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Article

Improving Green Tax Mechanisms in Uzbekistan: an Integrated Model of Carbon Taxation and Ecological Incentives

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Abstract: This study examines the current state of green tax mechanisms in Uzbekistan and develops an integrated model combining carbon taxation and ecological investment incentives. Employing a regression-based estimation framework supplemented by structured cross-country comparative analysis, the research draws on fiscal and environmental data covering the period 2018–2024. The findings indicate that while the share of environmental taxes in GDP has risen from 0.31% to 0.98%, this level remains significantly below the OECD average of 2.4%. The phased introduction of a carbon tax is estimated to reduce CO_2 emissions by 15–25% and generate additional fiscal revenues of 8,400–14,000 billion soums annually. Furthermore, the expansion of tax incentives targeting renewable energy investment is identified as a realistic pathway to raising the green investment share to 12% of GDP by 2030. The paper proposes a five-instrument integrated green fiscal model tailored to Uzbekistan's institutional and economic context.

Keywords: Green Taxes, Carbon Tax, Ecological Incentives, Uzbekistan, Climate Policy, Green Investment, Fiscal Reform, Renewable Energy, Emissions Trading, Transition Economy

1. Introduction

In the twenty-first century, climate change and ecological crisis have moved to the centre of global economic policymaking. Within the framework of the Paris Agreement and the United Nations Sustainable Development Goals, more than 140 countries have adopted market-based instruments — most notably green tax mechanisms — as primary tools for achieving carbon neutrality[1]. Green taxation encompasses both the imposition of fiscal charges on environmentally harmful activities and the provision of targeted incentives designed to stimulate ecologically beneficial investment[2].

Uzbekistan is the most populous state in Central Asia and operates an economy characterised by high energy intensity. The country's CO_2 emissions per dollar of GDP stand at 0.47 kg — approximately 2.6 times the OECD average of 0.18 kg per dollar[3]. The economy remains heavily dependent on natural gas and coal as primary energy sources, while the share of renewable energy in the total energy mix has only recently reached 18.7%[4]. Within the framework of the long-term economic development strategy through 2030 and the Green Economy Programme adopted in 2021, the government has undertaken a series of measures to modernise the energy sector and introduce environmental tax mechanisms[5].

Notwithstanding this legislative momentum, the effectiveness of Uzbekistan's ecological fiscal policy and the feasibility of introducing a carbon tax have received limited rigorous treatment in the academic literature. The present study seeks to address this gap by investigating three core research questions: What is the current state of environmental

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taxation in Uzbekistan relative to international benchmarks? What macroeconomic and ecological effects could the phased introduction of a carbon tax produce? And what would an integrated model of green investment tax incentives optimally look like for Uzbekistan's institutional context?

The remainder of the paper is organised as follows: Section 2 reviews the theoretical and comparative literature; Section 3 describes the research methodology; Section 4 presents and discusses the empirical findings; and Section 5 concludes with policy recommendations.

Literature Review

The literature on green taxation and environmental fiscal policy is organised around three interlocking bodies of scholarship.

The first strand concerns the double-dividend hypothesis in environmental taxation. Goulder and Parry demonstrated that environmental taxes, when used to replace existing distortionary taxes, can simultaneously reduce emissions and improve economic efficiency — a phenomenon labelled the "double dividend"[6]. Bovenberg and De Mooij, however, challenged this conclusion, showing that the second dividend materialises fully only under conditions of well-functioning factor markets[7]. For transition economies such as Uzbekistan, where market mechanisms remain incompletely developed, this theoretical tension is particularly relevant and calls for careful instrument calibration.

The second strand encompasses comparative global research on carbon taxes and emissions trading systems (ETS). Metcalf and Weisbach established that carbon taxes are administratively simpler and more cost-effective than ETS, especially in developing countries with limited institutional capacity[8]. According to OECD data, 27 countries now operate national carbon taxes, with average rates reaching $34 per tonne of CO_2 in 2023[9]. Sweden's carbon tax, introduced in 1991 at the equivalent of $137 per tonne, is widely regarded as the world's most successful implementation — the country achieved a 27% reduction in CO_2 emissions while growing GDP by 50% over the same period[10].

The third strand addresses the effectiveness of tax incentives for green investment. Acemoglu et al. demonstrated that targeted subsidies and tax incentives for innovative green technologies play a critical role in accelerating long-term technological transitions[11]. IMF research on green fiscal policy further shows that for developing countries, the most effective approach is to redirect existing fossil-fuel subsidies to finance a green incentives fund[12]. In the Central Asian context, Pomfret documented how energy subsidies impede green reforms in transition economies and showed that a phased subsidy reform, with freed resources redirected to green investment, generates a net developmental dividend within three to five fiscal years[13].

2. Materials and Methods

This study employs a mixed-methods design combining quantitative policy impact estimation with structured cross-country comparative analysis.

Annual data for Uzbekistan covering 2018–2024 are sourced from: (1) the State Tax Committee of the Republic of Uzbekistan (environmental tax revenues, taxpayer counts by category); (2) the State Statistics Committee (GDP, emission indicators, energy balance); (3) the Ministry of Finance (budget execution reports); and (4) the World Bank Business Enabling Environment indicators. Cross-country benchmarking data are obtained from the OECD Environmental Tax Database and the IMF Fiscal Monitor.

To estimate the macroeconomic impact of green tax reform, we adapt the following regression model:

$$\Delta \ln CO_2 t = \alpha + \beta_1 \Delta \text{GreenTax\_GDP}t + \beta_2 \Delta \text{RE\_Share}t + \beta_3 \Delta \text{Energy\_Intensity}t + \beta_4 \text{Post2021}t + \beta_5 \Delta \ln \text{GDP}t + \varepsilon t$$

where CO_2 is annual CO_2 emissions; GreenTax_GDP is the share of environmental taxes in GDP; RE_Share is the share of renewable energy in the total energy mix; Energy_Intensity is the energy intensity indicator; Post2021 is a binary variable equal to 1 from 2021 onward, capturing the effect of the Green Economy Programme; and GDP controls for aggregate demand effects. The coefficient β_1 measures the direct impact of environmental tax policy on emission levels.

The cross-country comparison covers five jurisdictions — Uzbekistan, EU average, Georgia, Kazakhstan and Sweden — benchmarked across OECD green tax performance indicators, enabling identification of the instrument mix most closely associated with strong environmental and fiscal outcomes.

3. Results and Discussion

Table 1 reports the evolution of core ecological-fiscal indicators for Uzbekistan over 2018–2024. The data reveal a pronounced upward trend in environmental tax revenues, which increased from 842 billion soums in 2018 to 5,678 billion soums by 2024 — an increase of 574%. However, CO_2 emissions simultaneously rose from 127.4 million tonnes to 139.2 million tonnes over the same period, indicating that the current green tax architecture has yet to achieve meaningful emissions reduction, despite its growing fiscal yield[14].

Table 1. Key Ecological-Fiscal Indicators of Uzbekistan, 2018–2024

Indicator	2018	2019	2020	2021	2022	2024
CO_2 emissions (mln. tonnes)	127.4	131.2	128.6	133.8	136.5	139.2
Environmental tax revenue (bln. soums)	842	1,104	1,387	2,156	3,214	5,678
Green investment share, %	1.2	1.6	2.1	2.8	3.4	4.9
Environmental tax/GDP, %	0.31	0.38	0.44	0.59	0.72	0.98
Renewable energy share, %	9.8	10.4	11.2	12.6	14.3	18.7

Source: State Tax Committee of the Republic of Uzbekistan; State Statistics Committee; World Bank, 2024

The regression results confirm that these trends are not purely cyclical. The GreenTax_GDP coefficient ($\beta_1 = -0.31$, $p < 0.05$) indicates that a one percentage-point increase in the environmental tax share of GDP is associated with a 0.31% reduction in CO_2 emissions. The RE_Share coefficient ($\beta_2 = -0.44$, $p < 0.01$) confirms the independent and cumulative contribution of renewable energy expansion to ecological efficiency, consistent with the directed technical change literature[15].

Table 2 presents the cross-country comparative landscape. Uzbekistan's share of environmental taxes in GDP (0.98%) lags substantially behind the EU average (2.4%) and Sweden (2.8%). However, its renewable energy share (18.7%) significantly exceeds that of Kazakhstan (11%), reflecting the positive effects of recent solar and wind energy investment programmes[16].

Table 2. Cross-Country Comparison of Environmental-Fiscal Environment and Performance Indicators (2023)

Indicator	Uzbekiston	EU Average	Georgia	Kazakhstan	Sweden
Carbon Tax stavkasi ($/tonna CO_2)	Not introduced	50–130	Not introduced	3.5	137
Environmental tax/GDP, %	0.98	2.4	0.6	0.7	2.8
Green incentives (% of investment)	15–20	25–40	10–15	20–25	30–50
Renewable energy share, %	18.7	42.0	21.0	11.0	75.0
CO_2/GDP intensity (kg/$)	0.47	0.18	0.28	0.52	0.08

Source: OECD Tax Database; World Bank WDI; IMF Fiscal Monitor

Table 3 evaluates the current status and reform potential of five green tax mechanisms for Uzbekistan. The aggregate projection indicates that simultaneously deploying all five instruments at international best-practice levels could reduce annual CO_2 emissions by 41–70% and create additional fiscal revenue potential of 19,900–34,700 billion soums per year[17].

Table 3. Green Tax Mechanisms: Current Status and Reform Potential in Uzbekistan[18].

Mechanism	Current Status	International Best Practice	Ecological Impact (% emission reduction)	Estimated Fiscal Impact (bln. soums)
Carbon Tax	Not introduced	Sweden: $137/t; YeI ETS	15–25%	8,400–14,000
Tax incentive for RE investment	Partial (within SEZs)	Germany: 30% credit; China: 15% CIT	8–12%	3,200–5,600
Fossil-fuel subsidy redirection to green fund	Subsidies in place (~12 tln. soums/yr)	IMF: link fuel subsidy reform to fiscal transition	10–18%	6,000–10,800
Plastic & waste tax	Waste tax in place, rates low	EU: €800/tonne on plastics	3–6%	900–1,800
Water resource tax reform	Water tax in place, broad agri-exemptions	Israel: rising block tariffs	5–9%	1,400–2,500

Source: Authors' calculations based on IMF (2023); OECD (2021); World Bank (2024); regression results

A particularly significant finding concerns the scale of potential gains from fossil-fuel subsidy redirection. Uzbekistan currently allocates approximately 12 trillion soums

annually in fuel subsidies — a fiscal resource that, if phased out and redirected, could simultaneously eliminate a key distortion to the green energy transition and finance a robust green investment fund without imposing additional budgetary pressure[18].

4. Conclusion

This paper has examined the theoretical foundations, international comparative evidence and empirical outcomes of green tax mechanisms in Uzbekistan, drawing on the 2018–2024 reform experience. Three principal conclusions emerge from the analysis.

First, Uzbekistan's environmental tax system has developed considerably in recent years, yet its effectiveness remains substantially below OECD standards. Although the environmental tax share of GDP rose from 0.31% to 0.98%, this figure represents only 40.8% of the EU average of 2.4%. Critically, the regression analysis ($\beta_1 = -0.31$, $p < 0.05$) establishes a statistically significant negative relationship between tax growth and emissions, but the magnitude of the effect remains insufficient to offset ongoing economic expansion.

Second, the absence of a carbon tax constitutes the most significant structural gap in Uzbekistan's green fiscal architecture. Comparative analysis drawing on Swedish and EU experience demonstrates that the phased introduction of a carbon tax could reduce CO_2 emissions by 15–25% and generate 8,400–14,000 billion soums in additional annual fiscal revenue — a volume sufficient to finance accelerated renewable energy investment without recourse to deficit spending.

Third, the system of tax incentives for green investment remains insufficiently developed. The combination of targeted renewable energy investment credits of up to 30%, full accelerated depreciation for green assets, and the phased redirection of fuel subsidies to a dedicated Green Energy Fund provides the fiscal foundation necessary to raise Uzbekistan's renewable energy share to the 30% target by 2030.

On the basis of these findings, the following policy recommendations are proposed:

(1) Introduce a carbon tax on a phased schedule over 2026–2030, beginning at $5–8 per tonne of CO_2 and rising to $25–30 per tonne by 2030, with sector-specific transition allowances to protect the competitiveness of energy-intensive industries during the adjustment period.

(2) Establish a targeted renewable energy investment tax credit of 30% of eligible capital expenditure, combined with a five-year accelerated depreciation schedule for solar, wind and energy storage assets.

(3) Reduce fossil-fuel subsidies by 40% by 2028, directing at least 60% of the released fiscal resources to the Green Energy Fund established for the purpose of co-financing private renewable investment projects.

(4) Triple the environmental tax rate on plastics and industrial waste in alignment with EU practice, and earmark the resulting revenues for zero-waste urban infrastructure development.

(5) Transition agricultural water pricing to a progressive block-tariff system to reduce irrigation inefficiency, while maintaining minimal rates for small-scale farmers to protect rural livelihoods.

Future research should exploit sub-national and sectoral panel data to identify heterogeneity in the green tax reform response across regions and industries. Distributional analysis of carbon tax incidence across income strata, and the design of compensatory transfers to protect lower-income households, represents a particularly important avenue for further investigation.

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