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International Best Practices in The Use of Green Investments: Lessons from Advanced Economies

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Abstract: This article examines the accumulated experience of advanced economies in mobilising, allocating and monitoring green investments. Drawing on the cases of Germany, Denmark, the Netherlands, France, the United Kingdom, the Republic of Korea, Japan, China, the United States and Brazil, the study identifies five institutional pillars that distinguish successful green investment regimes: a legally binding classification system, a de-risking public finance institution, predictable long-term revenue support, mandatory disclosure and verification, and a governance framework that links investment to measurable outcomes. Quantitative comparison shows that countries combining all five pillars attain green investment intensity of 2.5-3.8 per cent of GDP, whereas those relying on isolated instruments remain below 1.5 per cent. The article concludes with a sequenced set of recommendations adapted to the institutional capacity of emerging economies such as Uzbekistan.

Keywords: Green Investment, Sustainable Finance, Green Bonds, Climate Finance, Taxonomy, Blended Finance, Feed-in Tariff, Contracts for Difference, National Development Bank, ESG, Energy Transition, Carbon Pricing, Green Industrial Policy, International Experience

1. Introduction

The global transition towards a low-carbon economy has transformed green investment from a niche philanthropic activity into one of the largest structural shifts in modern capital markets. According to the International Energy Agency, global investment in clean energy technologies and infrastructure reached approximately 2.0 trillion US dollars in 2024, exceeding investment in fossil fuel supply by a factor of roughly two to one for the first time in history. Cumulative issuance of labelled green, social and sustainability bonds has surpassed 5.5 trillion dollars, and assets managed under formal environmental, social and governance mandates account for close to one third of professionally managed global assets [1]. Yet the aggregate figures conceal an uncomfortable asymmetry: more than seventy per cent of green capital flows are concentrated in a small group of advanced economies and China, while emerging and developing economies outside China attract barely fifteen per cent of the total despite hosting the majority of the world's population and the fastest-growing energy demand [2].

This asymmetry is not primarily a function of physical resource endowment. Many developing countries possess superior solar irradiation, wind regimes and hydropower potential compared with the northern European states that lead the green investment rankings. The binding constraint is institutional. Capital does not flow towards environmental merit; it flows towards risk-adjusted return, contractual certainty and legal

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enforceability. Countries that have succeeded in mobilising green investment at scale have done so by constructing institutional architectures that convert environmental objectives into bankable, verifiable and legally protected financial propositions. Understanding the anatomy of these architectures is therefore of direct practical relevance to any country seeking to accelerate its own energy and industrial transition [3].

The purpose of this article is to analyse the experience of ten advanced and large emerging economies in the design and operation of green investment regimes, to extract the common institutional features that explain their relative success, and to draw practical conclusions for countries at an earlier stage of institutional development. The analysis is organised around five recurring pillars: classification and taxonomy, public de-risking institutions, long-term revenue support mechanisms, disclosure and verification requirements, and outcome-linked governance. Each pillar is examined through concrete national cases, and the interaction between pillars is assessed [4].

2. Materials and Method

The first pillar is a legally binding classification system that defines what qualifies as a green investment. Prior to the adoption of formal taxonomies, the green label was self-assigned by issuers, creating substantial reputational risk and deterring institutional investors bound by fiduciary duty. The European Union addressed this problem through the Taxonomy Regulation, which entered into application in stages from 2022 and establishes technical screening criteria for economic activities across six environmental objectives. An activity qualifies only if it makes a substantial contribution to at least one objective, does no significant harm to the others, and complies with minimum social safeguards. The regulation is complemented by the Sustainable Finance Disclosure Regulation, which obliges asset managers to classify their products according to sustainability ambition. The immediate market effect was measurable: European green bond issuance rose from 148 billion dollars in 2020 to 405 billion dollars in 2024, and the average pricing advantage of green over conventional bonds, the so-called greenium, stabilised in a range of fifteen to thirty basis points.

China developed a parallel but distinct approach through the Green Bond Endorsed Projects Catalogue, first published in 2015 and substantially revised in 2021 to remove clean coal utilisation from the eligible list, thereby converging with international norms. The Chinese catalogue is administered jointly by the People's Bank of China, the National Development and Reform Commission and the securities regulator, which gives it unusual enforcement reach across the banking, corporate bond and equity markets simultaneously. Japan adopted a lighter-touch model, publishing transition finance roadmaps for hard-to-abate sectors such as steel, chemicals and shipping rather than a binary green classification, on the argument that a strict taxonomy would exclude precisely those heavy industries whose decarbonisation matters most. The Republic of Korea introduced its K-Taxonomy in 2021 with an explicit interoperability clause designed to allow Korean issuers to access European investor demand without dual certification.

The comparative lesson is that the specific legal form of the taxonomy matters less than three underlying attributes: it must be published by an authority whose decisions carry legal consequence, it must be revised on a predictable cycle as technology evolves, and it must be interoperable with the classification systems used by the international investors whose capital the country seeks to attract. Taxonomies that fail on interoperability impose duplicate certification costs that frequently exceed the pricing benefit they were designed to capture.

The second pillar is a public financial institution capable of absorbing the risks that private capital will not price. The archetype is the German Kreditanstalt für Wiederaufbau, which by 2024 held a climate and environment commitment portfolio exceeding 200 billion euros, representing more than half of its total new business. The

institution operates through the commercial banking system rather than in competition with it: a household or enterprise applies for a subsidised loan at its own bank, which passes the application to the development bank, retains a servicing margin and carries part of the credit risk. This on-lending architecture allows the state to achieve very large volumes of small-ticket transactions, particularly in building retrofits, without constructing a parallel retail apparatus. The German building modernisation programme alone has financed the renovation of more than six million dwellings since inception, achieving average energy consumption reductions of between forty and sixty per cent per renovated unit.

The United Kingdom pursued a different logic with the Green Investment Bank, established in 2012 with three billion pounds of public capital and privatised in 2017 after demonstrating commercial viability. Its mandate was deliberately temporary: to establish track record in offshore wind, waste-to-energy and energy efficiency until private investors developed the sectoral expertise to proceed without public participation. The privatisation attracted criticism regarding the loss of a strategic public asset, but the underlying model of a time-limited, sector-specific de-risking vehicle with a defined exit path has been replicated in several jurisdictions. The United States adopted a substantially larger version of the same principle through the loan guarantee programme of the Department of Energy and, more recently, through the Greenhouse Gas Reduction Fund capitalised at twenty-seven billion dollars, which channels resources to state-level and community green banks rather than lending directly.

The Netherlands illustrates a third variant: a fiscal rather than a balance-sheet instrument. Under the Green Funds Scheme, retail investors receive an income tax exemption on savings held in accredited green funds, which in turn must lend at least seventy per cent of assets to certified environmental projects. The scheme has mobilised in excess of ten billion euros of household savings for sustainable agriculture, organic construction and nature conservation at an estimated fiscal cost of roughly one per cent of the mobilised volume per annum, an unusually favourable leverage ratio compared with direct subsidy programmes.

The third pillar is a predictable long-term revenue mechanism that converts an uncertain future price into a contractually guaranteed cash flow. Denmark provides the clearest demonstration of the effect. Beginning in the early 1980s, Danish policy combined guaranteed grid access, fixed feed-in tariffs and cooperative ownership rules that required a share of each wind project to be offered to local residents. The result was not merely the highest wind penetration in the world, exceeding fifty-five per cent of domestic electricity generation, but the emergence of a domestic supply chain that now generates wind technology exports of more than ten billion euros annually. The critical design feature was duration: contracts extended over fifteen to twenty years, matching the economic life of the asset and the tenor of project debt.

3. Results

As technology costs fell, fixed tariffs were progressively replaced by auction-based contracts for difference, in which the state guarantees a strike price determined competitively and settles the difference against the market price in either direction. The United Kingdom's contract for difference regime reduced the strike price for offshore wind from approximately 150 pounds per megawatt-hour in the 2015 allocation round to under 40 pounds in 2022, a decline of roughly seventy-five per cent achieved primarily through competitive pressure and volume-driven learning effects. The mechanism transfers price risk from the developer to the state during the contract period while returning value to consumers when market prices exceed the strike price, an outcome that materialised on a substantial scale during the European energy price shock of 2022 [5].

France added a fiscal dimension through sovereign green bond issuance, becoming in 2017 the first major sovereign to issue a green bond of benchmark size. The French

green OAT programme now exceeds seventy billion euros outstanding and, importantly, is accompanied by an independent allocation and impact reporting framework audited by a dedicated evaluation council. Sovereign issuance performs a function beyond fundraising: it establishes a green yield curve that private issuers can use as a pricing reference, and it obliges the treasury to construct the expenditure tracking systems that subsequent corporate issuers will be expected to replicate [6].

The fourth pillar is mandatory disclosure and independent verification. The credibility of the green label depends entirely on the cost of misrepresenting it. Jurisdictions that rely on voluntary disclosure consistently experience greenwashing episodes that damage market confidence and widen spreads for genuine issuers. The European Union responded with the Corporate Sustainability Reporting Directive, which extends mandatory sustainability reporting to approximately fifty thousand companies and requires limited assurance by an independent auditor, moving progressively towards reasonable assurance. Japan and Korea have adopted the framework of the International Sustainability Standards Board, which consolidates several earlier voluntary regimes into a single baseline. The practical significance for investors is comparability: without standardised metrics, portfolio-level environmental performance cannot be aggregated, and capital allocation decisions revert to unverifiable narrative [7].

The fifth pillar is outcome-linked governance, meaning that the disbursement of public resources is conditional on the achievement of measurable environmental results rather than on the completion of expenditure. The Republic of Korea's Green New Deal, launched in 2020 with a commitment of approximately seventy-three trillion won, established quantified interim targets for electric vehicle deployment, building retrofit volume and renewable capacity, with budgetary allocations reviewed annually against those targets. Brazil offers a different but instructive model through the Amazon Fund, in which donor disbursements are calibrated to independently verified reductions in deforestation rates, creating a direct payment-for-results linkage. Where such linkages are absent, evaluations consistently find that green expenditure programmes drift towards the financing of activities that would have occurred regardless, a phenomenon known as additionality failure [8].

Table 1. Institutional architecture of green investment regimes in selected countries (2024)

Country	Core instrument	Public institution	Green investment (% of GDP)	Leverage ratio (private : public)
Denmark	Feed-in tariff, then auctions; cooperative ownership	Danish Green Investment Fund	3.8	6.2 : 1
Germany	Subsidised on-lending via commercial banks	KfW	3.1	5.4 : 1
Rep. of Korea	Green New Deal with quantified targets	Korea Development Bank	2.9	3.8 : 1
Netherlands	Tax exemption on accredited green savings	Invest-NL	2.6	8.1 : 1
China	Endorsed Projects Catalogue; directed bank lending	Policy banks (CDB, EximBank)	2.4	2.9 : 1
France	Sovereign green bonds; audited impact reporting	Bpifrance	2.1	4.3 : 1
Japan	Transition finance roadmaps for heavy industry	JBIC / DBJ	1.9	3.5 : 1
United Kingdom	Contracts for difference; time-limited green bank	UK Infrastructure Bank	1.8	4.7 : 1

United States	Tax credits; loan guarantees; state green banks	DOE Loan Programs Office	1.6	5.9 : 1
Brazil	Payment-for-results (Amazon Fund); concessional credit	BNDES	1.2	2.4 : 1
Uzbekistan	Sovereign green bonds; IFI concessional lending	Under formation	0.9	1.6 : 1

Source: author's compilation based on IEA, OECD, Climate Bonds Initiative and national agency data

Table 1 permits several observations. First, no single instrument explains success. Denmark achieves the highest investment intensity through revenue certainty and social ownership; the Netherlands achieves the highest leverage ratio through a fiscal instrument that mobilises household rather than institutional savings; Germany achieves scale through banking system integration. What the leading cases share is not a common instrument but the simultaneous presence of all five institutional pillars. Second, leverage ratios cluster between four and eight to one in jurisdictions with mature disclosure regimes, and fall below three to one where verification is weak, which is consistent with the interpretation that private capital prices institutional credibility directly. Third, the countries at the lower end of the intensity ranking are not those with the smallest programmes in absolute terms; the United States deploys the second-largest absolute volume in the sample while ranking eighth by intensity, reflecting the size of its economy rather than a policy deficit [9].

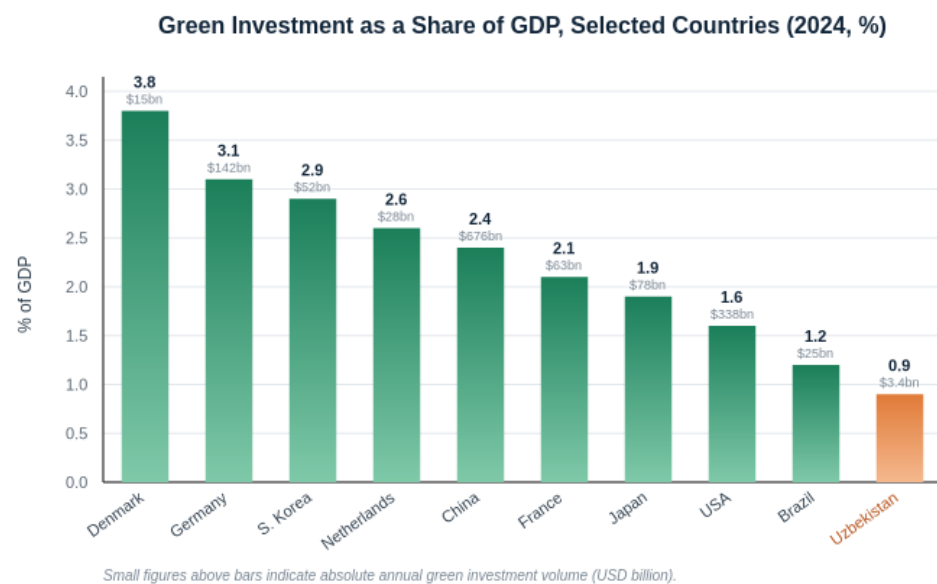


Figure 1. Green investment as a share of GDP, selected countries (2024)

Figure 1 displays the same intensity measure graphically and makes the gap facing emerging economies visually explicit. Uzbekistan's green investment intensity of approximately 0.9 per cent of GDP corresponds to roughly 3.4 billion dollars annually, a figure that has grown rapidly from a low base but remains between one third and one quarter of the intensity achieved by the leading European economies. Closing that gap does not require replicating the fiscal capacity of Germany or Denmark. It requires the sequential construction of the institutional preconditions that allow a given quantity of public resource to mobilise a larger multiple of private capital, since the difference between a leverage ratio of 1.6 to one and 5.0 to one is worth substantially more than any plausible increase in the public contribution itself [10].

4. Discussion

Several conclusions of practical relevance emerge from the comparative record. The first concerns sequencing. The evidence suggests that classification and disclosure should precede the deployment of large subsidy volumes rather than follow it. Jurisdictions that scaled subsidies before establishing verification, including several early European renewable support schemes, experienced cost overruns and subsequent retroactive tariff reductions that damaged investor confidence for a decade. The Spanish retroactive revision of solar tariffs after 2010 remains the reference case: the fiscal saving achieved was materially smaller than the increase in required returns that Spanish renewable projects faced in subsequent years [11].

The second concerns the design of public institutions. The German and Dutch cases indicate that operating through existing financial intermediaries is generally superior to constructing parallel state distribution channels, because it exploits existing credit assessment capacity and distribution networks. The relevant institutional question for a country building this capacity is therefore not whether to establish a green bank, but which functions the state must perform itself and which can be delegated to commercial intermediaries under appropriate incentive structures. Guarantee provision, first-loss absorption and concessional funding lines are typically retained by the state; origination, credit assessment and servicing are typically delegated [12].

The third concerns duration. Every successful revenue support mechanism in the sample offers contractual certainty over a horizon of at least fifteen years. Support schemes with shorter horizons, or with discretionary annual renewal, systematically fail to attract long-term institutional capital irrespective of their headline generosity, because pension funds and insurers match liabilities over decades and cannot accept regulatory reset risk within the asset's economic life. This is arguably the single most transferable lesson, since it requires legal and constitutional commitment rather than fiscal expenditure [13].

The fourth concerns local content and social ownership. The Danish cooperative model and the Korean Green New Deal both embedded distributional provisions that gave affected communities a direct financial stake in project outcomes. The consequence was a marked reduction in permitting delay and local opposition, which in the European offshore wind sector has been estimated to account for between fifteen and thirty per cent of total project development time. Distributional design, frequently treated as a political concession, functions in practice as a risk mitigation instrument with quantifiable financial value [14].

The fifth concerns interoperability with international capital markets. For countries whose domestic institutional investor base is small, the marginal green investor is foreign, and the binding requirement is that domestic instruments be recognisable to that investor without bespoke due diligence. This argues for alignment with established international standards at the outset rather than the development of idiosyncratic national frameworks that require subsequent and costly reconciliation. The Korean K-Taxonomy's explicit interoperability provision is the clearest example of this principle applied deliberately [15].

For Uzbekistan specifically, the comparative evidence suggests a sequenced agenda. The immediate priority is the adoption of a national green taxonomy interoperable with the European and ASEAN frameworks, which would allow existing sovereign green bond issuance to be extended to corporate and municipal issuers without duplicate certification. The second step is the consolidation of currently dispersed green credit lines into a dedicated de-risking institution operating through the commercial banking system on the KfW model, with a mandate focused on guarantee provision and first-loss absorption rather than direct lending. The third is the migration from administratively determined tariffs to competitive auctions with contracts for difference of at least fifteen years' duration, which the country's existing solar auction experience indicates is feasible. The

fourth is the phased introduction of mandatory sustainability disclosure for large enterprises and listed companies, beginning with limited assurance. The fifth is the establishment of an independent verification body reporting outside the line ministries responsible for disbursement, since self-verification by the disbursing authority is the most common single point of failure in emerging market green finance programmes.

5. Conclusion

In conclusion, the experience of advanced economies indicates that green investment volumes are determined less by environmental ambition or natural endowment than by the quality of the institutional architecture that translates policy objectives into enforceable financial claims. The five pillars identified in this analysis, namely legally binding classification, public de-risking capacity, long-duration revenue certainty, mandatory verified disclosure and outcome-linked governance, appear jointly rather than individually in every high-performing case examined. Their construction is largely a matter of legal and administrative design rather than fiscal expenditure, which places them within reach of economies with limited budgetary space. For countries seeking to accelerate their own transition, the practical implication is that investment in institutional credibility yields a higher return per unit of public resource than any increase in the volume of subsidy deployed within a weak institutional framework.

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