

Green Infrastructure Finance

A Public-Private Partnership Approach to Climate Finance

East Asia and Pacific Region



THE WORLD BANK



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Introduction

In June 2012, the *Green Infrastructure Finance Framework Report*¹ was published to address the constraints in financing green infrastructure and to develop a new approach to accelerate investments in low-emission technologies. This publication followed the *Leading Initiatives and Research Report*² that summarized much of the past work and identified remaining gaps. The conclusions of the *Research Report* formed the basis for the principles of the financial gap analysis and green investment climate assessment methodology proposed in the *Framework*.

Since publication, the overall approach of the *Framework* has evolved by sharpening its argument, clarifying its benefits and adding a regulatory/monitoring, reporting and verification (MRV) component, which brings the *Framework* closer to a workable financing mechanism for green technologies. Moreover, the approach now includes a financing and advisory interface, which clarifies the principles and concepts of the shared financing roles recommended by the methodology. The *Framework* attempts to bring clean investments towards a more familiar financing environment and to distance them from the charged political debate that has adversely affected the progress in international climate change discussions for over a decade. The task has evolved through the following three concepts.

First, green technology projects are sufficiently similar to other infrastructure projects and should rely on proven project financing approaches. The key difference is that many green investments require financial support to mitigate externalities, which private proponents alone have no ability to monetize. Public finance can play a critical

role in monetizing both global and local external-ity benefits. However, the added climate change dimension does not necessarily change how the financing problem should be resolved. While there is a need for a credible assessment methodology that can address the unique characteristics of green investments, this should not alter the fundamental principles on which low-emission projects are evaluated, structured and financed.

Second, many green technologies require subsidy support, but this is not different from many other infrastructure projects that are implemented as public-private partnerships (PPPs). Such hybrid financing schemes are more common as projects become more complex and not viable purely on private financing structures. Green technologies must develop an equitable risk allocation framework that can provide a compelling argument for different stakeholders to support these investments through subsidized financing to the extent that this financing is justifiable from a climate change perspective.

Third, the principle objective of Green Finance is to accelerate investment in green technologies by resolving their financing challenges, with carbon reduction as an indirect desired outcome of successful implementation. While the distinction between “accelerating investment” and “reducing carbon” may be subtle, it is nonetheless important to underscore that this approach is an investment and financing framework, which differs from other approaches to Climate Finance. As such, the focus is on obstacles that have impeded the financial closing of green investments. Moreover, the successful financial closure of low-emission projects will improve their contribution to climate change by locking new investments into clean technology over their lifetime, while displacing low-cost polluting alternatives. This is significant as carbon mitigation initiatives often deal with emissions of pre-existing assets rather than introducing new clean investments.

¹ Baietti, A., et al, *Green Infrastructure Finance Framework Report*, World Bank, 2012

² Baietti, A., Shlyakhtenko A., La Rocca, R., Patel, U., *Green Infrastructure Finance: Leading Initiatives and Research*, World Bank, 2012

Why a New Framework

Many interventions have been taken to increase investments in green projects. Feed-in Tariffs (FiTs) as well as other financial incentives for solar, hydro, biomass and wind energy have been introduced in many countries. A number of international programs with significant funding have also been established to support clean infrastructure investments. This includes, most notably, the Clean Technology Fund (CTF), Global Environment Facility (GEF), and the Clean Development Mechanism (CDM) created by the Kyoto Protocol.

For example, the latter, under the principle of shared responsibility, channels funding from GHG emitting entities in developed countries to carbon-reducing activities in less developed countries. Each eligible project earns certified emission reductions (CERs), payable at a market price for each ton of carbon it reduces. Governments in many developing countries recognized the opportunity to implement carbon mitigation projects while minimizing their own financial burden.

A substantial number of projects have been implemented in the CDM's 11-year history. By September 2012, the CDM achieved a major milestone when the total CER units reached one billion with a total value of US\$8 billion to US\$10 billion. CTF and GEF have also made significant contributions to investment levels and many other financial and policy interventions at the country level have spurred investment incentives. Unfortunately, as the *Research Report* highlights, "while investment trends in clean technologies have improved, the pace of these investments is still substantially insufficient in order to curb the effects of climate change." Investments have not kept pace with the need and the funding gap is growing.

Various levels of integration of the sources of concessional financing with regulatory frameworks have been implemented. CTF and GEF are two important sources of concessional financing that function primarily within other existing financing

and regulatory arrangements and procedures. CDM, however, is perhaps the only fully contained financing and regulatory framework that provides financial support to curb the effects of climate change by funding individual investment projects.

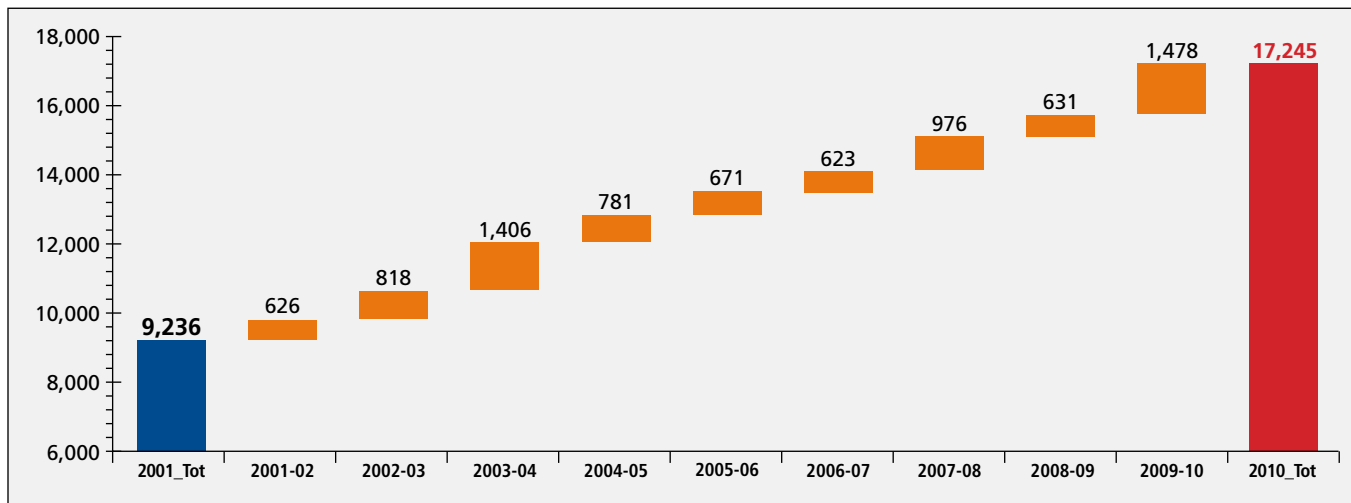
CDM establishes the rules for eligibility, procedures for analysis and carbon financing as well as the regulatory, monitoring and verification oversight. Despite its innovative approach and certain success, a number of limitations must be overcome if CDM is to have a greater role in accelerating investment in clean technologies. Some of these limitations include:

- Nearly two thirds of the CO₂ reductions from the one billion CDM CERs came from low capital-to-output projects that cut HFCs, PFCs, SF and N₂O. However, many of these industrial gases could have been eliminated through other mechanisms without the need for substantial subsidies. In addition, a number of these projects have earned financial windfall profits, making the practice controversial. In contrast, CDM has eliminated just 20 million tons of CO₂ per year from clean technology investments. This CO₂ reduction is underwhelming, especially given that it is approximately equivalent to eliminating only one large coal power plant per year for the entire group of 154 countries that have participated in the program. Conversely, the same group of countries (with the exception of some of the smaller ones³) nearly doubled their CO₂ emissions during 2001-2010 from 9.2 billion metric tons to 17.2 billion metric ton per year. Essentially, non-Annex 1 countries⁴ saw an average annual increase in energy related CO₂

³ Excludes new nations like South Sudan and small countries, such as Andorra, Palau, Marshall Islands, Micronesia, Tuvalu, San Marino, and others.

⁴ Annex I countries is the group of countries included in Annex I (as amended in 1998) to the United Nations Framework Convention on Climate Change (UNFCCC), including all the OECD countries and economies in transition. Under Articles 4.2 (a) and 4.2 (b) of the Convention, Annex I countries committed themselves to returning individually or jointly to their 1990 levels of greenhouse gas emissions. By default, the other countries that signed the Kyoto Protocol are referred to as Non-Annex I countries.

Figure 1. Total CO₂ Emission from Energy Sources – Non-Annex I Countries
million metric tons



Source: US Energy Information Agency (EIA)

emissions of approximately 7.18% per year. CDM lowered this from 7.32%—a barely discernible reduction;

- Essentially, CDM has been financing primarily “end-of-pipe” mitigation of pre-existing assets instead of creating a shift by favoring clean technologies (such as renewables) in new investment decisions. Addressing the existing base of investments is commendable, but ultimately ameliorating the effects of climate change will only occur if *new investments* will flow to low-emission projects rather than to polluting alternatives. This means not only expanding programs for energy efficiency investments in pre-existing assets, but also increasing the installed capacity of new renewable energy (RE) technologies;
- Another problem is how and when the carbon funds are received. CDM funding to projects relies purely on the per ton carbon price which is only paid after actual carbon benefits are produced. Moreover, the price is determined by a political market that is volatile and unreliable for long-term contracts. Both issues create significant uncertainty in resolving the up-front financing burden for clean investments. CDM financial support occurs only after the project is operational, and therefore project sponsors cannot rely on it for the initial capitalization. This

is particularly constraining on renewable energy (RE) projects that are also disadvantaged by their relatively high up-front capital costs. If a project genuinely requires a subsidy, support should be provided either at the financing stage or be guaranteed in order to make an otherwise unviable project bankable. Nevertheless, CDM does not address this problem directly, and while the cash stream of CDM benefits could conceivably be securitized as an upfront payment, such attempts have not been successful because their guarantee cannot be anchored to a reliable regulatory and pricing framework;

- CDM operates under an international framework of the United Nations Framework Convention on Climate Change (UNFCCC) and this presents a particular legal problem because parties must rely on commercial contracts to resolve disputes. This can be expensive in the event of non-compliance, thus making the output-based approach to payment the only practical way to reduce risk. Moreover, the project validation and registration process is bureaucratic, and verification can be very costly as it utilizes highly paid international experts;
- The volatility of the carbon markets has also been a significant deterrent to the extent that an entire financial industry has evolved with the aim of creating some degree of stability in

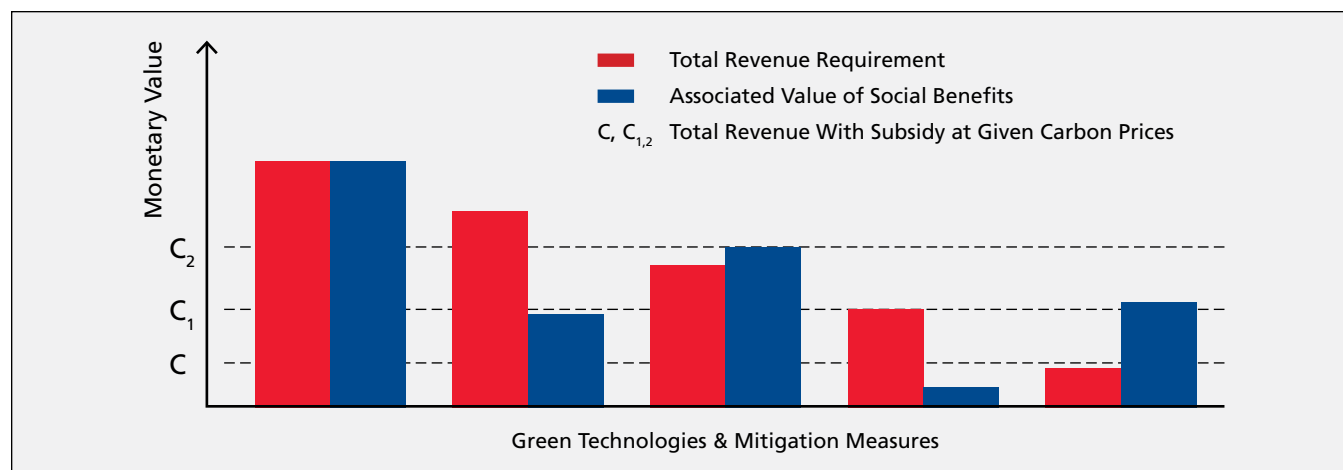
the system. However, these efforts also come at a significant transaction cost, raising questions as to whether investment financing, particularly payments for curbing environmental externalities or subsidies (from project point of view), could be channeled more efficiently;

- Another key problem is the eligibility of projects. CDM works on the principle of “additionality”, which means that the project would not have happened without the aid of carbon finance support. However, demonstrating a project’s additionality has been very challenging. This is illustrated by the fact that the majority of the projects that were denied registration (more than 70%) have been rejected on the grounds of additionality. Yet, some of such projects were likely justifiable from a climate change perspective. While projects should not be subsidized unnecessarily, eligibility criteria should be rigorous enough to reflect a country’s investment conditions, which can vary considerably, especially where benefits significantly outweigh costs;

- More importantly, financial subsidies should be sufficient to make projects bankable, not more or less. Even from an environmental policy perspective, where subsidies represent payments for public goods, private projects should not be supported beyond reasonable rates of return. Using the approach of competitive bidding for the least subsidy required can provide additional assurances that sponsors receive only the necessary subsidy. In contrast, CDM, depending on the carbon market price, can greatly exaggerate the returns of a given project or totally exclude other projects that are justifiable from a climate change perspective. The graph below illustrates this latter point, where carbon finance support at any given unit price does not always reflect the need or justifiable benefits.

The following chart summarizes some of the main differences between CDM and the *Green Finance Framework*.

Figure 2. How CDM Can Exclude Justifiable Projects and Reward Others More than Needed⁵



Source: Authors

⁵ Figure 2 illustrates the total revenue requirement for various green technologies and other mitigation initiatives, such as the destruction of industrial gasses (red bars). The C, C₁ and C₂ lines represent the levels of total revenue each of these investments would achieve. The blue bars represent corresponding value of monetizable social benefits of each activity. The case to the far right of the graph shows, as an example that at the C subsidy support, the project would already surpass its total revenue requirement thus earning a higher than required risk adjusted rate of return. Assuming the price/ton increases to C₁, the total value of profits would be more than double the revenue requirement and create a windfall situation. The project just to the left, on the other hand would only be viable at C₁ and above that line. Therefore, at any given carbon price, there would be a group of projects that would receive more than needed subsidies (to the right of the chart), while others would be unviable (toward the left of the chart). This is of particular concern when also factoring the total value of social benefits of each project in comparison to their total financial requirements. Projects should merit investment consideration when the monetizable value of the global and local externalities is equal or exceed the financing gap.

The figure below reflects the key differences between the CDM approach and the *Green Finance Framework*.

Figure 3. Key Differences between CDM and Green Finance

Features	Green Finance Framework	CDM
Outcome	Promotion of long-term investments in low-carbon infrastructure.	Promotion of greenhouse gas (GHG) reduction and sustainable development.
Authority	Enhancement of existing country-based legal and regulatory PPP framework.	UNFCCC protocols.
Financing Approach	Up-front structured financing. Projects cannot close without all financing being in place.	Output-based financing, usually regarded as a sweetener.
Subsidy Support	Mix of concessional public financing utilized to close the financial viability gap can be funded from multiple sources.	Highly dependent on carbon price.
Additionality	No additionality issues. Projects are not viable or financially attractive without gap financing and cannot go to closure.	One of the ways for the projects to prove additionality is to demonstrate that they are not viable in the absence of carbon benefit. Yet they need to reach closing before any benefits are received.
Double Counting (Paying)	None. Only the amount of subsidy benefits needed to close the gap is subscribed. In many cases the GHG value of the benefits can be greater than the subsidy that is needed, leaving a residual amount to be used for other purposes.	Potential for double counting in the event several financing sources are syndicated.

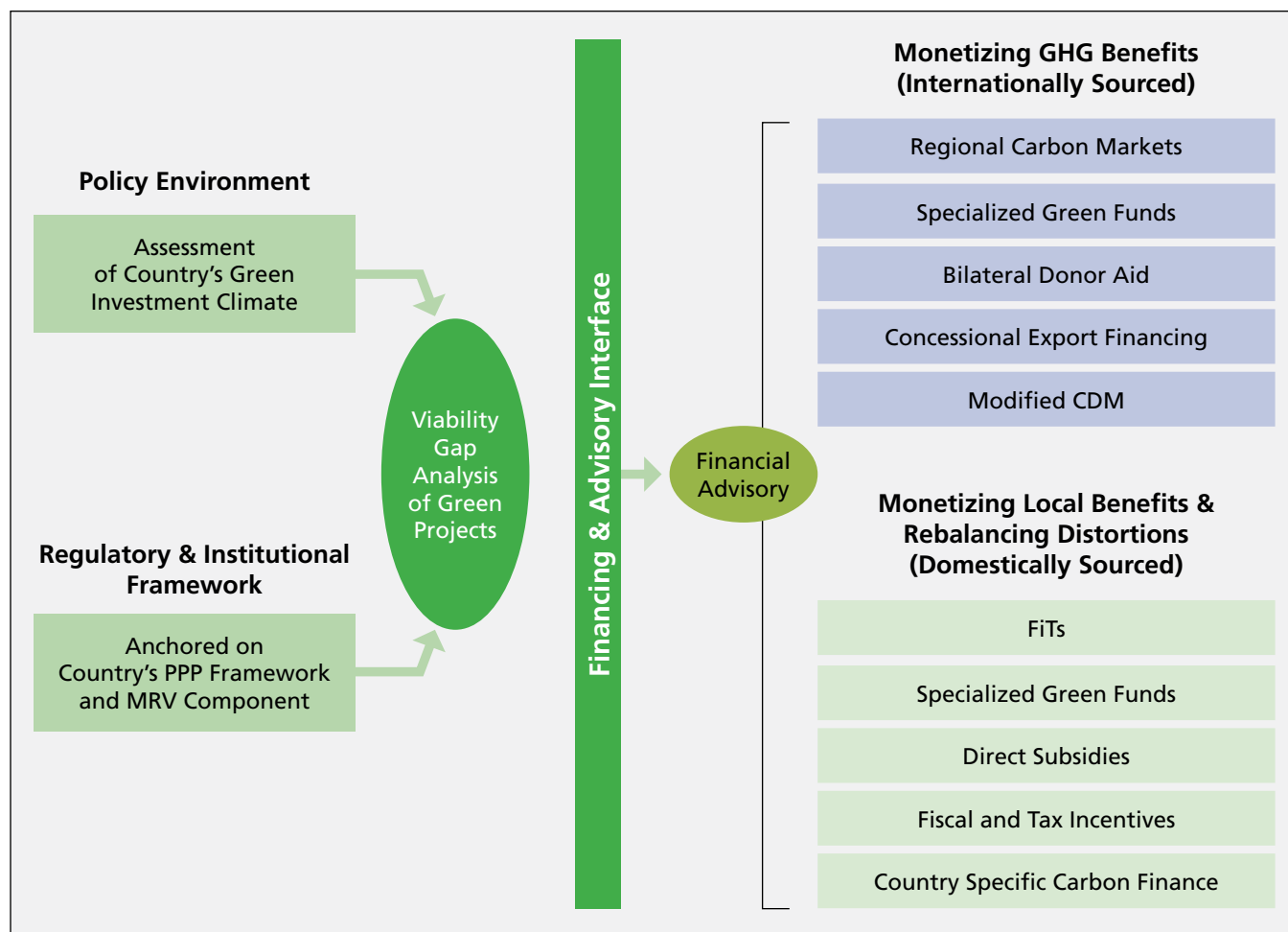
Source: Authors

The Green Infrastructure Finance Framework: An Overview

The *Green Infrastructure Finance Framework* is an attempt to re-evaluate how green projects can be assessed, structured and financed with the aim of positioning these investments as viable and attractive opportunities to polluting

alternatives. The approach is integrated into the existing policy, regulatory, and institutional environment and provides a way to allocate responsibility to respective stakeholders without creating additional economic distortions.

Figure 4. Components of the Green Infrastructure Finance Framework



Source: Authors

The “Viability Gap Analysis” methodology is the core of the *Framework*. This methodology presents a simple but elegant way to structure scarce public concessional financing to leverage market interest in “greening” infrastructure. It

bridges ideas and concepts between environmental economics and project finance practices to monetize environmental economic benefits and rebalance the distortions in order to close the financial viability gap of green technologies.

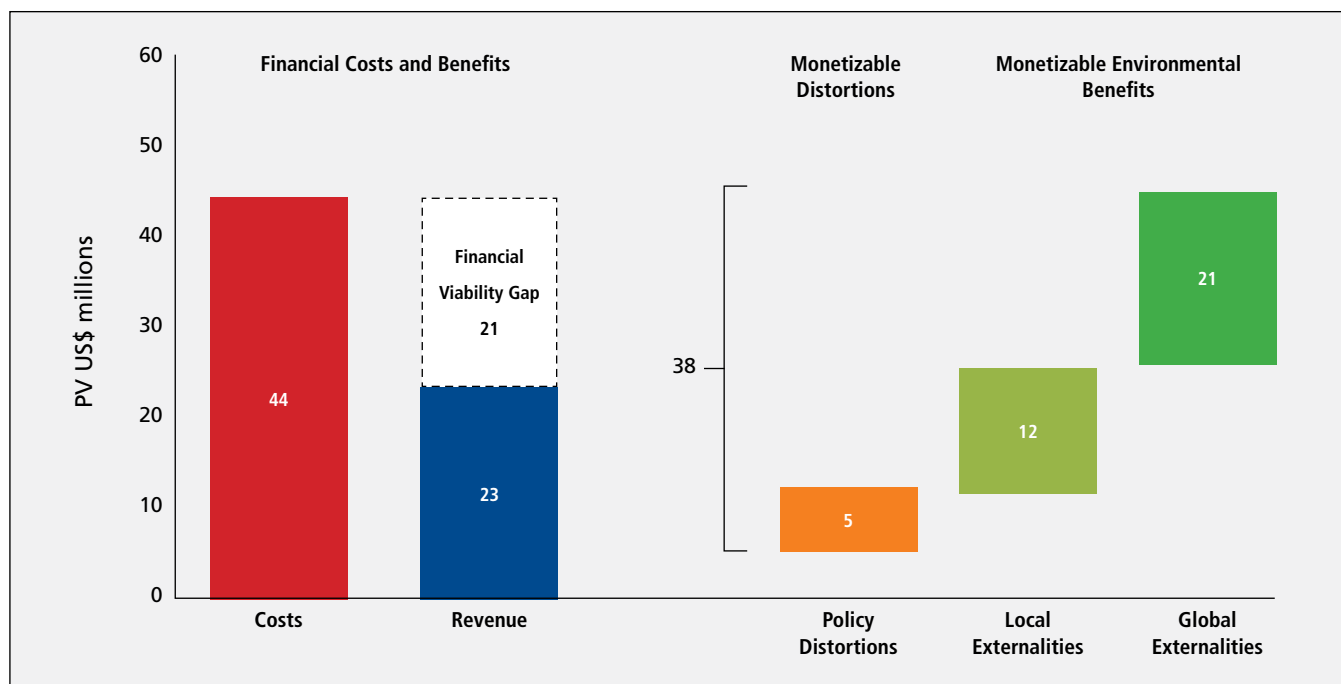
The methodology starts with determining the financial viability gap of a privately financed green investment that competes against the lowest cost polluting alternative. This gap is then compared to a series of monetizable economic benefits the project generates, including environmental benefits and avoided distortions created by a host government, for example, through fossil fuel subsidies.

The environmental benefits and avoided distortions are assessed to determine whether, if monetized, they can close the gap either individually or in combination, with public financing responsibilities allocated commensurately. The national government addresses the distortions and local benefits, while the international

community focuses on the global externalities benefits of the given investment. The outcome is a hybrid public-private partnership financing structure that can reduce additional distortions in the economy as it justifiably allocates funding responsibilities and costs to those stakeholders that actually receive the benefits. Most importantly, this approach makes clean investment a profitable and attractive proposition that earns the appropriate risk-adjusted rate of return.

The methodology is illustrated conceptually in the chart below. A clean energy investment such as a wind or solar project is evaluated financially against its least-cost polluting alternative (e.g. coal) to estimate a financial viability gap in net present value (NPV) terms.

Figure 5. Illustration of the Financial Gap Analysis Methodology



Source: Authors

Three different economic benefits and costs are then calculated for their monetizable values to assess whether the three combined or individually can potentially close the gap. In this case, the NPV values of the environmental benefits and distortions offset the values of the viability gap. The value to offset the distortions (e.g. a subsidy to

fossil fuels) and the local externalities (e.g. local pollution caused by the coal alternative) would be the responsibility of the host government, whereas the net global externality (e.g. GHG benefits of the RE project against coal) would be the responsibility of the international community. Each party would internally monetize these values

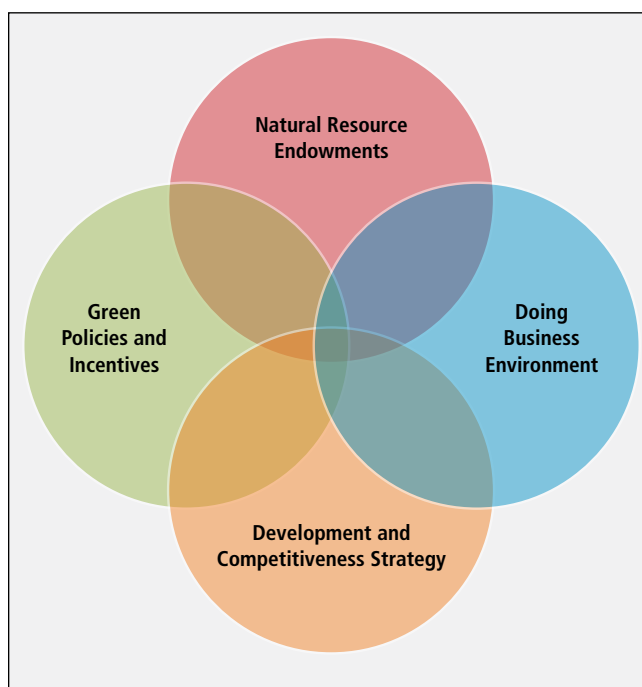
to determine a final financial structuring in combination with the private finance contribution and would utilize a combination of instruments equal to the NPV value required for their respective responsibility.

The financial measures to be enacted and the actual value that each party would be able to commit can form the basis of a wide-ranging dialogue. This can include: (i) the overall stage of economic development of a country and its budgetary resources; (ii) the country's current policy and incentive framework and emphasis towards greening its economy as opposed to promoting fossil fuel use; and (iii) other considerations such as general donor aid strategy, export promotion strategy of clean technologies owners and their governments, and bilateral agreements or exporting offsets to emerging regional carbon markets. In the case illustrated, the gap could be closed entirely from GHG benefits or through a lower international climate finance contribution with additional support from the national government.

Accelerating green investments must also focus on the right policy environment in a given country context. As such, the second part of the *Framework* relates to creating effective policies and financial incentives in order to create investment opportunities, while reducing the related risks. The approach calls for assessing the "green investment climate" of a given country in order to develop country-specific recommendations for policy and incentive programs as well as other measures which can be introduced to further promote green growth in an economy.

The assessment has to include not only the green policy and incentives environment but also the country's overall natural resource endowment of fossil and renewable energy, the industrial development strategy in addition to general business indicators and other considerations, such as electricity prices, the capacity of the financial sector to mobilize long-term domestic financing, as well as their overall regulatory and legal capacity to implement PPPs (see Figure 6).

Figure 6. Green Investment Climate Assessment Framework

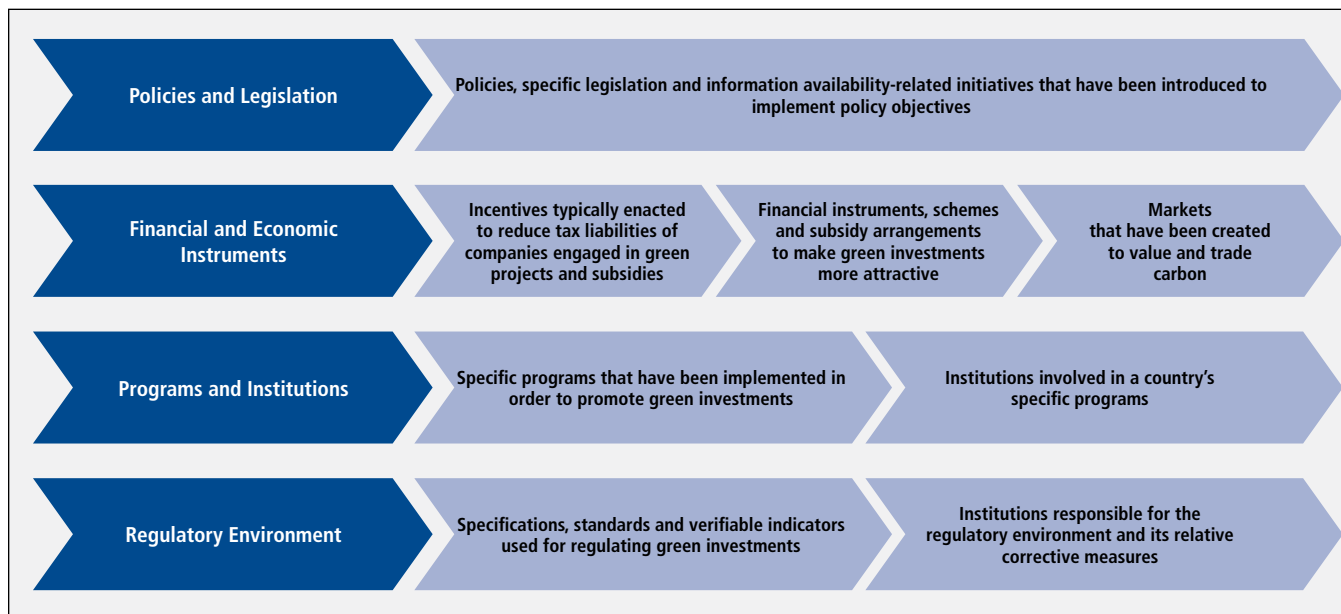


Source: Authors

The overall green investment climate assessment of countries provides a general understanding of the attractiveness, prevailing trends, strengths, and other aspects affecting the ability of the country to leverage its green growth potential. The core component of the green investment climate – Green Investment Policies and Incentives – (see Figure 7) includes four main parts: (i) policies and legislation; (ii) financial and economic instruments; (iii) programs and institutions; and (iv) the regulatory environment.

As indicated, the CDM regulatory framework is limited in supporting new investments to reach its green growth potential. Successful growth in these investments requires a credible and efficient regulatory framework of enforceable contracts that will ensure that financially supported projects actually achieve their service obligations and environmental benefits. Thus, the third element of the *Green Infrastructure Framework* is a regulatory component integrated with the existing country regulatory framework. The main element of such a regulatory framework should be

Figure 7. Components of Green Policies and Incentives



Source: Authors

a reliable and efficient system for measuring, reporting and verifying (MRV) environmental benefits of the investment that will be supported with concessional or subsidized financing, particularly if the intention is to issue CERs for up-front financing. Third party international contributors must be assured that remedies can be obtained if a project does not achieve such reductions in GHGs, and that those CERs can be backed up by a performance security that can be invoked in the event of default.

In contrast to the UN-based approach utilized by the CDM, the *Green Finance Framework* is anchored in a country's existing PPP framework of legal and enforceable contracts, procurement rules, and sanctions for non-performance. This *Framework* can be transformational in accelerating investment, to the extent that countries develop a credible, efficient and enforceable PPP domestic framework.

The MRV component would be an add-on to the existing PPP framework and would essentially form the basis for the proponent's legally binding service obligations. Performance security can

be established by performance bonds, third party guarantees and other forms of security—as with regular PPPs. An existing substantial body of work can be immediately implemented to make this approach operational. The in-country regulatory authority would be entrusted to implement the approach and would have oversight and responsibility to ensure transparency and compliance. If necessary, conflicts can be referred to international arbitration to provide greater assurance and reduce third-party risk.

The country-based approach to regulation and MRV offers additional benefits when compared to CDM in terms of reduced cost by using certified local auditors to carry out ex-post reviews. The MRV component can also be handled on an incremental basis and with greater cost effectiveness. This would reduce the need to carry out extensive baseline surveys because each project would be treated as an incremental contribution towards reducing GHGs.

Finally, the methodology allows for syndication of multiple funding sources for each component of the gap, helping avoid double counting

as each source can take up its own share of either local or global benefits that can be earned with the implementation of the given investment. For the GHG benefits, that share can be backed by the issuance of certificates at a price acceptable to the paying party. This means that the price of benefits would not be determined by a single financial market, but rather by each paying party giving its own GHG value to its corresponding share of total benefits. The *Leading Initiatives and Research* report indicated that the value of GHG benefits can differ significantly depending on who is valuing these benefits. Presently the carbon price in the European Union Emission Trading Scheme is about US\$5-6 per ton of CO₂. The global carbon supply/demand balance models typically predict an equilibrium price for global atmospheric stabilization at “safe” carbon concentration levels of US\$20-100 per ton and the marginal abatement cost in energy efficient OECD economies such as Japan has been estimated to be as high as US\$500 per ton of carbon.

This approach enables the syndication of the concessional financing needs of a given project and for different groups to collaborate to make such a project bankable by reducing financial exposure and overall risk of each party. The UN high-level advisory panel concluded that maximum effort must be taken to involve all sources of financing to close the financing gap. This approach succeeds because it relies on a private finance foundation coupled with public funding support from multiple sources.

The advisory needs of the project are similar to most PPP projects but with more broadening for “market maker” functions for sourcing climate finance. The financing and advisory interface can be implemented at the national, regional and global level depending on the ultimate objective of these funds. Governments seeking to accelerate investments in green technologies can set up a national fund purely for their own economy and solicit international support for the GHG concessional funding. Alternatively, a regional or global green fund could be established to complement existing efforts at the regional or national levels. Significantly, the approach provides the degree of flexibility to take advantage of a wide range of potential funding initiatives.

The gap in a typical project finance structure could be closed through a number of public financing sources coming from both government and international parties. Governments could rebalance distortions through an appropriately set FiT, increase that FiT to accommodate internalized local externalities and other benefits, or assemble an entirely different mix of funding and financial incentive arrangements that covers their commitment to the overall financing. International GHG sources could consist of a blend of GEF subsidies and guarantees, CTF financing, carbon market offsets, and other sources such as the Green Climate Fund which is currently being designed. Alternatively, one party may decide to fund the entire gap of a given project, depending on their strategic interests, tolerance for risk and desired financial exposure.

Concluding Remarks

The detrimental effect of climate change is growing, yet clean investments are still grossly insufficient making it necessary to rethink the approach to greening the global energy mix. While end-of-pipe treatment of the existing asset base is important and those efforts must continue (particularly for high emitters), an effective and easily implementable framework for new investment decisions must be established, particularly in less-developed countries. However, this will be challenging as green investments are invariably more risky, costly, and require more capital up-front. They also face other financing challenges—for example, many countries subsidize fossil fuels for other development reasons.

The need for some level of concessional financing or outright subsidy support is widely understood but the approach must be equitable, non-political and deliver a sufficient level of support. Current international programs have sought to address some of these constraints but lack elements in their framework to utilize public financing to their maximum effectiveness and to help host governments to play a responsible and legitimate role in resolving the financing dilemma of many green investments. The carbon market historically has not provided stable and predictable financing mechanism to support new investments in clean technologies. Moreover, CDM, that operates within this market, is not designed to handle structured finance requirements that many clean technology projects need in order to reach financial closure.

The *Green Infrastructure Finance Framework* places these investments in a commonly

understood framework of structured finance with public finance components, as in many hybrid PPPs. The methodology allocates financing responsibilities equitably. For example, governments only pay for the benefits that they specifically gain from a given project, not for the benefits gained globally. Equally important, a green project is evaluated against the low-cost alternative, rendering that project not only profitable but also a financially attractive investment choice for the economy.

The framework of shared responsibility aims to reduce additional distortions in an economy by ensuring that the parties paying for the benefits actually receive the benefits. It also reduces the financial burden on governments, which has been a significant political obstacle in identifying real solutions for accelerating green growth. Most importantly, although the selection of viable project opportunities does screen for justification, it ultimately leaves the decision to the party valuing the externality benefit. Therefore, each party can assign their own value depending on how they internalize the benefits. Moreover, international sources for concessional finance must be flexible because low-emission investments need the correct financial structuring to be bankable.

Finally, the concept of anchoring regulation in a country's existing PPP framework to focus on creating the right policy environment will greatly facilitate mainstream implementation and reduce costs. This aspect of the *Framework* is widely understood by many developing country governments and can be easily replicated not only in East Asia, but also in other regions.

The detrimental effects of climate change are growing, yet investments in clean technologies are still grossly insufficient, making it necessary to re-think how these projects should be evaluated, structured and financed in order to render them viable and attractive opportunities to polluting alternatives. Existing approaches lack key features in order to adequately address the key financing challenges of these investments, and do not utilize public support to its maximum effectiveness. The international community is essential in resolving this financing challenge, and host governments need to create an environment that levels the playing field for green investments vis-à-vis their conventional alternatives.

The *Green Infrastructure Finance Framework* places clean investments in a commonly understood framework of structured finance with public finance components, as in many hybrid PPPs. The framework includes four main elements: (i) a viability gap methodology for evaluating, structuring and equitably allocating financing responsibilities to different private and public parties; (ii) linkage to a country's PPP's procurement and regulatory framework along with an MRV component for ensuring the service obligations of projects; (iii) measures for addressing the adequacy of the climate for these investments; and (iv) a financing and advisory interface for allocating a wide variety of public sources of financing in a coherent fashion.



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