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Article

Financial Incentives for Enterprise Green Transition: An Environmental Policy and Decision-Making Framework for Uzbekistan

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Abstract: The transition of enterprises towards a green economy requires financial mechanisms that reconcile environmental objectives with investment viability. This paper develops an environmental policy and decision-making framework for stimulating enterprise green transition in Uzbekistan. The methodology combines institutional analysis, comparative assessment of financial instruments and a multi-criteria approach. Instruments are assessed according to environmental and financial additionality, accessibility, fiscal efficiency, measurability and verifiability. The analysis argues that concessional lending alone cannot address all financial barriers. A differentiated system combining green loans, partial credit guarantees, investment grants, tax incentives, green bonds and blended finance is proposed. The type and intensity of support should be linked to project-specific financing constraints and verified environmental outcomes.

Keywords: green economy; green finance; financial incentives; environmental policy; enterprises; decision making; green transition; blended finance; ESG; green taxonomy.

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1. Introduction

The transformation of enterprises towards environmentally sustainable production has become an important component of contemporary economic policy. Businesses are expected to improve energy efficiency, reduce greenhouse gas emissions, introduce renewable energy sources, minimize waste, and increase resource productivity. Achieving these objectives requires substantial capital investment [1].

Environmental technologies often involve high upfront costs, while financial returns emerge gradually through lower energy consumption, reduced material expenses, or avoided environmental costs. Some benefits are public in nature and are not fully reflected in an enterprise's cash flows. Consequently, a project may be socially desirable but insufficiently attractive to the enterprise or a commercial lender.

In emerging economies, the problem is compounded by high financing costs, collateral requirements, limited access to long-term capital, and information asymmetry. Uzbekistan provides a significant example: improving resource-use efficiency and

mobilizing green investment are important conditions for sustainable development. Green-financing mechanisms are expanding in the country, including credit lines provided by international financial institutions through local banks [2]. However, the availability of financing alone does not guarantee an effective green transition.

Five major barriers to green investment can be identified: high initial equipment costs; long or uncertain payback periods; insufficient collateral among small and medium-sized enterprises (SMEs); technological and information uncertainty; and the incomplete monetization of environmental benefits. Since these barriers differ, a single financial instrument cannot be equally effective for all enterprises.

A reliable green-finance system requires common project-eligibility criteria. A national green taxonomy can define activities and technical parameters consistent with environmental objectives, establish a common language for government, banks, and enterprises, and reduce the risk of greenwashing [3]. However, a taxonomy answers whether an activity is environmentally eligible; by itself, it does not determine whether a project needs public support or which instrument would be most effective.

The taxonomy therefore needs to be combined with assessments of additionality and financial viability, as well as a system for monitoring, reporting, and verification (MRV).

2. Materials and Methods

The study uses an analytical methodology comprising institutional analysis of national documents and green-finance programmes, comparative analysis of financial instruments, and the development of a multi-criteria decision-making model. The instruments considered include concessional lending, interest-rate subsidies, partial guarantees, investment grants, tax incentives, green and sustainability-linked bonds, and blended finance.

The instruments are proposed to be assessed against five criteria: environmental additionality, financial additionality, accessibility for enterprises, fiscal efficiency, and measurability and verifiability. The aggregate score is expressed as $S_j = \Sigma_i w_i x_{ij}$, where S_j is the aggregate score of instrument j; w_i is the weight assigned to criterion i; and x_{ij} is the score of instrument j against criterion i. The weights sum to one. An illustrative baseline scenario may assign equal weights of 0.20, but an applied calculation should justify the weights using expert evidence or policy analysis.

The proposed model is a conceptual decision-making framework. This version does not provide empirical estimates of the weights or final numerical rankings because these require expert evidence and comparable indicators for specific projects. This limitation should be taken into account when interpreting the results.

3. Results and Discussion

Uzbekistan is gradually developing a financial architecture that brings together national green-development priorities, bank lending and support from international financial institutions ; one example is the Green Economy Financing Facility (GEFF) , through which local financial institutions channel funds towards investments that meet green-finance eligibility criteria, making it possible to use existing banking infrastructure, apply technical project-selection criteria and complement financing with advisory and institutional support (Figures 2–3), although further expansion requires common classification criteria, high-quality environmental reporting, project preparation and transparent monitoring of actual results, and the next stage should focus not only on increasing the volume of credit resources but also on improving the efficiency of support allocation [4], [5]. The comparative analysis shows that each instrument addresses a different barrier. Concessional green lending, $r(g) = r(m) - \Delta r$, where r(g) is the green-loan rate, r(m) is the market rate and Δr is the size of the concession, reduces the cost of capital and is suitable for commercially viable projects with long payback periods, such as energy-

efficient equipment, solar installations and water-saving technologies, but it does not eliminate collateral shortages and may provide excessive support to projects that would have proceeded without government intervention [6]. An interest-rate subsidy reduces the effective rate paid by an enterprise, $r(e) = r(b) - s$, where $r(e)$ is the borrower's rate, $r(b)$ is the bank's rate and s is the subsidy, and a results-oriented design can link the subsidy to verified environmental performance, $s = s_0 + \alpha E$, where E is an environmental performance indicator and α is the incentive coefficient, which requires baseline values, comparable indicators and independent verification [7]. Partial guarantees, $G = \gamma L$, where G is the guaranteed amount, L is the loan and γ is the guarantee ratio below one, are appropriate for SMEs that lack sufficient collateral, while retaining part of the risk with the bank preserves incentives for sound credit assessment. Grants are appropriate for projects with substantial public environmental benefits but insufficient private returns, as well as for environmental audits, feasibility studies, certification and pilot projects, but to preserve investment discipline they should cover only part of eligible expenditure; tax incentives, such as accelerated depreciation or investment allowances, require narrowly defined eligibility criteria, otherwise they may subsidize routine capital replacement [8]. Green bonds are suitable for large enterprises, banks and infrastructure projects where rules for the use of proceeds, reporting and external verification are in place, whereas sustainability-linked financing ties financial terms to environmental key performance indicators (KPIs), such as emissions intensity, energy consumption per unit of output, the share of renewable electricity, water intensity or the waste-recycling rate. Blended finance combines public resources, development-finance institution funding and private capital, $F = F_{public} + F_{DFI} + F_{private}$, with public or concessional funds used to prepare projects, provide guarantees or cover specific risks, and the private-capital mobilization ratio assessed alongside actual environmental outcomes, not as a substitute for them [9]. On this basis, a five-stage project-selection procedure is proposed (Figure 1): first, the project is checked for compliance with the national green taxonomy; second, its environmental additionality is assessed against a baseline; third, financial viability is analysed, including cash flows, debt-servicing capacity and payback period; fourth, the specific financial barrier is identified; and fifth, requirements for monitoring, reporting and verification of results are established. A composite environmental indicator may be defined as $E = \beta_1 C + \beta_2 EN + \beta_3 W + \beta_4 R + \beta_5 P$, where C denotes emissions reductions, EN improvements in energy efficiency, W water savings, R increased resource circularity and P reduced pollution, with the β coefficients established in light of the sector and environmental-policy priorities [10]. The key principle of the model is that environmental eligibility is not equivalent to a need for a subsidy: a commercially viable project that would be implemented without support may comply with the taxonomy while having low financial additionality, whereas a project with a substantial environmental impact that is not implemented because of insufficient collateral or technological risk may justify targeted support [11]. Accordingly (Table 1), for commercially viable energy-efficiency projects the main instrument may be a green loan with a limited interest-rate subsidy; for viable SME projects facing collateral constraints, a loan with a partial guarantee; where environmental benefits are high but private returns are weak, a loan combined with a partial grant; for innovative technologies with high risk, blended finance supplemented by a guarantee and technical assistance; transformation programmes for large enterprises may be financed through sustainability-linked loans or bonds, portfolios of green assets can underpin green-bond issuance, and project preparation and MRV systems can receive targeted technical assistance [12]. The justified level of support can be represented conceptually as $FI_i = \lambda_1 E_i + \lambda_2 F_i + \lambda_3 A_i - \lambda_4 R_i$, where FI_i is the incentive level for project i, E_i is environmental additionality, F_i is the severity of the financial constraint, A_i is alignment with national green-development priorities, R_i is the risk of lacking additionality or of greenwashing and λ represents the model coefficients; support should increase when environmental benefits are high, a genuine financing constraint exists and the project aligns with national priorities, and decrease when the project is commercially viable without intervention, outcomes cannot be verified or the

enterprise would make the investment without public assistance, so that the model distinguishes environmental eligibility from financial additionality [13]. The results imply that the green taxonomy should be used as an operational criterion for access to support rather than only as a statistical classification, sector-specific environmental thresholds should be developed, the amount of support should gradually be linked to verified results, partial guarantees for SMEs should be expanded where insufficient collateral is the main obstacle, financing should be combined with technical assistance, especially in industrial energy efficiency, renewable energy, water conservation and circular production, digital MRV systems and environmental disclosure should be strengthened, and public resources should be used to mobilize private capital and address market barriers rather than replace private financing, with programme performance assessed using a mobilization indicator, the volume of private green investment divided by the amount of public financial support, considered alongside reductions in emissions and energy and water consumption, as well as other environmental outcomes [14], [15]. The proposed model thus changes the traditional sequence of financial-policy design: instead of selecting an instrument first and then identifying recipients, it defines the environmental objective, identifies the financial barrier and only then selects the instrument, so the same type of project may require different mechanisms depending on the enterprise's financial position [16]. Financing transitional activities is also important in sectors where fully green alternatives are not yet available, since in Uzbekistan industrial transformation will involve both the development of new green industries and the gradual modernization of existing production; support criteria should therefore consider a credible transition plan and measurable improvement relative to a baseline [17]. Finally, the effectiveness of the system depends on institutional links between the taxonomy, financing, ESG reporting and MRV, which should form a single chain: taxonomy → project identification → financing → disclosure → verification → policy evaluation. The diagram below links environmental eligibility and additionality assessment to the selection of a financing instrument and subsequent verification [18].

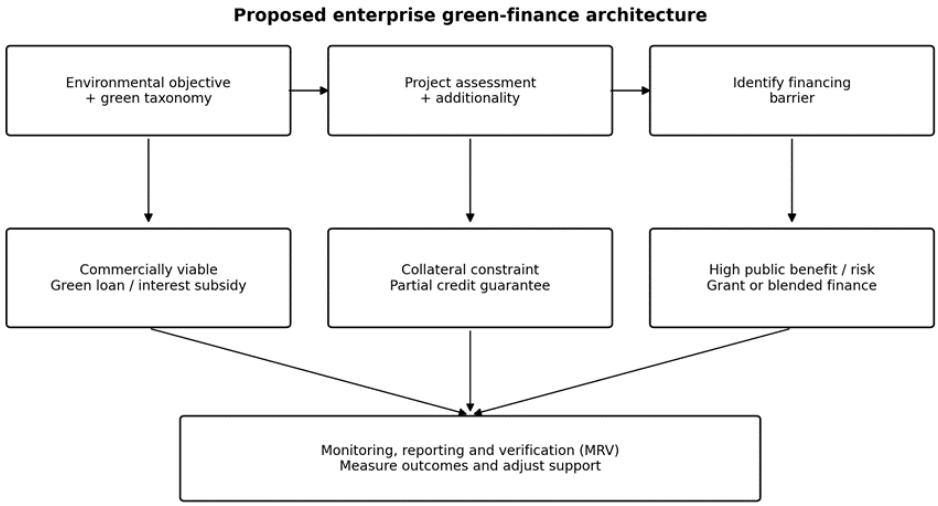


Figure 1. Project-selection and financial-instrument decision process

The diagram summarizes the five-stage conceptual procedure proposed in this study; it is not an empirically estimated model [19], [20].

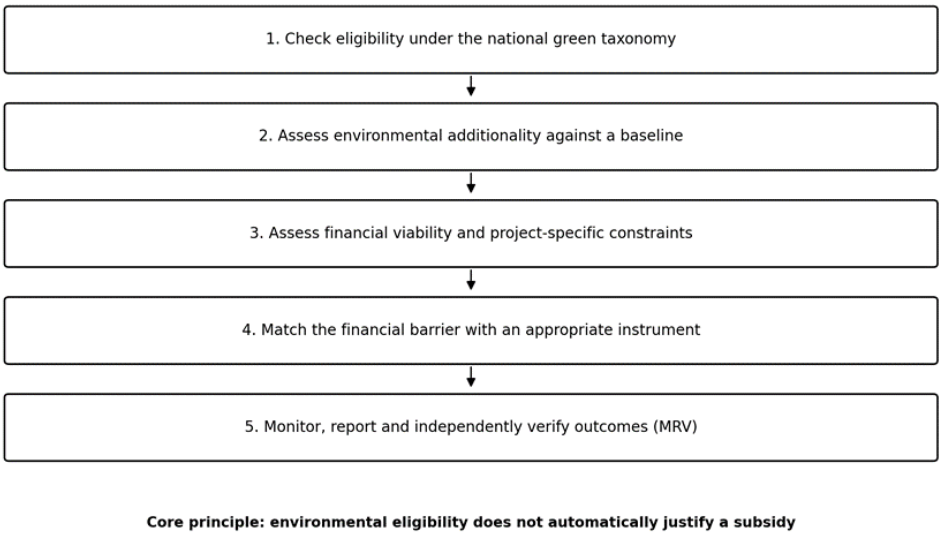


Figure 2. GEFF I Uzbekistan: reported programme results (2019–2024)

Official programme information reports 179 loans, annual primary energy savings of 547,458 GJ, annual CO_2 reductions of more than 22,091 tonnes, and annual water savings of approximately 9,425 m^3. Source: EBRD GEFF programme information [21].

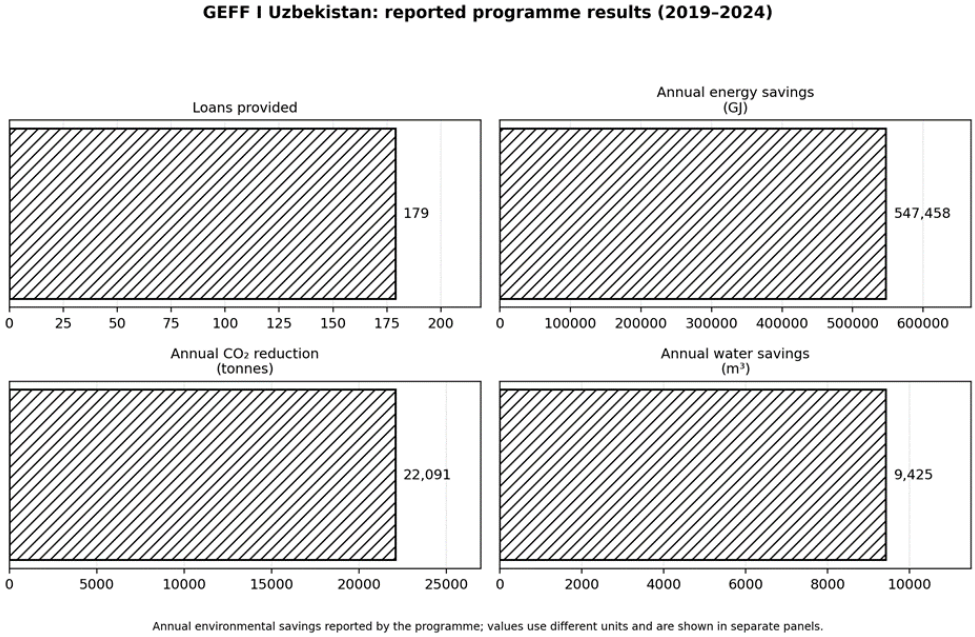


Figure 3. GEFF II Uzbekistan: Ipak Yuli Bank results reported in 2026

The bank's programme snapshot reports 177 green projects, annual energy savings of 130,986 GJ, and annual CO_2 reductions of 8,357 tonnes [22], [23] . These figures are a separate programme snapshot and should not be directly compared with GEFF I because reporting scope and periods differ [24], [25].

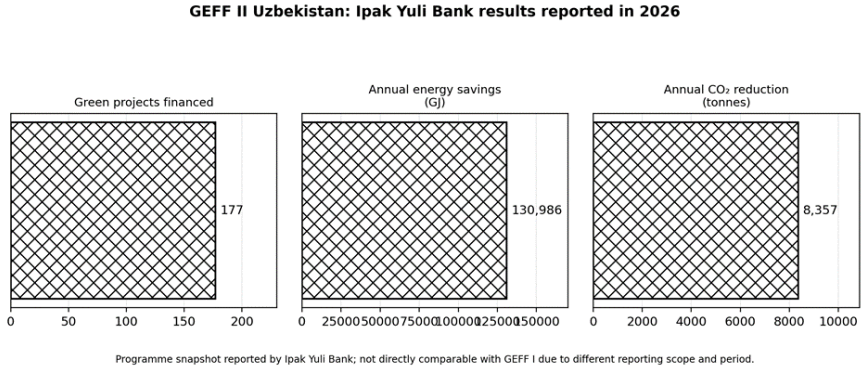


Table 1. Matching project characteristics with financial instruments

Project characteristic	Recommended instrument	Rationale
Commercially viable energy-efficiency project	Green loan; limited interest-rate subsidy	Lower financing costs
Viable SME project with insufficient collateral	Loan with a partial guarantee	Overcoming collateral constraints
High environmental impact but weak private returns	Loan and partial grant	Compensation for environmental externalities
Innovative technology with high risk	Blended finance; guarantee; technical assistance	Sharing technological risk
Transformation programme for a large enterprise	Sustainability-linked loan/bond	Linking financing terms to KPIs
Portfolio of green assets	Green bonds with verification	Mobilizing long-term capital
Early-stage project preparation	Project-preparation grant and technical assistance	Improving investment readiness
Development of MRV and environmental reporting	Grant or concessional loan	Improving measurability and verifiability

This qualitative matrix follows the instrument-selection logic discussed in the article. It does not report measured performance scores or rank the instruments.

4. Conclusion

The transition of enterprises towards a green economy requires a financial architecture that goes beyond the provision of concessional loans, since enterprises face different financial constraints and therefore need differentiated instruments. The proposed model integrates the green taxonomy, assessment of environmental additionality, financial viability, identification of financial barriers, instrument selection and results monitoring, and it shows that environmental eligibility should not automatically imply entitlement to public support. Support is justified when a project delivers measurable environmental improvement and financial intervention materially affects the probability, timing or scale of the investment: a green loan may be sufficient for commercially viable projects; a partial guarantee may be suitable for SMEs with insufficient collateral; blended finance may be appropriate for innovative projects with high technological risk; sustainability-linked financing may suit large enterprises; and targeted grants may be justified for projects with high social benefits but low private returns. Further research should test the model using enterprise-level data and assess the impact of different instruments on energy intensity, emissions, resource productivity and the mobilization of private investment; until such data are available, the proposed model should be treated as an analytical framework rather than an empirically validated algorithm.

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