight practical opportunities for carbon finance to support Ukraine's recovery, including:

- **Building capacity** for small and medium-sized projects through clear market-entry guidelines and digital MRV systems
- **Exploring international cooperation** in ITMOs trading with developed countries to diversify opportunities and attract green finance.
- **Improving access** to global capital through public-private partnerships and international market frameworks.

These actions will help Ukraine attract financing for projects that address war-related environmental and energy damage.

Introduction

Global energy transition investments in 2024 amounted to USD 2.08 billion – just 37% of the annual spend that BloombergNEF estimates is needed this decade to achieve net zero emissions by 2050.[1] This shortfall highlights the need for innovative financial instruments.

Green financing is emerging as a key solution, with governments, banks, and financial institutions increasingly directing capital towards sustainable projects in renewable energy, sustainable agriculture, and biodiversity conservation.[2] The market's growth reflects this shift – rising from USD 4.18 trillion in 2023 to a projected USD 28.71 trillion over the next decade.[3]

Figure 1. The green finance landscape

Source: UASIF, based on data from Climate Bonds Initiative and DGB Group

Green finance encompasses mechanisms such as green debt, equity financing, and green credit enhancement (see Figure 1) that channel capital into projects that reduce

1 BloombergNEF, Energy Transition Investment Trends 2025 January 2025
2 Climate Bonds Initiative, ASEAN Green Financial Instruments Guide January 2019
3 Spherical Insights, Global Green Finance Market Size, Forecast to 2023-2033 February 2024

greenhouse gas (GHG) emissions and mitigate climate change.[4] As part of this, carbon pricing is increasingly directing revenues towards green spending.[5]

Although they vary depending on the country of region, carbon markets operate in two forms:

- **Compliance markets**, government-mandated cap-and-trade systems that limit emissions for certain industries
- **Voluntary carbon markets** (VCMs), where companies offset emissions by funding renewable energy or reforestation projects[6]

Monetizing emissions creates additional revenue from mitigation activities, which can be used to fund renewable and sustainable projects, thus boosting returns and encouraging further investment.[7]

The Paris Agreement includes a proposal for voluntary emissions trading.[8] Article 6.1 of the Agreement establishes a framework for governments to trade Internationally Traded Mitigation Outcomes (ITMOs), enabling countries to meet their climate commitments.

Carbon markets benefit both enterprises and governments by helping them to achieve emission targets while funding climate-positive initiatives. These markets totaled nearly USD 950 billion in 2023, and are expected to grow to USD 4.73 trillion by 2030.[9]

For Ukraine, integration into global carbon trading presents critical opportunities. While supporting decarbonization and net zero transition efforts, carbon markets can also address war damage, especially in the energy sector, by driving capital towards green initiatives and other sustainable projects. Ukraine's natural resources and industrial base position it to generate carbon credits and ITMOs, securing revenues for renewable energy, biofuel production, and sustainable agriculture. This approach can support reconstruction efforts while modernizing infrastructure ("build back better") to avoid carbon lock-in.

4 Climate Bonds Initiative, ASEAN Green Financial Instruments Guide January 2019
5 DGB Group, The basics of carbon pricing: a comprehensive guide 2021
6 The Global City, Enabling the voluntary carbon market in the context of the Paris Agreement October 2022
7 Carbon Credits, The Impact of Carbon Credits on Renewable Energy Development April 2023
8 UNFCCC, Paris Agreement text English December 2015
9 Grand View Research, Carbon Credit Market Size To Reach $4,734.35Bn By 2030 May 2024

Methodology

This paper employs a four-step methodology:

1. **Energy and emissions assessment.** We analyze Ukraine's emissions profile and identify the key role of the energy sector. We then evaluate the war's impact on emissions and highlight the need for green finance to support sustainable reconstruction without carbon lock-in.
2. **Carbon market overview.** We examine compliance and voluntary markets in terms of their potential as green finance instruments, and highlight the adaptability of VCMs and their lower regulatory barriers compared to the complexities of compliance systems. We connect voluntary ITMOs under the Paris Agreement with VCMs.
3. **Case studies.** We subsequently analyze carbon credit implementation in the areas of renewable energy, biomethane, and reforestation, showing how carbon credits can channel green finance into environmental initiatives.
4. **Barriers and recommendations.** Finally, we examine the institutional and market factors impeding Ukraine's access to VCMs, and offer actionable recommendations to integrate Ukraine into global frameworks and attract capital.

Ukraine's emissions landscape

Prior to 2022

When Ukraine ratified the Paris Agreement in 2016, its Nationally Determined Contribution (NDC) included a target of reducing GHG emissions to 60% of 1990 levels by 2030. By 2021, Ukraine had made considerable progress in meeting its commitments, and updated its NDC to reduce emissions to 65% of the 1990 levels.[10] However, this "progress" was mostly the result of deindustrialization and depopulation following the collapse of the Soviet Union and subsequent Russian aggression, rather than structural climate action.[11] Consequently, despite some gains in energy efficiency, the country's carbon intensity is significantly higher than the global and EU averages, putting Ukraine in 13th place overall in 2021.[12] That same year, Ukraine's total emissions reached 341.5 MT of CO_2e.[13] According to modelling by the United Nations Framework Convention on Climate Change, continued

10 UNFCCC, Updated Nationally Determined Contribution of Ukraine to the Paris July 2021

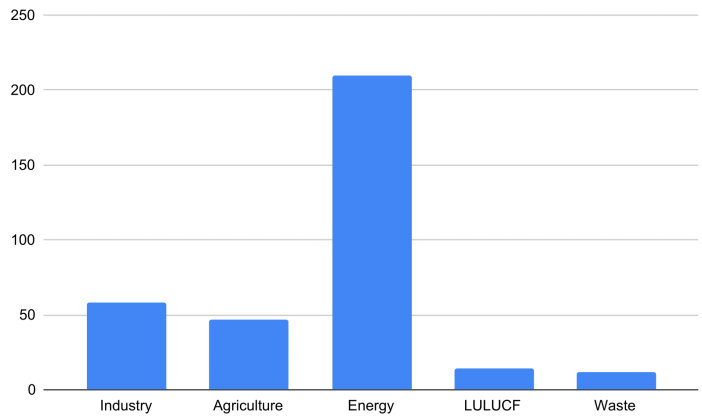
11 Conflict and Environment Observatory, Ukraine conflict environmental briefing: the climate crisis - CEOBS November 2023

12 Our World in Data, Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation - Our World in Data July 2023

13 UWEC Work Group, Prospects for green recovery and decarbonization in Ukraine December 2023

underinvestment and lack of access to climate finance could lead to a 19% rise in Ukraine's GHG emissions by 2030 compared to 2021.

Figure 2. Emissions per sector in Ukraine in 2021 (in MT of CO_2)



Source: UASIF, based on data from Green Deal Ukraine

In 2021, the energy sector was the largest source of greenhouse gas emissions in Ukraine,[14] driven by a heavy reliance on fossil fuels, which made up 53% of the domestic energy mix. Although nuclear power – responsible for the largest share of electricity generation – produces negligible GHG emissions, the remainder of Ukraine's electricity supply was heavily dependent on coal and natural gas. By 2021, most thermal and combined heat and power plants had outlived their design lifespans and employed outdated technologies, which contributed significantly to the country's carbon intensity.[15] This reliance also had broader environmental impacts: in 2020, Ukraine was the largest emitter of sulfur dioxide in Europe, largely due to coal-fired thermal plants, and ranked fourth globally in economic losses from air pollution.[16] Renewable energies accounted for only one-tenth of electricity generation, reflecting limited progress in clean energy deployment.

The industrial sector was another major emitter,[17] due to its reliance on fossil fuels and insufficient investment in low-carbon modernization.[18] Meanwhile, agricultural emissions

14 Green Deal Ukraine, https://greendealukraina.org/assets/images/reports/ghg-emissions-paper.pdf July 2024

15 DiXi Group, Supporting Ukraine's Energy Sector: Keeping Ukraine's Accession to the EU in Sight January 2025

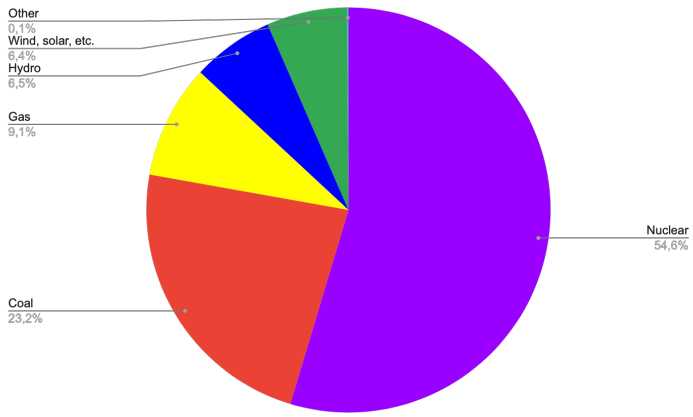
16 Oxford Smith School of Enterprise and the Environment The Green Phoenix Framework: Climate-Positive Plan for Economic Recovery in Ukraine June 2023

17 Green Deal Ukraine, GHG emissions assessment in Ukraine on the way to climate neutrality and ETS introduction July 2024

18 Oxford Smith School of Enterprise and the Environment The Green Phoenix Framework: Climate-Positive Plan for Economic Recovery in Ukraine June 2023

were primarily attributable to livestock digestion, manure management, and the use of chemical-based fertilizers.[19]

Figure 3. Ukraine's energy mix (2021)



Source: UASIF, based on data from IEA

Since 2022: destruction and instability

The full-scale war that began in February 2022 has caused significant environmental damage. Three years of military operations have led to the release of an additional 230 MT of CO_2e into the atmosphere.[20] War-related forest fires alone have reduced Ukraine's annual carbon storage potential by 100,000 tons of CO_2e.[21]

Concurrently, Russia's systematic attacks on transmission facilities (since 2022) and power plants (since 2023) have triggered a crisis and altered Ukraine's energy mix. Most hydroelectric facilities have been destroyed or disabled, and coal- and gas-powered plants have suffered extensive damage.[22] One-quarter of Ukraine's renewable capacity is now in the occupied territories and another 6% has been destroyed.

As a result – and in spite of Russia's occupation of the Zaporizhzhia nuclear plant, Europe's largest – nuclear power now accounts for nearly 65% of Ukraine's total electricity generation. Even at optimal capacity, however, nuclear power alone cannot meet Ukraine's energy needs, since generation capacity (12 GW) falls short of peak demand, which ranges from 14 GW in the summer to 18 GW in the winter.[23]

19 UNFCCC, Updated Nationally Determined Contribution of Ukraine to the Paris July 2021

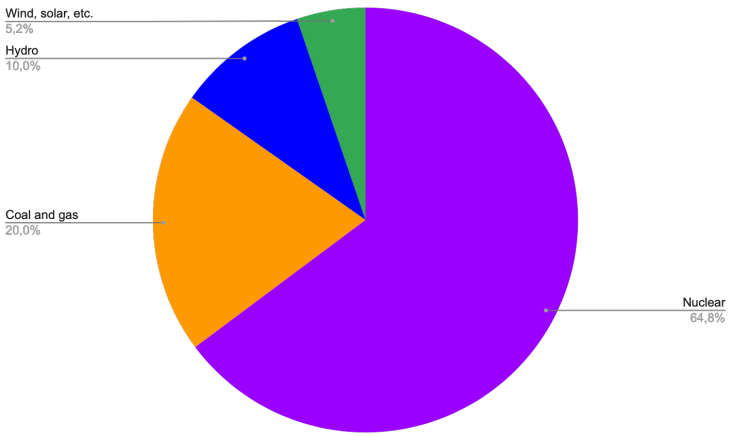
20 Initiative on GHG accounting of war, Climate Damage Caused by Russia's War in Ukraine February 2025

21 Conflict and Environment Observatory, Ukraine conflict environmental briefing: the climate crisis - CEOBS November 2023

22 Kyiv Independent, Russia has destroyed all thermal power plants, nearly all hydroelectric capacity in Ukraine ahead of winter, Zelensky says September 2024

23 Nafta&Gaz Ukrainy, Енергетична система України: стан на кінець 2024 року та сценарії на 2025 November 2024

Figure 4. Ukraine's energy mix (2024)



Source: UASIF, based on data from Nafta&Gaz Ukrainy

Ukraine currently covers its energy shortfall with diesel generators, which have a high carbon footprint.[24] Although the country plans to build natural gas-powered peaking plants,[25] which would help it meet short-term emission reduction targets, this approach has limitations, considering the 80-85% depletion of Ukraine's gas fields.[26] This would make the country reliant on imports, increasing energy security risks and worsening the trade deficit.

Energy recovery is further complicated by geographic disparities. Much of Ukraine's renewable energy infrastructure lies in territories under Russian occupation,[27] whereas most of its fossil fuel plants are located in government-controlled areas and may be prioritized for reconstruction. This imbalance risks locking the country into carbon-intensive energy production. Additionally, reconstruction efforts will themselves generate emissions.[28] It is essential that Ukraine focus on developing carbon-free renewable energy projects, particularly given the country's commitment to climate neutrality by 2060.[29]

Solar energy holds strong potential, given that solar insolation in Ukraine ranges from 1,100 to 1,500 kWh/m², which makes the entire country suitable for installing solar panels. Wind power is also promising, particularly in northeastern oblasts where average wind speeds are above 7 m/s.[30] Biofuel production represents yet another opportunity, since agricultural

24 Vox Ukraine, The Critical Role of Energy Equipment Imports in Ukraine's Resilience Amidst Russian Aggression, and a Path Towards Renewable Future October 2024

25 Kyiv Post, Ukraine Racing to Build Energy Capacity Before Winter June 2024

26 Ukrinform, Yuzivka: Between fake news and truth about Ukraine's gas independence December 2021

27 UWEC Work Group, Prospect for renewable energy in wartime: How Ukraine plans to ensure energy independence using "green generation" December 2024

28 Conflict and Environment Observatory, Ukraine conflict environmental briefing: the climate crisis - CEOBS November 2023

29 UNFCCC, Updated Nationally Determined Contribution of Ukraine to the Paris July 2021

30 Ukraine Invest, Renewable energy - UkraineInvest April 2025

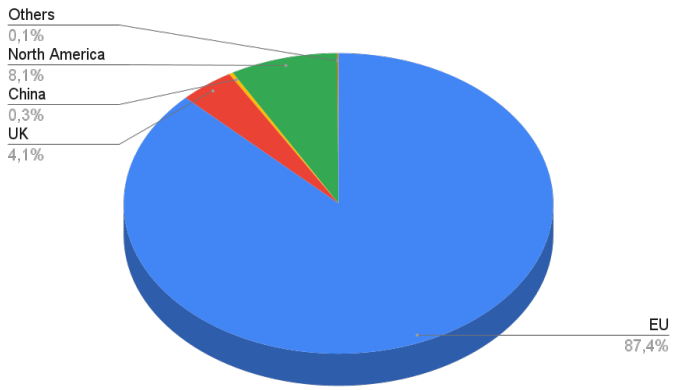
biomass waste can converted into power.[31] Although these projects require significant investment, green financing instruments – such as carbon trading – can help fund a sustainable energy supply, support decentralization of the country's energy grid, and advance reforestation efforts to offset conflict-related emissions.[32]

Overview of global carbon markets

Compliance markets

Compliance carbon markets are regulated systems designed to reduce GHG emissions using a "cap-and-trade" approach. A regulatory body sets a limit – or cap – on emissions by energy-intensive emitters such as iron and steel plants, oil refineries, power plants, and airlines.[33] Enterprises are allocated or can purchase a limited number of carbon allowances, and at the end of each year, they must hand in enough allowances to cover the amount of greenhouse gases they emitted. If they emit less, they can sell their unused allowances; if they emit more, they must purchase allowances from others.[34] This creates a financial incentive to reduce emissions and supports progress toward net zero.

Figure 5. Global compliance carbon markets in 2023



Source: UASIF, based on data from Reuters[35]

31 Energies, Transforming Agriculture into Energy: Unlocking Ukraine's Bioenergy Potential for Sustainable Post-Conflict Recovery March 2025

32 TheCityUK, Guest blog: Ukraine should be plugged into global carbon markets to close a funding gap for green and sustainable reconstruction February 2025

33 The Global City, Enabling the voluntary carbon market in the context of the Paris Agreement October 2022

34 Deloitte, Understanding the Compliance and Voluntary Carbon Trading Markets July 2023

35 Reuters, Global carbon markets value hit record $949 bln last year - LSEG February 2024

Compliance markets dominate global carbon trading, accounting for over 90% of total trade, and reaching USD 865 billion in 2022.[36,37] The most prominent examples are the EU Emission Trading System (EU ETS) and UK Emission Trading Scheme (UK ETS), both of them traditional cap-and-trade systems.

Launched in 2005, the EU ETS covers about 40% of the EU's total emissions (including CO_2, N_2O, HFCs and PFCs) across the energy, industry, aviation, and shipping sectors, among others. The EU ETS first allocates carbon allowances to each Member State, who in turn allocate and auction them among key sectors. Companies face a penalty of USD 108 for every excess ton of CO_2 emitted without a corresponding allowance.

The EU ETS also serves as a powerful green finance mechanism, since the revenues collected – USD 47 billion to date – are reinvested in clean energy projects. Member States have USD 35 billion to fund industrial decarbonization, clean technologies, and climate change adaptation. The remainder was allocated to the Innovation Fund, an EU-wide initiative to enhance financing of decarbonization efforts, and the Modernization Fund, which finances energy systems in the bloc's low-income countries.[38]

Since 2023, the EU has implemented the EU Carbon Border Adjustment Mechanism (CBAM), which applies a carbon price to certain imports, including aluminum, fertilizers, iron, chemicals, electricity and cement, from countries with weaker or no carbon pricing. Although the use of CBAM revenues, which could reach USD 10 billion annually by 2030, is still being determined,[39] they could potentially support green finance for sustainable projects across the EU.[40]

Voluntary markets (including the Paris Agreement)

The voluntary carbon market (VCM) allows companies, organizations and individuals to purchase carbon credits to offset their emissions and meet (voluntary) climate targets.[41] When buyers use these credits, they become permanent "offsets" that cannot be traded again.[42] VCMs account for only 0.01% of global carbon markets.

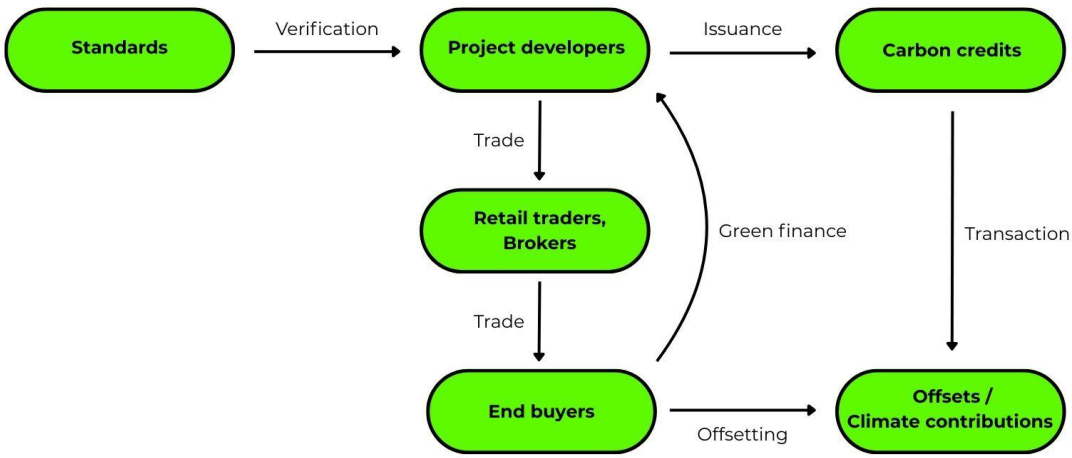
Climate projects generate carbon credits[43] by reducing or removing GHG in three main ways. **Prevention projects** (which account for the lion's share of these credits) build renewable energy solution instead of fossil fuel plants. **Removal projects** sequester carbon

36 Respira, Compliance and voluntary carbon markets: What is the difference? November 2022
37 Carbon Pulse, Global carbon markets post 14% increase in value in 2022, despite 21% drop in volume – analysts February 2023
38 EEA, Use of auctioning revenues generated under the EU Emissions Trading System December 2024
39 Wood Mackenzie, Playing by new rules: How the CBAM will change the world September 2023
40 Carbon Market Watch, FAQ: The EU Carbon Border Adjustment Mechanism (CBAM) July 2024
41 CSIS, Voluntary Carbon Markets: A Review of Global Initiatives and Evolving Models May 2023
42 S&P Global, Voluntary carbon markets: how they work, how they're priced and who's involved June 2021
43 The Global City, Enabling the voluntary carbon market in the context of the Paris Agreement October 2022

through reforestation or direct air capture technologies. Finally, **reduction projects** cut emissions from existing operations using efficient industrial equipment or clean cookstoves.[44] These projects often deliver additional benefits like protecting biodiversity and improving public health.[45]

The VCM was valued at USD 1.4 billion in 2024 but could reach USD 250 billion by 2050 as demand surges.[46] Carbon credits are especially useful for companies that want to contribute to global net zero efforts but are unable to eliminate emissions within their business operations. Unlike government-regulated compliance markets, the voluntary market has no supply caps, allowing unlimited clean projects to generate credits and attract green financing.

Figure 6. How voluntary carbon markets work



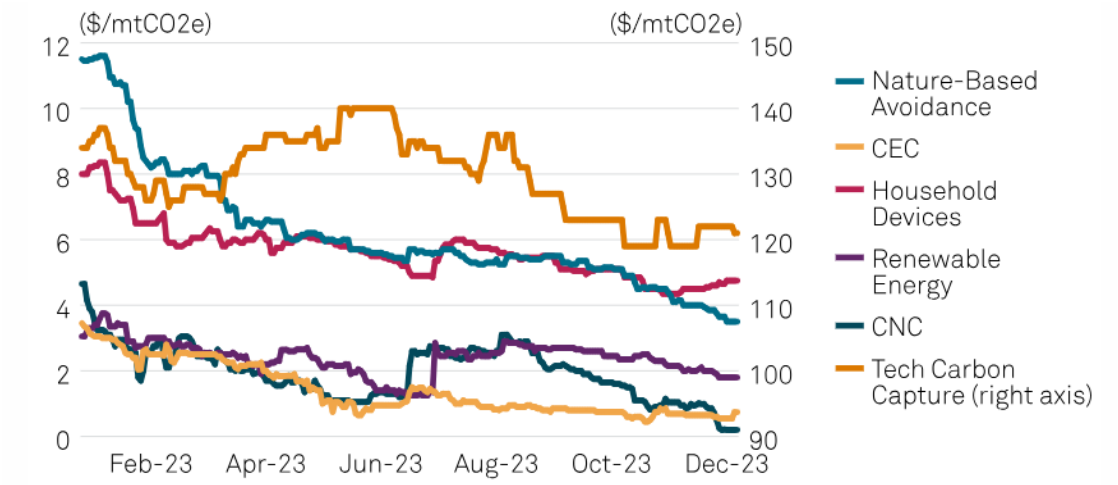
Source: UASIF, based on data from S&P Global

Like other financial markets, the VCM connects buyers and sellers through brokers and traders. Major exchanges include Xpansiv CBL (New York) and Air Carbon Exchange (Singapore). Traders buy credits directly from projects, create portfolios, and sell to companies seeking offsets, Brokers can buy credits from traders.

Without a single regulator, independent "carbon standards" verify credit quality. The two main standards are Verra's Verified Carbon Standard (VCS), which offers simpler certification for small-to-medium businesses across renewable energy, forestry, and land-use projects, and the Gold Standard, which has more rigorous requirements for large enterprises focused on sustainable development. Both are widely recognized, and ensure that each ton of CO_2 is counted only once, and that actual reductions match issued credits.[47]

44 Carbon Direct, Carbon removal, reduction, and avoidance credits explained October 2023
45 Greenly, Voluntary Carbon Market (VCM): principles and examples April 2024
46 Carbon Credits, Carbon Credits in 2024: What to Expect in 2025 and Beyond ($250B by 2050) January 2025
47 S&P Global, Voluntary carbon markets: how they work, how they're priced and who's involved June 2021

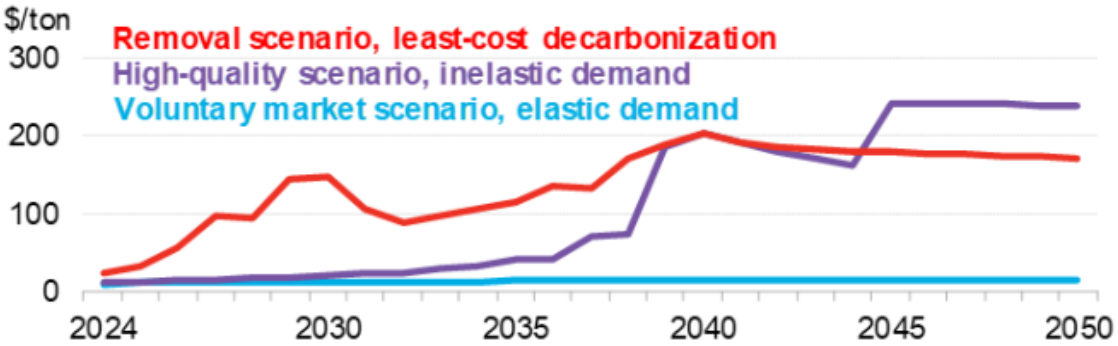
Figure 7. Carbon credit prices in 2023



Source: S&P Global

At the same time, buyer concerns about the adequacy of project assessment and pricing transparency has slowed growth.[48] In 2023, credit prices slumped. The Platts CNC index, which tracks nature-based carbon credits, plummeted following reports questioning the integrity of REDD+ credits from reforestation initiatives certified by Verra.[49] Cookstove projects also faced monitoring concerns. However, improved verification standards and major corporate investment are driving recovery. [50] With enhanced standards and projects, experts predict that certain high-quality credits could reach USD 200 per ton by 2050.[51]

Figure 8. Carbon credit pricing scenarios



Source: BloombergNEF

48 Carbon Credits, Trafigura Bets Big, $600M, on Carbon Credits Market Revival December 2024

49 S&P Global, Commodities 2024: Price slump in 2023 clouds outlook for voluntary carbon market January 2024

50 Carbon Credits, Trafigura Bets Big, $600M, on Carbon Credits Market Revival December 2024

51 BloombergNEF, Carbon Credits Face Biggest Test Yet, Could Reach $238/Ton in 2050, According to BloombergNEF Report, February 2024

The Paris Agreement and ITMOs

The Paris Agreement also created its own voluntary emissions trading system. Under Article 6.2, countries can trade Internationally Traded Mitigation Outcomes (ITMOs)[52], which are essentially carbon credits, between governments. If a given country struggles to meet its climate commitments, it can buy ITMOs from another country that exceeded its targets.[53]

This approach creates a win-win situation. Purchasing countries can meet their climate goals in a cost-effective manner by funding projects in places where emission cuts are cheaper to achieve. Selling countries receive green financing that can be used to develop renewable energy and conservation projects,[54] enabling them to improve the environment while earning revenue.

Unlike private carbon markets, ITMOs operate between sovereign states based on bilateral or multilateral agreements rather than trading platforms. As a result, countries must carefully track these trades through "corresponding adjustments" to prevent double-counting. When a country sells ITMOs, it deducts those emission reductions from its national inventory, while the purchaser counts them towards its climate targets.[55]

Importantly, the system is evolving to include private entities as well.[56] Some countries now allow enterprises to take part in ITMO trades.[57] For example, Switzerland has signed agreements allowing Swiss companies to buy ITMOs from projects in partner countries, such as Peru. A Swiss company recently purchased ITMOs from a Peruvian cookstoves project, with the emissions counting towards Switzerland's climate commitments.[58] Japan has adopted a similar approach.

This expansion is driving market growth. As countries approach their 2030 climate deadlines, demand for ITMOs is increasing. A growing number of developing nations are seeing an opportunity to attract much-needed green finance for domestic sustainable initiatives,[59] thus boosting the supply side.

52 UNFCCC, Paris Agreement text English December 2015

53 King&Wood Mallesons, The rise of carbon trading between governments: Can businesses benefit from Intergovernmental Carbon Credits under Article 6.2? August 2024

54 White&Case, Emerging Fundamentals in Climate Mitigation Through ITMO Transactions Under Paris Agreement Article 6.2 March 2023

55 King&Wood Mallesons, The rise of carbon trading between governments: Can businesses benefit from Intergovernmental Carbon Credits under Article 6.2? August 2024

56 The Global City, Enabling the voluntary carbon market in the context of the Paris Agreement October 2022

57 King&Wood Mallesons, The rise of carbon trading between governments: Can businesses benefit from Intergovernmental Carbon Credits under Article 6.2? August 2024

58 White&Case, Emerging Fundamentals in Climate Mitigation Through ITMO Transactions Under Paris Agreement Article 6.2 March 2023

59 King&Wood Mallesons, The rise of carbon trading between governments: Can businesses benefit from Intergovernmental Carbon Credits under Article 6.2? August 2024

Carbon market options for Ukraine

Launching a **compliance carbon market** like an emissions trading system (ETS) in Ukraine faces major hurdles. A functioning ETS requires more than emissions data – it calls for a comprehensive regulatory framework that includes a national registry, an allowance allocation system, enforcement mechanisms and technical oversight. Ukraine only established its Measurement, Reporting and Verification (MRV) system in 2021, and reporting was suspended after the full-scale invasion. Although it was reinstated in January 2025.[60] experts say that at least three years of consistent and comprehensive data are needed before a carbon market ETS can be function effectively.[61]

In addition to these technical gaps, institutional and financial challenges await. Building the capacity to operate an ETS – particularly one aligned with EU standards – will take time. Additionally, the cost of premature implementation could be high. A Deloitte study estimates that introducing carbon pricing too early could cost the equivalent of 7% of Ukraine's prewar GDP as opposed to 0.25% in the EU.[62]

Voluntary carbon markets, by contrast, offer a more accessible and immediate alternative. Since they are not government mandated, they do not require the same level of legislative alignment or administrative infrastructure that an ETS would. Project developers can immediately generate carbon credits through renewable energy and climate initiatives using international standards such as VCS or the Gold Standard.[63] Although VCMs do not meet the EU's CBAM criteria, they provide access to growing international demand for carbon offsets.[64,65]

VCMs also offer broader benefits. High-value credits such as ITMOs can attract premium prices and bring in capital from developed countries.[66] Many of these projects deliver not just emissions reductions but also social and health co-benefits[67,68] aligned with the UN's Sustainable Development Goals (SDGs), making them a practical tool for channeling green finance into Ukraine's recovery now, without waiting for ETS infrastructure to catch up.

60 CMS Law-Now, Ukraine restores mandatory greenhouse gas emissions reporting February 2025

61 Rosa Luxemburg Stiftung, Ukraine's Climate Policy: Between Bankability, EU Sticks and Leaving No One Behind May 2025

62 Deloitte, Policy framework for green reconstruction: Towards an EU-readiness of Ukraine's carbon pricing November 2024

63 CFP Energy, Compliance vs. Voluntary Carbon Markets Explained September 2024

64 CO2 IQ, CBAM deductions of carbon prices in third countries September 2024

65 BloombergNEF, Carbon Credits Face Biggest Test Yet, Could Reach $238/Ton in 2050, According to BloombergNEF Report, February 2024

66 OPIS, Voluntary Carbon Market Faces Messy Integration with Article 6 of Paris Agreement September 2024

67 Ecohedge, Carbon Offset Standards Comparison: Verra VCS vs. Gold Standard June 2024

68 Klik Foundation, KliK Foundation 2025

Unlocking green finance in Ukraine through VCMs

Potential VCM project sectors

Participation in VCMs, including under the Paris Agreement's ITMOs framework, remains underdeveloped in Ukraine. Some examples, however, show how carbon credit generation can deliver financial and sustainability gains[69] in priority sectors. These sectors are well-positioned to generate high-integrity credits by leveraging Ukraine's natural assets and recovery needs. They include:

Agriculture

Practices such as no-till farming, regenerative methods, biofuel from cover crops, and improved fertilizer use enhance soil carbon and reduce emissions. With 20% of farmland lost due to war, sustainable practices are critical to preserving what remains. An example of this is the Ivan Franko farm, a 9,200 ha crop and cattle farm in northeast Urkaine. This enterprise has pioneered monetization of sustainable agriculture through carbon credit sales, generating an average of EUR 22 per hectare.[70]

Potential buyers include large agricultural enterprises aiming for sustainable supply chains, among others.

Forestry

Afforestation, reforestation and forest preservation, especially under REDD+ frameworks, are vital, with 30% of forested areas damaged and in need of restoration. Initiatives such as the LIFE UkrForest project are are already piloting carbon-credit-driven reforestation.[71]

Potential buyers could include timber and paper companies with net-zero pledges and green funds, among others.

Manufacturing

In the heavily damaged industrial sector, energy efficiency retrofits, fuel-switching (e.g., coal to biomass), and emission cuts in steel and cement plants (use of electric arc furnaces, linker substitution) offer significant carbon savings. Reconstruction opens the door to integrating low-carbon technologies.

Potential buyers could include steel/chemical plants seeking to offset difficult-to-reduce emissions and donors funding upgrades.

69 GIZ, Ukraine Voluntary and Compliance Carbon Pricing Schemes in the Context Of Reconstruction and the Vision of a Sustainable Future November 2024
70 Kurkul, Вуглецеві кредити – як отримати більше за те, що робиш щодня February 2024

Renewable Energy

Within the context of a 2–6 GW electricity shortfall and a large share of renewable sources damaged, solar, wind, and small hydropower projects reduce emissions and boost Ukraine's energy security. Carbon finance can enhance viability of new projects, especially where infrastructure was damaged. DTEK has already issued 880,000 carbon credits from the Nikopolska solar farm operating close to the front line, with revenues expected to fund the development of new renewable energy projects.[72]

Potential buyers could include utility firms, heavy industry, and multinationals seeking green power.

Waste Management

Methane capture from landfills and biomass conversion from agricultural waste represent underused opportunities with strong GHG mitigation potential.

Potential buyers could include gas firms, waste management enterprises, and companies targeting methane reduction.

Case studies

Importantly, carbon credits can directly improve a project's economics: research shows that renewable energy developers can increase returns by up to 3% through carbon credits alone.

The following case studies illustrate how Ukrainian projects are already capturing – or could soon capture – carbon finance opportunities across different sectors:

Biomethane production

Ukraine's agricultural sector – a major contributor to GDP – offers strong potential for carbon credits through converting methane-rich livestock and crop waste into biomethane, a renewable natural gas substitute. The country has the potential to generate up to 21 billion cubic meters of biomethane, much of which could be exported to the EU.[73]

Recently launched biomethane plant

- **Feedstock:** Manure straw and corn silage
- **Capacity:** 3 million m^3 of CH_4/year
- **EU export value:** USD 1.5 million/year (at USD 500 per 1,000 m^3)[74],[75]

72 DTEK, DTEK Renewables issues first carbon credits DTEK in Ukraine January 2025
73 DiXi Group, Співпраця України та ЄС в Біометановому Секторі: Перспективи та Перешкоди March 2024
74 UABIO, Challenges and drivers for Ukrainian Biogas Sector Development February 2025
75 Kyiv Post, Ukraine Begins Biomethane Exports to EU, Plans Expansion February 2025

- **Carbon savings:** ~2 kg CO_2e per m^3 of methane[76]
- **Carbon credit revenue:** USD 90,000/year (at USD 15 per ton)[77]
- **Net gain:** +6% in annual revenue

Additionally, biomethane production offers valuable spillover benefits to other sectors with carbon credit generation potential. Its key byproduct is digestate, an organic fertilizer.

Solar and wind energy projects

In a recovering postwar Ukraine, solar and wind energy projects serve dual purposes: they reduce GHG and enhance the country's energy security. These decentralized energy assets are more resilient and harder to target,[78] and generating carbon credits can boost investment in these efforts. Under Article 6.2 of the Paris Agreement, carbon credits generated and sold through the ITMOs framework could yield even higher revenues. For example, in 2023, Switzerland paid an average of USD 31 for Article 6.2 credits.[79]

50 MW grid-connected solar plant in Kyiv Oblast[80]

- **Annual production**: 96,404 MWh
- **GHG reduction**: 34,000–38,000 tCO_2e
- **Energy revenue**: EUR 11 million/year (at EUR 115/MWh)
- **ITMO credits**: EUR 1 million
- **Revenue increase**: +10%

35 MW wind park

- **Annual production**: 92,000 MWh
- **GHG reduction**: 50,000–60,000 tCO_2e
- **Energy revenue**: EUR 14 million
- **ITMO credits**: EUR 1.8 million
- **Revenue increase**: +13%

Additionally, participation in VCMs can help support projects that are not solely driven by commercial interests but also prioritize ecosystem restoration and broader green recovery efforts in Ukraine.

76 European Commission, Processing of livestock waste, for the production of biomethane for use in agricultural vehicles and biofertilizers June 2024

77 Down To Earth, Bio-CNG projects as carbon credit generators July 2023

78 IEA, Ukraine's energy system under attack – Ukraine's Energy Security and the Coming Winter – Analysis - IEA September 2024

79 OPIS, Voluntary Carbon Market Faces Messy Integration with Article 6 of Paris Agreement - OPIS, A Dow Jones Company September 2024

80 These calculations are a high-level estimation of the project

Reforestation and ecosystem recovery

Ukraine's forests – spanning 9.6 million hectares – provide critical ecosystem services and mitigate GHG emissions But the ongoing war has devastated large areas,[81] particularly the destruction of 6,500 hectares of pine forests in the Lyman area of Donetsk.[82]

Despite active hostilities, reforestation efforts have begun, albeit at a slow pace,[83] underscoring the need for additional resources. Reforestation in Ukraine costs an average of USD 500 per hectare, though costs are likely higher in conflict zones.[84]

Planting a hectare of coniferous woodland can sequester nearly **5 tons of CO_2 annually**.[85] If integrated into a jurisdictional REDD+ program, reforested areas could represent USD 50 per hectare annually.[86] Leveraging green financing could cover up to 10% of reforestation costs, increasing the pace of ecosystem restoration.

Key challenges and recommendations

While VCMs offer a more immediate and accessible pathway for attracting green finance in exchange for emission reductions, several barriers limit their potential for supporting Ukraine's green recovery. The following recommendations address these challenges:

Building capacity for small and medium projects

Navigating voluntary carbon markets can be challenging due to complex trading environments, varying standards, and shifting dynamics. Even in developed markets like the UK, smaller projects and rural communities struggle with access to reliable information and compliance requirements. While Ukraine's larger players may have sufficient technical expertise to access these markets, there's a clear need to focus on capacity building for small and medium projects. This requires clear market-entry guidelines aligned with international standards like the Gold Standard and VCS, with particular focus on robust project-level monitoring, reporting, and verification (MRV) systems that improve credit competitiveness and transparency.

Navigating VCMs can be challenging due to the absence of a unified platform for trading, varying standards and shifting dynamics. Even in developed markets like the UK, smaller projects and rural communities struggle with access to reliable information and compliance

81 WWF, 'Ukraine: Sustainable Economic Recovery for People and Nature'. September 2022

82 Ministry of Environmental Protection and Natural Resources of Ukraine, Черговий акт екоциду: понад 100 га за тиждень – такі масштаби знищення лісу росіянами на Лиманському напрямку April 2024

83 Free Radio, Близько 15 тисяч гектарів лісу у Слов'янській та Лиманській громадах знищені внаслідок бойових дій, на відновлення потрібні десятки років March 2024

84 Wilson Center, Is President Zelensky's Reforestation Project Doable? | Wilson Center June 2021

85 Scottish Forestry, New report sheds light on CO2 uptake by different types of woodlands July 2022

86 Environmental Defense Fund, Average Prices for Jurisdictional REDD+ Credits to Reach $15 in 2028 June 2024

requirements.[87] While Ukraine's larger stakeholders might have the technical expertise and administrative capacity to access these markets, there is a clear need to focus on capacity building for small and medium-sized projects. This requires market-entry guidelines aligned with international standards, with a particular focus on robust project-level MRV systems that improve credit competitiveness and transparency.[88]

Digital MRV systems are particularly promising. Unlike the manual processes of conventional MRVs, which can consume 20-30% of total credit revenue,[89] digital solutions streamline reporting, reduce errors and cut costs.[90]

Expanding buyer networks

Ukraine has signed agreements with Switzerland and Japan for ITMOs trade under Article 6.2 of the Paris Agreement, enabling direct country-to-country carbon transactions.[91] However private sector participation remains untapped. Building cooperative frameworks with other countries – such as Sweden and other developed states – would diversify carbon credit opportunities and reduce the risk of market concentration.

Additionally, Ukraine could integrate ITMO transfers into joint green recovery initiatives where partners countries purchase carbon credits from Ukrainian renewable energy projects.

Improving access to global capital markets

Ukraine's prewar capital markets size was estimated at around USD 1.6 billion[92], less than 1% of the country's GDP in 2021 – insufficient for mobilizing domestic green finance. The country has also struggled to attract international impact investment due to a lack of structured equity and debt financing.[93] Without adequate financing access, carbon credit projects have difficulty securing full funding, as low carbon projects that generate credits often rely on resources from international capital markets.[94]

Developing VCMs without adequate access to equity and debt financing may prove unfeasible. For small and medium-sized project developers, including local communities positioned to generate credits, private-public partnerships offer a strategic pathway by

87 NICRE, Evaluating the accessibility and inclusivity of voluntary carbon markets for rural enterprises in the UK February 2025

88 Journal of Environmental Management, The status of forest carbon markets in Latin America January 2024

89 RMI, How to Build a Trusted Voluntary Carbon Market - RMI September 2022

90 SustainCERT, How – and why – should we prepare for digital MRV? May 2023

91 Cabinet of Ministers of Ukraine, Cabinet of Ministers of Ukraine - National emissions trading system will be launched in a pilot mode in 2025: Ruslan Strilets January 2024

92 OECD, Mapping Ukraine's Financial Markets and Corporate Governance Framework for a Sustainable Recovery January 2025

93 CSIS, The Untapped Market for Impact Investing in Ukraine June 2024

94 IIMB Management Review, India's low carbon value chain, green debt, and global climate finance architecture June 2023

facilitating access to finance and funding technical training and capacity building for effective market participation.

For larger entities investing in carbon credit projects, frameworks such as the London Stock Exchange offer mechanisms for listing on exchanges issuing carbon credits to shareholders as dividends.[95] Leveraging such frameworks could enable Ukrainian green projects to secure equity and debt capital from global investors.

95 LSEG, Infrastructure, integrity and innovation: how to bring the voluntary carbon market to scale June 2024