

LEVERAGING ECOLOGICAL TAXES AND CIRCULARITY FOR A “GREEN” RECOVERY OF THE UKRAINIAN COMMUNITIES

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Purpose: the primary objective is to synthesize global empirical evidence to formulate strategic recommendations for optimizing Ukraine's ecological taxation framework, thereby accelerating a sustainable, climate-resilient green recovery across Ukrainian communities.

Design/methodology/approach: the study achieves its objectives by deploying the long-term economic forecasting models alongside structural analyses of localized institutional frameworks, resource allocation mechanisms, and environmental policies necessary for decentralized municipal reconstruction.

Findings: the paper finds that while Ukrainian communities exhibit remarkable grassroots resilience, severe infrastructure destruction and fiscal constraints require the urgent implementation of market-based ecological taxes and circularity to catalyze localized green investments in the rebuild process.

Research limitations/implications: the primary limitation of the paper stems from the extreme unpredictability of the ongoing war in Ukraine, which complicates long-term localized planning and limits the availability of real-time environmental data required to assess community-level ecological impacts.

Social implications: the social implications of this paper indicate that embedding circular economy frameworks into municipal reconstruction will generate equitable green employment, thereby elevating public well-being across Ukrainian communities.

Originality/value: the originality of this paper lies in its novel synthesis of international empirical evidence on environmental taxation and its targeted application to the decentralized, post-war green recovery of Ukrainian municipalities, offering an unprecedented policy blueprint for national legislators, local authorities, and international donors seeking to leverage fiscal instruments for circular, community-led reconstruction.

Keywords: carbon taxation, circular economy, decarbonization, resource efficiency, sustainable development.

Category of the paper: Conceptual paper.

1. Introduction

The global “green” transition toward sustainable future is currently advancing into a critical implementation phase, necessitating innovative policy instruments and strategic frameworks. The contemporary challenge lies in operationalizing actionable pathways that accelerate the systemic phase-out of fossil fuels while simultaneously reinforcing energy security, economic competitiveness and sustainable development paradigms. In this context, the Roadmap for Transitioning Away from Fossil Fuels (TAFF), initiated by the COP 30 Brazilian Presidency and substantiated by the International Renewable Energy Agency (IRENA, 2026), functions as a foundational platform for delineating trajectories commensurate with multifaceted climate, security, and socio-economic exigencies.

Mitigating hydrocarbon reliance demands a multi-faceted paradigm encompassing regulatory updates, policy innovations, institutional reforms, infrastructural modernization, and robust international financing mechanisms. This systemic paradigm shift requires a fundamental reconfiguration of both the production and consumption of energy services globally. Crucial interventions include the exponential expansion of renewable power generation capacity, pervasive electrification across key end-use sectors (namely transportation, industry, and the built environment), augmented energy efficiency protocols, the modernization of grid and storage infrastructure, and the widespread commercial deployment of sustainable fuels. In Ukraine, where the ongoing war creates additional challenges for the development of all sectors of economy, the economic prospects for increasing the share of renewable energy sources include a number of advantages, in particular, reducing dependence on energy imports and increasing energy and economic security (Korchyha, 2026).

These global “green” transition frameworks hold acute, practical relevance for the post-war “green” recovery of Ukrainian communities. To successfully operationalize these national strategies at the municipal level, Ukraine must utilize environmental taxes to drive a circular economy approach directly within local communities. Currently, the circular economy sector in Ukraine is assessed by experts as very low or non-existent, with circularity remaining mostly in the planning phases and confined primarily to basic waste management concepts.

The reform of ecological taxes in Ukraine is currently undergoing a massive structural transformation aimed at integrating the nation's environmental policies with the European Union standards and facilitating a post-war green recovery. As of 2026, the country is shifting from a fragmented environmental tax system toward a comprehensive, market-based carbon pricing mechanism.

The urgency of this domestic reform is heavily driven by the European Union's Carbon Border Adjustment Mechanism (CBAM), which officially began full operations on January 1, 2026. Starting in 2027, Ukrainian exporters to the EU must annually report and pay for the carbon emissions generated during the previous year. To mitigate the financial impact on

domestic businesses, the new draft ETS law allows Ukrainian exporters to make voluntary carbon border adjustment contributions directly to the national Modernization Fund.

It is assumed that the implementation of an effectively calibrated, market-based ecological tax framework, specifically the transition to a national Emissions Trading System ETS (Cabinet of Ministers order, 2025) and the strict ring-fencing of environmental revenues for local Modernization Funds will act as a primary economic catalyst for the Green Recovery of war-affected Ukrainian communities, significantly accelerating the integration of circular economy models, resource upcycling, and sustainable municipal infrastructure. At the same time it is predicted that gradual increasing of ecological taxes will stimulate Ukrainian enterprises and households to introduce ecologically friendly solutions and circular technologies.

To establish a rigorous epistemological foundation for this investigation, the introductory framework is organized around a highly structured matrix of objectives: (i) identification of the research gap; (ii) formulation of the primary research question; (iii) definition of the explicit purpose of the article; (iv) delineation of intermediate objectives; (v) statement of testable assumptions and hypotheses; and (vi) specification of the overarching research method.

The primary research gap stems from a systematic literature review indicating that while environmental taxation is thoroughly evaluated within stable market economies, its operationalization within decentralized, war-affected regions undergoing active reconstruction remains unexplored. According to what we were able to find, there are no studies referring and reporting on the direct integration of global empirical carbon pricing frameworks with localized circular economy models specifically tailored for the post-war recovery of Ukrainian communities. This study bridges this gap, establishing its practical and theoretical significance.

Research question: How can market-based ecological taxes be systematically integrated to drive a sustainable, decentralized green recovery within war-torn Ukrainian municipalities?

Purpose of the article: The primary purpose is to synthesize international empirical evidence on ecological taxation and translate these insights into an actionable policy blueprint for Ukraine's community-led green recovery.

Intermediate objectives:

1. To evaluate the long-term impacts of pollutant pricing on corporate behavior in developed nations.
2. To identify the specific mechanisms through which environmental levies influence corporate research and development (R&D) and institutional absorptive capacity.
3. To present data of several Ukrainian regions with effective implementation of green transition.
4. To formulate targeted, decentralized fiscal mechanisms for ecological taxes and green public procurement across Ukrainian communities.

Assumptions and Hypotheses:

H1: The implementation of a calibrated, market-based carbon tax and national Emissions Trading System (ETS) in Ukraine will incentivize domestic enterprises to expand their internal absorptive capacity for clean technologies without inducing severe industrial decline.

H2: The strict ring fencing of ecological tax revenues for localized municipal Modernization Funds will successfully mitigate the fiscal constraints of war-affected Ukrainian communities, directly accelerating community-level circular reconstruction.

Research method: the research method deployed relies on a comparative macro-level policy synthesis and structural simulation, linking validated OECD empirical patterns with current Ukrainian institutional and regional data.

2. Literature review

With Europe tightening carbon-pricing rules while mobilizing hundreds of billions of Euro for sustainable infrastructure and circular economy transition, researchers (Martinsson et al., 2024) suggest emissions taxes can spur firms to invest in the technical know-how needed for cleaner production, even when they do not produce breakthrough green inventions. The central achievement of the study is proving that a substantial carbon tax directly causes significant reductions in firm-level carbon emissions without severely penalizing economic performance. The authors demonstrate that targeted firms achieved meaningful decarbonization while maintaining their output, sales growth, and productivity.

In "The Macroeconomic Impact of Europe's Carbon Taxes", Gilbert E. Metcalf and James H. Stock (2023) deliver a crucial, data-driven assessment of the macroeconomic consequences of carbon pricing. By analyzing a multi-decade panel dataset across European Union countries that implemented carbon taxes prior to the mid-2010s, the authors provide much-needed empirical clarity to a debate often dominated by highly theoretical and pessimistic modeling. By showing that historical European carbon taxes successfully reduced emissions while leaving macroeconomies stable and unharmed, the paper offers strong justification for adopting carbon pricing as a core, economically safe pillar of international climate mitigation strategies.

Podolchuk's scientific research (Podolchuk, 2023) concludes that the EU ETS functions as far more than a passive environmental policy; it is a dynamic economic engine driving the structural transition toward European energy independence. The paper provides an essential reference framework for transitional economies—including Ukraine—demonstrating how robust carbon market mechanisms can be synchronized with national regulatory policies to accelerate grid decarbonization and support sustainable economic regulation.

A long-running debate in climate policy is whether environmental taxes simply raise costs for firms or whether they also encourage cleaner technological change.

3. Methods

The methodology of this study is primarily declarative and conceptual, functioning as a comparative policy synthesis rather than an independent econometric regression of raw primary datasets. This research summarizes, evaluates, and critically extrapolates the empirical findings, statistical analysis of the macro-level OECD panel data, patent metrics from PATSTAT, and corporate financial records from Compustat originally established and published by Brown, Martinsson, and Thomann (2022).

The author's independent analytical contribution consists of synthesizing these international baseline mechanisms — specifically temporal asymmetry, corporate absorptive capacity, and high-knowledge-spillover dynamics—and mapping them against Ukraine's contemporary institutional landscape. To perform this contextual application, the author aggregates public macro-environmental data from the Cabinet of Ministers of Ukraine, CAIT, and the IEA to construct a simulated model of an effective carbon rate (ECR) profile. Furthermore, a comparative fiscal analysis is deployed to benchmark Ukraine's historical environmental tax revenue-to-expenditure ratios against European counterparts. Finally, this structural framework is applied directly to the operational realities of Ukrainian communities, evaluating a policy transition from traditional least-cost public procurement to a circularity-driven recovery paradigm.

4. Results

The imposition of stringent greenhouse gas (GHG) emission taxes has been empirically linked to significant expansions in corporate research and development (R&D) expenditures, alongside the accelerated integration of circular economy paradigms. Notably, the impact of such environmental levies on R&D investment is disproportionately pronounced within industries reliant on highly polluting production technologies; this differential response strongly supports a causal relationship between pollution taxation and technological adaptation (table 1), as documented in the foundational literature compiled by Brown et al. (2022) and the Stockholm School of Economics (2022).

Interestingly, while emission taxes stimulate R&D spending, they do not correspond with a concurrent increase in patenting activities among high-emission enterprises. This divergence suggests that affected corporations primarily allocate R&D resources toward enhancing their "absorptive capacity"—the ability to assimilate, operationalize, and deploy external environmental knowledge—rather than generating new, patentable innovations. Corroborating this mechanism, the strategic shift toward R&D and circular economy practices in response to pollution taxation is predominantly concentrated in sectors characterized by high knowledge spillovers, where external technological insights are more readily accessible and acquired (Stockholm School of Economics, 2022).

Table 1.

Taxonomy of environmental taxation strategies and implementation trajectories across selected OECD countries (1990-2012).

Tax Implementation Strategy	Represented countries (1990-2012)	Macroeconomic Policy Pattern Observed
Aggressive / Rapid Scaling	Denmark, South Korea	Sharp transition from zero taxation to maximum index levels (0 to 6).
High Baseline Stability	Japan	Consistent maintenance of high baseline taxation across the timeline.
Moderate / Incremental Scaling	France, Italy, Spain	Gradual upward adjustment; critical inflection point identified between 1997-2001.
Minimal or Non-Taxation Baseline	Australia, Canada, Germany, United Kingdom	Minimal active pricing or complete absence of active SO _x levies (10 sample nations).

*Note: Table synthesized by the author to organize the visual parameters of the OECD dataset distribution.

An analysis of the provided Table 1 reveals distinct patterns in how developed economies operationalize environmental taxation. There is no universal consensus on the magnitude or speed of environmental taxation. Approaches range from aggressive, rapid implementation (e.g., Denmark and Korea spiking from 0 to 6) and consistently high baseline taxation (Japan) to moderate, incremental scaling (France, Italy, Spain) or minimal taxation (Australia, Canada). The period between 1997 and 2001 represents a critical inflection point. Almost all the nations that transitioned from zero taxation to an active SO_x tax did so during this specific macroeconomic window. Once established, emission taxes are rarely rescinded or significantly reduced. Countries generally maintain or increase their tax levels over time, indicating that such policies provide a stable, long-term regulatory environment. As noted in the study's parameters, a substantial portion of the sample (10 nations, including major economies like Germany and the United Kingdom) chose not to implement a SO_x tax during this period, highlighting inconsistencies in international pollutant pricing strategies.

Utilizing a comprehensive dataset spanning 18 OECD nations from 1990 to 2012, (Martinsson et al., 2022) demonstrate that the imposition of sulfur oxide (SO_x) emission taxes significantly stimulated corporate research and development (R&D) expenditure within the manufacturing sector (Figure 1).

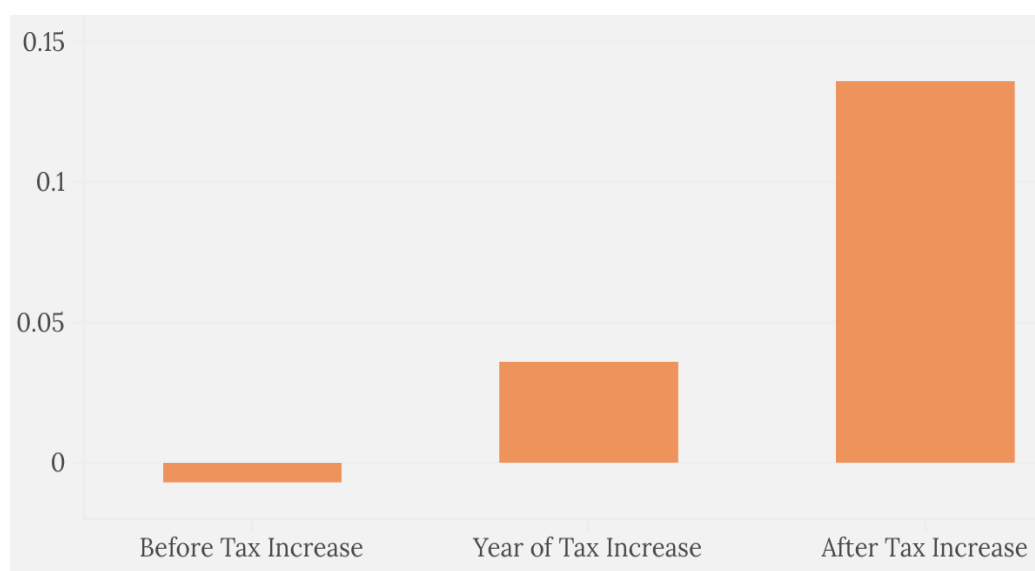


Figure 1. Estimated change in research and development spending. (Only the post-tax increase in R&D is statistically significant; estimates before and during the tax increase fall within the study’s margin of error).

Source: Brown, Martinsson, Thomann, 2022.

This surge in R&D investment was predominantly concentrated in heavily polluting industries — specifically cement, chemical production, metallurgy, and petroleum refinement — characterized by high-emission production processes. The authors posit that environmental levies fundamentally alter the cost structure for these firms, rendering the continued reliance on legacy, emission-intensive technologies economically unviable.

Methodologically, the study integrates macro-level OECD pollution tax data with micro-level corporate R&D expenditures derived from Compustat, alongside global patent metrics sourced from the European Patent Office’s PATSTAT database.

The empirical findings reveal economically substantial impacts:

- a one-standard-deviation escalation in pollution taxes correlated with an approximate 11% increase in mean R&D expenditure,
- the discrete introduction or elevation of such taxes yielded an even more pronounced effect, driving an average R&D spending increase of 13% to 14%,
- manufacturing entities exhibited a 13% increase in R&D outlays exclusively post-intervention.

This temporal asymmetry – whereby significant R&D expansion manifests solely following the tax implementation, with pre-intervention estimates remaining within the statistical margin of error – substantiates a causal interpretation that the policy shift directly induced the corporate response (Brown et al., 2022).

While contemporary discourse on green industrial policy frequently emphasizes inventions, this research highlights a critical, albeit less visible, mechanism. Paradoxically, despite augmented R&D expenditures, the most heavily taxed, high-pollution firms did not exhibit a commensurate increase in patenting activity.

The authors attribute this divergence to investments directed toward enhancing absorptive capacity — the organizational ability to identify, assimilate, and exploit external knowledge and technologies. Consequently, the R&D response was most acute in sectors characterized by accessible external knowledge spillovers. Firms effectively prioritized the internal expertise requisite for modernizing operations and adopting externally developed clean technologies over the generation of proprietary, breakthrough inventions. Crucially, this behavioral shift permeated beyond traditionally innovative enterprises, compelling even corporations with negligible patent histories to elevate their R&D commitments.

From a financial market perspective, these adaptive R&D investments were appraised positively. The marginal value of R&D capital appreciated significantly under regimes of heightened pollution taxation, indicating investor confidence that such expenditures would bolster long-term competitive advantage and ensure compliance with increasingly stringent environmental standards.

For regulatory bodies, these findings reinforce the efficacy of market-based environmental instruments. Beyond mere compliance, taxation architectures actively incentivize the technological investments necessary for systemic production overhauls and source-level emission reductions.

While the authors acknowledge a methodological limitation — the inability to directly quantify corresponding emission reductions due to the absence of standardized, cross-national firm-level emissions data—ancillary research provides compelling contextual evidence. In a parallel longitudinal study of the Swedish market (Martinsson et al., 2022), estimated that carbon pricing mechanisms were responsible for a minimum of one-third of observed emission reductions between 1991 and 2015, averting a counterfactual scenario wherein emissions would have been approximately 30% higher.

So, in the turbulent world a sufficiently high carbon price — even an imperfect one — should attract investments in green industrial investments. However, the decisions of these investors might in themselves also be imperfect, potentially postponing investments. One crucial factor is uncertainty and how it interacts with the irreversible nature of investments. That's why beyond emission trading scheme design, complementary policies targeting specific sectors or technologies — such as sector-specific decarbonisation targets or direct technology support — may be warranted to address observed delays in low-carbon technology adoption, though the appropriateness of such instruments remains contingent on underlying techno-economic conditions and sector-specific contexts (Hoogsteyn et al., 2026).

5. Discussions

Regarding Ukraine, the country achieved one of the largest reductions in greenhouse gas (GHG) emissions globally, of 76% between 1990 and 2022 and was approaching its 2030 emissions reduction target prior to 2022 (United Nations Climate Change, 2024). This reduction in part reflects the drop and change in economic activity. Relative to GDP, Ukraine's emissions are among the highest globally (Climate Action Tracker, 2021), reflecting very low emission prices, alongside subsidised energy costs that reduced incentives to improve energy efficiency. Greenhouse gas emission tax rates are the equivalent of less than one USD per tonne of CO₂, and about 50% of emissions are priced, mostly via fuel excise and carbon taxes (illustrated as the lighter blue areas in Figure 2). While military actions have generated significant emissions, the war has damaged or destroyed many of the largest sources of Ukraine's emitters of emissions, such as coal-fuelled steel plants and thermal power plants (Bulman et al., 2025).

The recovery and reconstruction give a renewed impetus to modernise Ukraine's industry and infrastructure, ensuring that it is adapted to the projected effects of climate change and achieves the emissions reductions objectives. Ukraine is committed to ensuring that the reconstruction and recovery lead to more sustainable investments and circular activity, both through regulatory reform and developing taxes and incentives. For example, its estimates of the costs of reconstruction account for adaptation and reducing emissions.

The government has adopted a National Waste Management Plan through to 2033 (Roadmap of the National Waste Management Plan until 2033, 2024) and has a roadmap for creating a National Environmental Fund over 2025-2027 with the goal of building a new system of environmental taxes. Ensuring that these many plans turn into concrete actions implemented early in the reconstruction, informed by international experience, can provide greater certainty to investors and ensure investments improve the economy's environmental sustainability. Ukraine plans to align emission prices with the European Union through an emission trading scheme (ETS), combined with higher taxes for emission sources not included in the ETS. Ukraine has adopted an action plan for developing its national ETS, with the first operational phase to be start in 2028 (Cabinet of Ministers of Ukraine, 2025). It will raise coverage of industry emissions to 87% and the price towards international targets (the green areas in Figure 2 illustrate the simulated likely coverage of the planned emission trading scheme). Not implementing this price could subject exports to the European carbon border adjustment mechanism. To limit the welfare costs for vulnerable households, the scheme could use some of the revenue generated to provide well-targeted income transfers that offset some of the increase in costs, building on policies that Ukraine implemented for the energy price adjustments in the late 2010s.

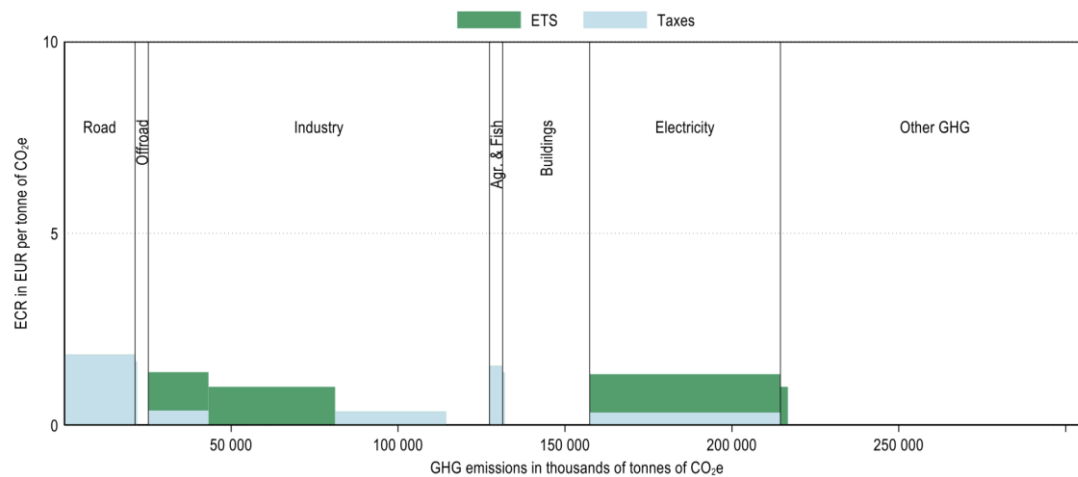


Figure 2. Modelling of the Ukraine effective carbon rate (ECR) profile if its emission trading scheme were in place in 2021.

Source: OECD estimates of coverage using information from the Cabinet of Ministers of Ukraine (2020). Other GHG emissions data are from CAIT (Climate Watch, 2022), data on CO₂ emissions from energy use are based on the IEA World Energy Balances (IEA, 2023).

Ukraine plans to expand its emission trading scheme and to raise its low carbon prices. Similarly, implementing well-designed prices on pollution and other environmentally damaging activity can limit damages while encouraging polluters to adapt their operations in the most cost-effective and circular manner. Existing environmental taxes are significant, but they could more coherently support environmental policy objectives (Neuweg et al., 2023). Eliminating subsidies or reduced tax rates for environmentally damaging items, is a first step. In addition, Ukraine could consider imposing excise taxes on fertilisers or manure that would damage the soil quality or groundwater, as in the Flemish region of Belgium (OECD, 2020). Complying with environmental tax requirements would be easier for businesses if the different administering bodies aligned their approaches. Building cooperation and information exchanges between the tax authorities and the State Environmental Inspection would help improve consistency (Neuweg et al., 2021).

Circular economy development is crucial for the Ukrainian recovery and it has to be implemented for the entire product life cycle – from design and manufacturing to consumption, repair, reuse, recycling and return of resources to the economy. Currently, the life cycle of many consumer products is too short, they cannot be reused, repaired or recycled, or they are intended for single use only. It will lead to the shortage of GHG emissions.

Regarding public procurement, it is worth noting that the main drawback was considered to be the selection of the cheapest offer without taking into account other criteria. That is, more environmentally friendly goods, services or technologies did not have the opportunity to "defeat" products manufactured using "environmentally dirty" technologies. Through the implementation of a new procurement policy based on the circularity, the public sector has the opportunity to have a real impact on resource conservation, reducing environmental pollution

and preventing climate change, stimulating investments in the production of more environmentally friendly goods, services and technologies.

Despite the important legislation that is in force, it has not yet crystallized in Ukraine as a whole. Experts assess the state of development of the “circular” economy sectors themselves in Ukraine as very low or non-existent. Given that the priority issue for the closed-loop economy is waste management, “circularity” is currently only in the plans.

An important issue is to encourage the Ukrainian government to use more targeted economic instruments, namely an environmental tax, to support “circular” measures. It is worth noting that the revenues from the environmental tax in Ukraine are lower than in neighboring member states, and in terms of euros they are significantly decreasing in dynamics. This is explained by the fact that various types of environmental taxes that can be levied in EU countries partially coincide with the components of the environmental tax in Ukraine, and despite this, EU environmental taxes include such types of taxes as transport taxes and rents for the special use of forest resources, water, subsoil use, etc. Another problematic issue arises in the ratio of environmental tax revenues to state expenditures on environmental protection. In all European countries, except Ukraine, environmental tax revenues are significantly higher than state expenditures on environmental protection measures. Taking European countries as an example, France, the UK, Spain and Italy allocate a significant part of their environmental spending to waste management. In Germany and Poland, this area of environmental protection accounts for up to 20% of spending (OECD, 2022).

To ground these international insights within the specific geopolitical reality of Ukraine, a comparative examination of regional vulnerabilities and municipal fiscal capacities across Ukrainian oblasts is required. Highly industrialized and war-affected regions such as Dnipropetrovsk, Kharkiv, Zaporizhzhia, and the de-occupied territories of Kyiv and Chernihiv oblasts face disproportionate infrastructure destruction paired with legacy, carbon-intensive manufacturing profiles. Conversely, western regions including Lviv and Ivano-Frankivsk, exhibit higher baseline institutional readiness for circular waste initiatives and renewable energy development.

For example, in the Carpathian region, the number of private solar power plants increased by 40% per year. As of spring 2026, 217 industrial solar power plants with a total capacity of 354 MW were operating in the Ivano-Frankivsk region. For comparison, in February 2025, there were 156 such facilities (263 MW). Solar generation on the roofs of private houses is developing no less actively. Currently, 7289 home solar power plants with a total capacity of 178 MW are operating in the Carpathian region. The statistics include only plants operating under the “green tariff” mechanism. A year ago, there were 5290 such power plants, and their capacity was 137 MW (Savchyn, 2026).

Among the communities of the region, the highest indicators of industrial solar generation are demonstrated by the Ivano-Frankivsk, Tysmenyts'ka, Halyts'ka and Zabolotiv'ka communities. At the same time, the Snyatyn, Horodenkiv, Ivano-Frankivsk, Rohatyn and Kalus communities are leading in terms of the number of home solar power plants (Savchyn, 2026).

In the neighboring Lviv region, 144 renewable energy facilities with a total capacity of over 537 MW operate. In addition, over 4 thousand households have installed solar power plants. In 2026, it is planned to launch another 62 renewable energy generation facilities with a capacity of over 300 MW, which will strengthen the energy self-sufficiency of the region (Lviv regional administration, 2026).

A successful example of attracting foreign grant funds for the implementation of renewable energy projects in the Western macroregion is the United Nations Industrial Development Program (UNIDO), funded by the German Federal Ministry for Economic Cooperation and Development (BMZ), which helps Ukrainian municipalities stimulate recovery and reconstruction through green industrial solutions (UNIDO Knowledge Hub, 2026).

Last year project, implemented in three communities in the Lviv region, focused on inter-municipal cooperation to catalyze biogas production. It combined capacity building (training, study tours, etc.), local stakeholder engagement, comprehensive waste mapping, and feasibility studies for joint biogas plants. Its activities are aimed at increasing knowledge and technical readiness for green energy projects in line with Ukrainian norms and development plans. Drawing on international experience and focusing on cross-sectoral cooperation, the project strategy not only addresses urgent capacity gaps, but also lays the foundation for long-term, scalable, and replicable solutions.

An evaluation of the regional indicators and policy frameworks managed by the Ministry for Development of Communities and Territories of Ukraine demonstrates that a uniform national fiscal strategy for ecological taxation is structurally insufficient. The ongoing full-scale war has fundamentally disrupted the nation's socioeconomic geography, creating stark regional asymmetries in industrial capacity, environmental liabilities, and local revenue potential that a centralized, one-size-fits-all tax model cannot effectively address (UNECE, 2024).

Instead, ecological tax distribution must be structurally weighted. Directing a minimum of 60% of locally collected carbon and environmental taxes directly to municipal budgets within these specific affected regions will allow local communities to finance circular public procurement, process localized debris into secondary raw materials, and establish local Modernization Funds.

Key structural incongruities of an active state fiscal policy are: asymmetric destruction of industrial tax bases, demographic shifts and macro-regional enterprise relocation and divergence in local functional requirements.

The deliberate destruction of capital-intensive heavy industries (e.g., metallurgical and thermal power installations in eastern and southern oblasts like Dnipropetrovsk, Zaporizhzhia, and Kharkiv) has decimated traditional localized ecological and carbon tax revenue streams.

A uniform national strategy implicitly assumes a stable, homogenous baseline of emissions, which fails to account for the reality that frontier regions face severe environmental degradation but lack the active corporate tax base to generate localized recovery capital (UNIDO, 2026).

Data tracking internal migration indicates the displacement of millions of citizens alongside the physical relocation of hundreds of large-scale enterprises to safer western macro-regions (such as Lviv, Zakarpattia, and Ivano-Frankivsk). This geographic pivot has artificially intensified municipal pressure on western local communities. These hosting regions now experience an acute inflation in localized consumption emissions and municipal waste volumes, yet under a uniform system, they lack the legal and fiscal mechanisms to temporarily raise or retain ecological levies to fund defensive green infrastructure (Antoniuk et al., 2024).

The implementation of specialized diagnostic tools — including the Ministry's Geographic Information System (GIS) for regional monitoring — reveals that communities are highly fragmented by distinct functional needs. De-occupied and heavily shell-damaged northern and eastern zones require immediate, heavily subsidized fiscal interventions to process hundreds of thousands of tons of toxic military debris into secondary raw materials (UNECE, 2023). Conversely, western communities require proactive structural investments to integrate advanced circular waste management facilities and decentralized renewable energy grids (NEFCO, 2026).

6. Summary

In evaluating the critical research underpinning this policy synthesis, a notable limitation of the foundational model by Brown, Martinsson, and Thomann (2022) must be acknowledged. Their framework relies on historical, stable OECD datasets (1990-2012) and lacks the capacity to account for extreme macroeconomic shocks, localized institutional fragility, or the physical destruction of industrial assets characteristic of an active conflict zone. Furthermore, their focus on corporate absorptive capacity is centered heavily on high-knowledge-spillover manufacturing sectors, which may not directly translate to agrarian or severely disrupted regional municipal economies. Despite these weaknesses, the critical lesson learned and new knowledge highlighted by this synthesis is that environmental pricing operates more effectively as an organizational catalyst for technology adoption and absorption than as a driver for radical, proprietary invention.

The wider significance of this research lies in demonstrating how transitional and crisis-struck nations can strategically utilize environmental taxation not merely as a passive fiscal levy, but as a dynamic structural engine for localized green reconstruction. The practical information obtained from this analysis can be operationalized by Ukrainian legislators and international donors to draft municipal green procurement frameworks, calibrate regional

compliance pathways for the upcoming national ETS scheduled for 2028, and establish ring-fenced community funds. This structured financial model will empower local authorities to transform localized reconstruction liabilities into assets, accelerating the widespread integration of circular technologies across war-affected municipalities.

The centralized carbon and ecological pricing model in Ukraine must shift toward a geographically differentiated architecture. Rather than routing environmental revenues through centralized funding streams that distribute capital via rigid national formulas, the empirical and spatial data supports a structurally weighted policy:

- Local municipalities within de-occupied or high-impact functional zones should be legally empowered to retain a significantly higher proportion (e.g., 60% to 75%) of environmental tax receipts to finance immediate localized upcycling projects, bypassing rigid centralized limits.
- The national allocation of resources from the upcoming national Modernization Fund and Emissions Trading System (ETS) must be programmatically tied to the real-time damage layers and regional vulnerability metrics verified by the state's regional development databases.

Ultimately, replacing a rigid, uniform fiscal approach with an adaptive, region-specific ecological taxation framework is the only method to ensure that post-war recovery capital is directed exactly where environmental liabilities are highest.

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