A Climate Finance Initiative To Achieve the Paris Agreement and Strenghten Sustainable Development

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Summary for Policy Makers

Achieving a Safer World: Speed and Scale in Climate Finance

The window of opportunity for a world with less than 2°C global warming is closing. One urgent matter is to scale up low-carbon investments[2] in developing countries. This paper tests the feasibility for a Group of Initiatives for Climate Finance (GICF) made up of countries from the North and the South to carry out this scaling-up. It explores what is perhaps the only remaining actionable way of achieving this in the current context of tight public budgets and a global crisis of confidence in financial stability, growth and jobs.

The size of required investment

This study first builds upon six other studies, which found that the mean size of low-carbon investments required in energy and transportation between 2018 and 2035 to provide a '2°C world' is about USD 6.78 trillion a year, i.e. about 5.7% of projected global GDP.

The increase in investment required above the baseline scenario, to both reduce the current infrastructure funding gap and cover the incremental costs of low-carbon options, is lower, equivalent to about 2.5% of projected global savings. The crucial element is the far greater amount of reallocated investment within the projected investment portfolio. For energy and transportation infrastructure we used a sum of additional and reallocated investment of between USD 1 360 and 3 210 billion a year on average up to 2035. The amount of 428 to 1 010 billion to be covered by private funds can be compared with the total size of global financial (debt, equity and bond) markets, i.e. some USD 386 000 billion.

What makes the prospect challenging is that about 63% of low-carbon investment has to take place in developing countries, where access to long-term financing is constrained and costs are high, reflecting heightened risk-aversion by investors. At the same time, the application of the principle of Common But Differentiated Responsibilities is constrained by pressures on scarce public finances in industrial countries. Even meeting the USD 100 billion a year in climate finance promised in Paris is proving difficult. How then can efficient and at-scale policies be designed in such circumstances?

The instrument: coordinated Sovereign Public Guarantees

The paper argues that the most effective leverage for at-scale policies would rely on ***issuance of multi-sovereign public guarantees in order to reduce perceived risk for project developers, financial***

intermediaries and savers and support business models that cut down the transaction costs currently hindering the supply of low-carbon projects.

Historically, public guarantees provided by sovereign and sub-sovereign entities have been one of the main forms of backing for projects that serve the public interest, but are otherwise perceived as too risky because of their long duration (infrastructure projects with long payback periods), high upfront capital costs, market uncertainties, public policy instability and scale and network requirements to achieve systemic technical changes. Four reasons justify the expanded use of this instrument for the low-carbon transition today:

***First,* recent changes in the financial community's mind-set demonstrate a readiness to scale-up low-carbon business commitment**: emergent 'Green Bond' funds, institutional investors seeking safer and sustainable investment opportunities, reflections about climate-risk related disclosure of financial portfolios, multilateral and national development banks envisaging the deployment of guarantees at a larger scale than the current 4-5% of their total portfolios. However, maintaining and deepening this change requires clear public support. Typically, 'green bonds' suffer from doubts about their 'greenness' and the banks capacity to offer guarantees is limited by their preference for direct lending, since the risk capital allocation of guarantees is treated as equivalent to loans on their books.

***Second*, this public support cannot come from an explicit 'universal carbon price' set at the level needed to switch private investment decisions to low-carbon investments**. The reduction of the gap between this level and a level that is politically implementable indeed depends upon the pace at which carbon pricing can be embedded into reforms of fiscal systems and tariff policies that tackle its distributional consequences. Intrinsically, this is a matter of domestic policy (Paragraph 136 of the Paris Agreement) and is affected by political uncertainty. The promised 'penalty' of a carbon price for high carbon options is a 'reward' for low-carbon options that occurs too late for risk-adverse decision-makers.

***Third*, public guarantees provide this upfront 'reward' for low-carbon options while maximizing the efficiency of using public finances**. They are superior to direct subsidies because they leverage much more investment for a given public cost (a multiplying factor of about 6- to 16-fold). They place a limited burden on taxpayers thanks to the tax revenues produced by the supported activities and the fact that historically-demonstrated default rates for projects are lower than 5%. Public guarantees exert a high leverage effect when the borrower does not have a strong financial reputation, when track records are not yet well-established, and when the public social benefits are high relative to costs while, after de-risking, the investments are amenable to profit-driven market activities.

Fourth,* calibrating the guarantees on agreed social value of climate mitigation actions (SVMA)** (article 108 of the Paris Agreement decision) ***will ensure the economic efficiency of project selection. A facility backed by coordinated sovereign guarantees, with common selection rules and the same implicit value for each ton of avoided emissions, will thus reach the credibility level necessary to support innovative business models, adapted to various sectors, technologies and geographies and capable of overcoming the transactional constraints on the emergence of at-scale low-carbon projects.

Designing the right institutional set-up: the offer of a new facility

Access to a new facility backed by sovereign guarantees should initially be restricted to projects contributing to host countries' NDCs, thus linking them closely to those countries' enabling policies. It can then be used by project stakeholders to increase the number of bankable projects. To achieve this, it should:

a. Cover appropriate risks, while minimizing default. Low-carbon investments face the same type of risks as any long-term investment: **(a)** *commercial*; **(b)** *regulatory and contractual*; **(c)** *macroeconomic;* and **(d)** *political*. Financial markets can be expected to provide their own internal risk-mitigation actions to cover these 'normal' risks. The crucial role of GICF is in providing *additional de-risking* to deal with the specifics of low-carbon investments, such as higher up-front capital costs, longer duration, uncertain carbon prices, and scaling risks of new technology. In taking on these additional risks, standard rules would apply: **(a)** avoid *adverse selection* by covering only a part of total risks; **(b)** avoid *moral hazard* through strong screening criteria and charging for guarantees; **(c)** transparent daily decision-making free from political interference **(d)** adequate capitalization of contingency reserves for prompt remedial actions in case of calls on guarantees (an initial capital of 20 percent that would be tapered down as successful experience is gained).

b. Use SVMAs to make project selection more transparent, maximize its social benefits and hedge against default risks. Governments of developed countries would use a global SVMA within the range of values given by the IPCC for the marginal costs of carbon for a 2°C target. Governments of developing countries would use a domestic SVMA for the proportion of guarantees they would be willing to provide. It will be easier to reach agreement about such values than about carbon prices because SVMAs do not adversely impact existing capital stocks. A global SVMA that is higher than domestic SVMAs would transform the heterogeneity of countries into an opportunity for reciprocal gains, including helping host countries to improve the enabling policies of their NDCs and generating export revenues for guarantor countries

c. Standardize project proposal and selection processes to reduce transaction costs (assessment of avoided emissions, legal procedures for approval, enabling policy support from host governments). This standardization will build upon the experience of the CDM, should be backed by peer-reviewed scientific information and processed by third-party experts. It should aim at a *statistical environmental additionality* of projects in a context of imprecise knowledge of their individual performance and allow for *'bundling' of projects* differentiated by sector, technological maturity and geography. This will help cities and local communities to access funding to achieve their Sustainable Development Goals.

d. Establish a 'new asset class' of Carbon Remediation Assets. The possibility arises of establishing a new asset class by explicitly assigning values to the carbon saved by the projects and making it tradeable and available as a security for financing. The GICF could implement this among its members and 'crowd-in' funding for such an asset class in financial markets with the agreement of central banks thus further enhancing the power of its guarantees.

e. Maximize the leverage effect of public funds and provide a fulcrum for cooperative behaviour to reduce the fragmentation of the development finance system: The choice is between a Distributed Guarantee Funding Mechanism (DGFM) and a Multi-Sovereign Guarantee Mechanism (MSGM). Under a DGM a guarantee fund is created by each participating country, individually covering its share of GICF guarantees and ensuring payment of guarantees if called upon. The due diligence would be contracted out, for example to MDBs. The MSGM establishes a common guarantee fund with its own governance structure, with paid-in and callable capital. The paper shows that, thanks to greater confidence given to markets by pre-committing resources, the expected 'multiplier' of public capital under the MSGM would be far greater than under the DGM (16 vs 6 times) with the possibility of significant 'dynamic gains'. In either case, the cost to the public purse would be smaller than with direct funding (multiplier of less than one).

A dynamic of mutual gain

a. Lower interest costs, longer maturities, and greater access to capital markets for developing countries. The pooled sovereign guarantees provided by highly rated (AAA-AA) developed countries would work by 'credit enhancement'. We estimate, backed by evidence of past effects of guarantees, an initial likely reduction in average spreads of 100-300 basis points, maturity extensions by 10-15 years and a 3 to 5-fold increase in access to financing. The gains would be significant for creditworthy countries and biggest for the countries with low creditworthiness.

b. Fulfil the 'USD 100 billion a year and beyond' commitment of the Paris Agreement (para. 53 Decision of the PA 1/CP.21) through an average grant equivalent value of between USD 87 and 160 billion annually over the next two decades. This grant equivalent would combine with an equity inflow (the proportion of the USD 160 to 300 billion of equity provided by foreign investors).

c. Macroeconomic and sustainability benefits. Developing countries would carry more external debt to finance low-carbon projects but would be able to do so in macro-economic terms and would gain in creditworthiness thanks to the growth benefits of projects, savings in imported energy and access to certified climate remediation assets. Developed countries would gain through faster growth. Some 40 percent of project financing will flow back as import demand to developed economies, with a positive fiscal impact, offsetting the public cost of their capital contributions to the guarantee mechanism (only 2.82% and 3.12% of imports in LCI would offset the guarantors public cost).

d. Free up fiscal grant resources for adaptation and loss & damage. A large indirect benefit would be the freeing up of fiscal resources from the current direct mitigation lending activities, making possible significantly higher ***grant-financed flows*** from developed countries to developing countries for their '*pure public goods' adaptation and loss and damage investments* –closing the 'win-win' circle of trust and confidence in climate finance, as envisaged under the Paris Agreement.

The paper concludes by suggesting: **(a)** the immediate establishment of ***a 'Design Lab' initiative*** to bring 10 projects to 'ready for financing' stage and demonstrate the parameters of, and prospective gains to be achieved by, the GICF; and **(b)** the establishment of a ***high-powered political and policy consensus task-force*** to implement and fund the full range of GICF activities by 2020.

Contents

Introduction: towards an instrument of trust

The window of opportunity is closing fast to restrict global warming to under 2°C and to achieve the Sustainable Development Goals (UNEP 2017, The Emissions Gap Report). The international community will miss this window unless it successfully establishes an ***instrument of trust between developed and developing countries*** to trigger a wave of low-carbon investments with large positive and immediately tangible impacts on global economic growth, employment and poverty reduction in addition to climate change mitigation and adaptation. Trust matters: not only to overcome the misunderstandings that have accumulated over time in global climate affairs but also to recover the feeling that reciprocal gains are possible (Ostrom and Walker, 2005) despite rising economic tensions in international relations (Hoffmann, 2002).

FIGURE 1: The emissions GAP: GHG Emissions Under Different Scenarios (2010-2030)

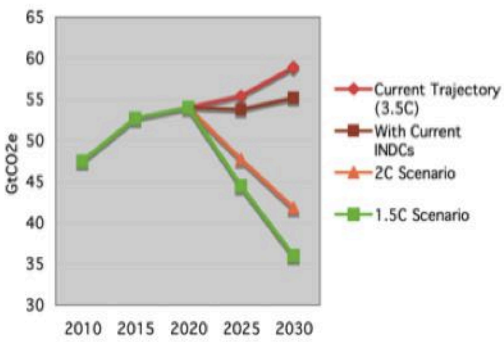
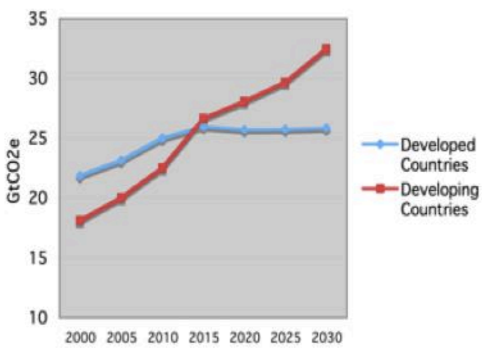


FIGURE 2: Emissions Baseline Scenario By Developed and Developing Regions, 2000-2030



Source: Dasgupta (2018) and UNEP (2017)

This note thus explores the basic principles of such an instrument that could be launched by a ***Group of Initiatives for Climate Finance (GICF)***, composed of willing developed and developing countries and that would be expanded later. The ultimate objective is to ***catalyse global savings at scale and speed*** *to finance sustainable low-carbon infrastructure and climate-resilient development*, (Article 2 of the Paris Agreement) and to realize the Cancun Agreement's promise of equitable access to development (Hourcade, Shukla and Cassen, 2015) despite tight public budgets and high levels of private debt. Finance has indeed always been a key enabler and driver of scale, technologies and transformations, and the backing of sovereign entities is vital whenever there are large externalities (Dasgupta, 2018).

The framework proposed by the GICF initiative will aim to reallocate global savings towards sustainable infrastructure and low-carbon production processes in industry and agriculture in developing countries through a ***coordinated issuance of public guarantees by sovereign and sub-sovereign entities in order to reduce project developers', financial intermediaries' and savers' exposure to risk.*** The coordinated commitments of state and sub-state entities will scale up initiatives by multi-lateral and national development banks, emergent 'Green Funds,' and financial institutions seeking safe, sustainable investment opportunities. Moreover, public guarantees maximize efficiency in the use of scarce public resources because, when properly managed, their burden on public budgets is only a fraction of the amount of project financing that they enable. Historically, such guarantees were often used to help finance a surge in investments, e.g. the global shift to rail transport, the building of the Suez Canal, the spread of electricity and even more recently, that of mobile telephony (by granting sovereign guarantees on licensing and frequency allocation). States must 'nudge' the global finance system and remove some of the risk from the table in the early stages.

This study provides a diagnosis of the funding needs of, and the financial constraints upon, the low-carbon transition, and uses this diagnosis to propose an architecture based on:

a) calibrating the guarantees issued by the developed countries on a value per avoided ton of carbon emission that will be higher than the host country would otherwise be able to pay from its own resources

b) enabling developing countries to access global capital markets at lower interest rates and longer maturities, thanks to guarantees provided by highly-rated (AAA-AA) countries

c) establishing a multi-sovereign guarantee mechanism to speed up the transformation of low-carbon infrastructure projects in developing countries into a new asset class

The first section of the paper establishes the rationale for a system based on sovereign guarantees. The second section then sets out the key features of its proposed operational architecture. The third section concludes by explaining how immense reciprocal gains could be obtained, over the relatively short term, by participating countries deploying such an architecture.

1. A diagnosis and a strategy

Main findings

Scaling up low-carbon investments (LCIs) is only possible if it helps to respond to short term concerns, such as poverty, unemployment and financial instability, and reduces the gap between the propensity to save and the propensity to invest in infrastructure projects that is undermining the world economy.

• Globally speaking, the quantitative challenge is not unsurmountable. Up to 2035, the average annual global investment in the energy and transportation sectors required to meet a 2°C target is estimated at between USD 4.788 and 5.86 billion (a 36% increase on current levels) of which between 1,308 and 3,206 would be LCIs, of which between 453 and 1 069 would be incremental investments compared with baseline scenarios. Given the budgetary constraints on public funds, the private funds to be mobilised would be between USD 428 and 1 010 billion annually which equates to allocating between 3.2% and 9.1% of private capital revenues to LCIs. These figures are valid subject to the emergence of low-carbon assets to compensate for the loss in value of fossil fuel-based assets (section 1.1)

• The key challenge is a massive reallocation of world savings towards LCIs. This challenge can be met by simultaneously a) lowering the specific risks associated with LCIs generated by higher upfront costs and higher uncertainty about the costs and performances of technical options in a context of unstable oil prices and regulatory frameworks, b) changing the current distribution of capital flows by lowering country-related risks in developing countries where more than 60% of the LCIs should be made and where they suffer from costly access to financial markets c) overcoming the paradox of, on the one hand, complaints about difficult access to capital and, on the other, practitioners' observations of the lack of projects on offer, a paradox that stems from high transaction costs in non-stabilised institutional contexts (section 1.2.3)

• The environment of confidence necessary to trigger these changes cannot be created only by combining existing policy tools: a) in a high-risk context, carbon prices should be higher than commonly accepted in order to switch decisions towards low-carbon options and this would increase the political costs of the transfers needed to tackle their distributional impacts b) feed-in tariffs and long-term purchase agreements constitute risks to public budgets and c) in the absence of positive incentives, climate-related risk disclosure of financial portfolios will not necessarily lead asset managers to invest in LCIs (section 1.2.1)

• Sovereign guarantees are the main credible tool available for at-scale upfront de-risking of LCIs. Such guarantees maximise the efficiency of public funding and have historically underwritten other global technological transformations. They leverage more investment than public lending for a given budgetary cost because they are only paid out in the case of default. It will be difficult for MDBs, FDIs and national development banks to deliver such guarantees at the required scale because of their charters, their internal accounting rules and the fact that they require counter-indemnity by host governments (1.2.2).

• For the Common But Differentiated Responsibility Principle to be applied in practical terms, it is important that developed countries offer such sovereign guarantees to back LCIs in developing countries. For reasons of creditworthiness and economic efficiency, it is also critical that this offer be made in a coordinated manner by a collective of sovereign entities. To hedge against the fragmentation and arbitrariness of low-carbon initiatives, such coordination should involve common project assessment principles and calibration of guarantees for cross-border investment, all based on a common notional price for avoided GHG emissions (section 1.2.3).

• The Group of Initiatives for Climate Finance (GICF) strategy should offer an open access architecture, undifferentiated with respect to the type of risk covered in order to: give developing countries access to capital markets at lower cost and longer maturities, mobilise the financial community in search of safer assets, enabling a higher use of blended concessional loans by multilateral and national development banks, help the emergence of 'safe havens' for investors and of new business models for infrastructure, break the glass ceiling that works against small-scale projects by lowering their transaction costs and creating project pipelines, aggregated to reach a critical scale, through which cities and local communities can achieve their Sustainable Development Goals (section 1.3).

The key indicator of success will be the 'multiplying factor' between the total amount of public capital that appears on the liability side of public accounts, and the total volume of financial investment mobilised. This multiplier will be far higher than that associated with other forms of public support if the institutional architecture implemented maximises the credibility effect of joint pre-commitments by sovereign entities and minimises the sentiment of regulatory uncertainty.

Strategies for accelerated climate action cannot disregard political economy constraints on public finance. Any climate finance initiative calibrated to meet the under 2°C objective will likely have such pervasive and important implications (scale and nature of investments, macroeconomic equilibria, job reconversion) that it will be short-lived — unless it manages from the outset to quickly attract many of the *climate-resigned* policy-makers. Such policy makers who do not deny climate change, but, concerned by many other pressing issues such as unemployment, poverty, financial instability, public budget deficits or migration, tend to believe that it is untimely to accelerate climate action.

Climate finance, symbolic speechifying or tool for reconciling short-term and long-term objectives?

The argument that well-designed climate policies will entail only very small GDP losses, and may even yield small GDP gains in the long run, will fail to convince them, even though that argument is supported by a large body of economic literature[1]. They might indeed perceive climate action as a distraction, given the administrative and institutional mobilization necessary to design such *almost-zero-cost policies*, and the transition costs towards low-carbon growth pathways, which remain an under-researched issue[2].

The challenge for any strategy is thus to mobilize both climate pro-active and climate-resigned policy-makers through financial mechanisms that help to simultaneously address global warming challenges and reduce the structural fault lines of the world economy to deliver significant development benefits in the short and medium term. The acceleration of low-carbon investments can potentially reduce the 'gap between the propensity to save and the propensity to invest' (Summers 2016) and the preference of savers for liquid assets for short-term gains or real estate for long-term investment. This 'gap' undermines both the financial system and the 'real economy'. One of its practical consequences is the infrastructure funding gap pinpointed by the IMF and others (IMF 2014; Gurara et al. 2017). To provide at-scale and targeted response to climate and non-climate related issues, climate finance thus cannot remain a marginal component of financial policies.

1.1 Climate action and the infrastructure investment gap

Table 1 displays orders of magnitude of the annual investments needed over the period 2018-2035. The figures are derived from a set of six scenarios produced by four integrated assessment models, the OECD and the International Energy Agency[3]. Note that there is no investment 'gap' in all these

[1] This abundant literature is periodically summarized in IPCC reports: chapter 8 of the 2nd AR (1995), chapter 8 of the 3rd AR (2001), chapter 6 of the 4th AR and chapter 6 of the 5th AR.

[2] Symptomatically, while the 5th IPCC assessment report devotes very few pages to short-term economic issues in comparison to the previous reports, because of its focus on the 2nd target, Chapter 4 of the 5th report is entitled 'Mitigation and development pathways in the near- to mid-term', coordinated by F. Lecocq (France) and H. Winkler (South Africa).

[3] Just as this report was being completed, a World Bank study was published on 'How Countries can Afford the Infrastructure they Need while Protecting the Planet (M. Fay and J. Rozenberg 2019). We could not use it. The scope of this study differs from that of our own assessment (The World Bank report encompasses water and sanitation, flood protection and irrigation and emphasizes the differences

scenarios (baseline and low-carbon), that assume all the required production capacity and infrastructure to be built.

The mean value of the required global investment for the energy sector projected by these six scenarios would be USD 2.450 billion yearly on average between 2018 and 2035 to reach an under-2°C-compatible world. If the transportation sector and other types of infrastructure are included, the total infrastructure investment required would be far higher, with a mean value of USD 5 235 billion[4]. The role of transport is critical for mitigation, given its role in lowering emissions, with the difficulty that mobility demand and the penetration of low-carbon options depend upon many other parameters in addition to that of energy prices (e.g. land prices, urban policies, and industrial policies) that will be mobilized for reasons other than climate change *stricto sensu*.

TABLE 1. REQUIREMENTS FOR GLOBAL INVESTMENT IN 2°C SCENARIOS, 2015 TO 2035 ANNUAL AVERAGE (see details in Annex 1)

	Energy S&D			Transport	Total			Ratio to GDP		
10^{12} USD 2017	Min	Mean	Max		Min	Mean	Max	Min	Mean	Max
A. Total inv	2.0	<2.45	<3.10	2.78	4.79	<5.24	<5.89	3.6%	<4.4%	<5.1%
B. Increm. inv from BAU	0.17	<0.42	<0.79	0.28	0.45	<0.70	<1.07	0.3%	<0.6%	<0.9%
C. Low-carbon investment (LCI)	0.52	<1.27	<2.37	0.84	1.36	<2.11	<3.21	1.0%	<1.8%	<2.8%
D. LCI in developing countries (63% C)	0,33	<0,80	<1,49	0,53	0,86	<1,33	<2,02	0,6%	<1,1%	<1,8%
E. Proportion of private and public firms (50% D)	0.17	<0.40	<0.74	0.26	0.43	<0.66	<1.01	0.3%	<0.6%	<0.9%

[a] Minimum, average and maximum values are computed over 6 modelling scenarios. Detailed modelling results are in the Annex.
[b] The only available estimate is from the OECD. We assume that this estimate is added in a similar manner to all energy investment estimates.
[C] Low-carbon investment is the sum of incremental and reallocated investment.

between capital cost and maintenance cost, but gives less emphasis to the difference between incremental investment and redirected investments. Nevertheless, the report's figure for total infrastructure spending as a percentage of GDP is consistent with our estimates.

[4] These figures are consistent with other available best estimates, such as USD 6-7 trillion dollars annually in the period 2015-30 (in constant 2010 USD prices) in infrastructure investment, of which USD 2-3 trillion a year was expected to be required for developed countries and USD 3-4 trillion a year for low and middle-income developing countries, as quoted in Bhattacharya, A. J. Oppenheim and N. Stern (2016).

There is large uncertainty with respect to the mean values. Total investment in the energy sector ranges between USD 2 005 and 3 102 billion in the six scenarios and the uncertainty is far higher for specific techniques in different regions. Only one of the scenarios includes the transportation sector[5]. However, for lack of anything better, and in order not to forget that the volume of investment in transportation is higher than in the energy sector we systematically use hereafter the ranges of values of the sum of energy and transport investments. This indicator underestimates uncertainty but will help keep in sight a major source of problems for investors, which would be masked if we referred only to mean values.

Reallocated projected investments much higher than incremental investments

From an economy-wide perspective, what matters is the volume of incremental investment. However, this notion is not straightforward. It depends on whether the point of comparison is:

- ***the reference scenarios behind the mitigation scenarios in Table 1:*** in this case the incremental investments would amount to between USD 174 and 790 billion (mean value of 424) for the energy sector and between USD 453 and 1069 billion when transport infrastructure is added. The core issue is whether these higher investments will be funded through higher savings at the cost of lower consumption than in the baseline scenario or, at constant savings/consumption ratio, through a reallocation of savings. In the first hypothesis, the aggregate consumption would be between 0.22% and 1.04% lower to fund energy investment only, and between 0.39% and 1.18% once transportation infrastructure is included. Even though these numbers are not very high, the corresponding lower consumption, if not evenly distributed, could be detrimental enough for some members of the population to block the transition process from the outset. The alternative hypothesis is to reallocate between 0.39% and 1.18% of global gross capital formation (the percentage of gross capital formation being much higher than for consumption) under the baseline scenario to the energy sector, and between 1.27% and 3.8% if transportation infrastructure is included.

Incremental investments, cost or growth booster?

- ***current investment levels:*** in this case, incremental investment encompasses both the reduction in the infrastructure investment gap and the incremental costs of low-carbon options. Available scenarios cannot make this distinction since they do not consider any 'investment gap'. However, comparing their investment levels in 2015 to the mean value of these investments over the period 2016-2035 reveals an average required increase of 36%. This gives an order of magnitude of the short-term effort required. In macroeconomic terms, however, the key point is that these ***higher investments are not necessarily a cost since a proportion of them simply contributes to reducing the existing infrastructure investment gap***[6]. The reallocation to low-carbon infrastructure of a proportion

[5] A recent study by Ó Broin & Guivarch provides novel insights into the investment needs of the transportation sector. It finds that, by 2050, the investment required in the transportation sector to meet climate targets is lower than in the baseline scenarios. This is logical, since in the long term, a low-carbon scenario leads to changes in the spatial and productive structures that reduce the need for passenger and freight transport. In this study, however, we have maintained an increase in investment in transport over the next two decades, investment that is required to conduct these shifts.

[6] The reduction of this infrastructure investment gap is critical to making *existing infrastructure* more climate-resilient, in other words, to adaptation. The rising incidence of extreme global weather events, floods, and other losses around the world is making the retrofitting,

of the capital flows that currently go to the real-estate sector and to liquid financial products could indeed generate a higher, more sustainable growth path if not a new growth cycle. (Stern, 2015)

From a financial perspective, allocating more savings to infrastructure investment is only part of the challenge and the major challenge is the reallocation of investment within the infrastructure sectors.

Why private funding needed

Most low-carbon options are not 'end of pipe' investments. Replacing a fossil-based system requiring say USD 100 per unit of capacity with a renewable energy system requiring USD 110 implies an incremental investment of USD 10 only, but also a reallocation of the basic USD 100. Modellers rarely provide an assessment of these reallocated investment requirements in published papers because that is not the focus of those papers. However, digging into the data of modelling exercises shows that reallocated investment generally represents about three times the value of incremental investment in the energy sector, with a large uncertainty range of between two and four. The ratio depends on the economic growth rate underlying the baseline scenario and the degree of optimism about the costs of low-carbon options (the lower the incremental costs, the higher the relative weight of reallocated investment). Even less is known about the amount of redirected investment required for transportation infrastructure, but there are good reasons to think that the ratio of reallocated to incremental investment is higher[7]. Without intending to giving a false idea of precision, yet not underestimating the order of magnitude of the reallocation challenge, we henceforth use a ratio of two to one between the amount of reallocated and incremental investment required. This leads to a mean value of USD 1 272 billion of reallocated investments required in the energy sector alone, and about USD 2 108 billion when transportation is included.

In principle, the public sector has complete latitude to reallocate its investment and it will certainly fund part of the incremental investment for the low-carbon transition. However, given public budget constraints, it is unlikely to be able to cover these incremental costs alone. It is not very easy to assess what proportion of the funds will have to come from the mobilisation of private capital. In official statistics, the public sector represents about 25% of global investment, China excluded[8]. However, this proportion is far higher in infrastructure sectors and (Bhattacharya et al. 2016) consider that in the energy sector the proportion is two thirds. This figure in turn cannot be used because a) the separation

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redesign and climate-proofing of existing infrastructure increasingly essential. For example, sea-level rise is already affecting coastal cities, excess and intense rainfall is already damaging large swathes of roads, bridges, railways and coastal and inland water-management structures, and other big effects are being seen from rising temperatures. How much investment is required for climate-resilient infrastructure? The UNEP (2016) estimate of investment requirements for adaptation in developing countries is between USD 140 and 300 billion per year in 2030. A recent working paper from the OECD suggests that it could even equal low-carbon mitigation investment requirements, although options might exist for blending the two in the overall transition to a low-carbon economy. See Vallejo, L. and M. Mullan (2017), 'Climate-resilient infrastructure: Getting the policies right', *OECD Environment Working Papers*, No. 121, OECD Publishing, Paris, https://doi.org/10.1787/02f74d61-en. However, these figures confront the very difficult methodological problem of isolating a) specific investment to enhance climate resilience from the provision of basic infrastructure that is currently suffering from underinvestment (Gurara et al 2017) and b) what proportion of it is complementary to overall SDG-related investments can be a joint product of mitigation and SDGs policies. The most interesting insight of Rozenberg & Fay study is a first attempt to quantify the gap between the investment needed in a preferred scenario and the actual spending in 2011. They show very important gaps specially for Africa and Middle East.

[7] The role of end-of-pipe technique is lower in this sector than in the energy sector

[8]This 25% is derived from World Bank Statistics https://data.worldbank.org/indicator/NE.GDI.FPRV.ZS?locations=US that do not consider certain countries like China, where the public sector plays a large role. Moreover, the proportion of public funding in the infrastructure sector is higher than average.

between the private and public sectors depends on jurisdictions of each country and is constantly changing, and firms with predominantly public capital managed in similar ways to private firms, including the use of private funding b) the increasing constraints on the public sector in developing countries (Gurara et al. 2016) and c) the fact that in both the energy and transportation sectors demand-side options are mainly a matter for private investment.

> *Reallocating between 2,7% to 9% of yearly private capital revenue*

Let us assume, for lack of a better figure, that fifty percent of the required total investment in Table 1 comes from public funds. The total private funding required to cover both incremental and reallocated investment for energy and transport would be between USD 428 billion and USD 1 010 billion a year. How difficult is this challenge? One method is to compare it to the annual returns from the global financial markets. The global stock of private financial capital is currently about USD 386 trillion of which USD 100 trillion is in bonds[9], USD 60 trillion in equity, and USD 226 trillion in bank loans (World Bank 2018; Barkakaty et al. 2017). The long-term expected rate of return (interest plus increase in shareholder value) is approximately 3% annually on bonds, 5% on bank lending, and 7% on equity, leading to a weighted mean 'cost of capital' of 3.4% annually in real terms (5.4% annually in nominal terms)[10]. Using 3.4% as a lower bound and 5% as a higher bound (following Piketty, 2014) and making a conservative assumption that global financial capital grows at the same rate as global GDP, the estimated 'newly available' financial capital revenues would be in the order of between USD 16.8 and USD 25.4 trillion annually, far greater than the sums required. This conclusion would hold even if we used an unrealistic 25% proportion of public funding and a corresponding 75% proportion of private funding see Annex A.

The required reallocation of capital to the low-carbon economy is thus unconstrained by the scale of available financial capital and savings in global markets. Depending upon whether the annual expected return of 3.4% or 5% is assumed for private capital income, the low-carbon transition would imply an allocation of between 2,7% to 4% of this income for the low LCIs pathways and 6,4% and 9,4% for the high-income pathways. Sensitivity tests with low (40%) and high (70%) share of private investments see Table A.2 in Annex A show that even in the worst-case scenario, 9,1% of private income would suffice in funding all the needed LCIs. The qualitative insight, no global quantitative constraint; is thus robust. However, this is a critical point in the economics of the low-carbon transition, it is ***valid only if the emergence of profitable low-carbon assets is fast enough to compensate for a 38% loss in value, by 2035, of current fossil fuel assets*** (energy sector and indirect holdings in downstream uses such as

[9] https://www.sifma.org/wp-content/uploads/2016/10/US-Fact-Book-2017-SIFMA.pdf

[10] For forecast long-term equity and bond market returns, 2016-2026, see Christine Benz, 2018, Experts Forecast Long-Term Stock and Bond Returns, 2018 Edition, Morningstar. https://www.morningstar.com/articles/842900/experts-forecast-longterm-stock-and-bond-returns-2.html. Historical long-term returns in the recent past (2004-2014) averaged about 8.1% for the USA S&P 500 stock index, and 4.6% for US bonds. For an even longer period, 1928-2017, returns were about 9.6 percent for stocks and 3.4% for US bonds, see A. Damodaran, Stern, NYU. http://pages.stern.nyu.edu/~adamodar/

gasoline-fuelled cars) (Mercure et al. 2018). If the value of such 'stranded assets' and losses also has to be progressively written-off, then the proportion of additional investment going to low-carbon and non-fossil-fuel projects will be even higher.

Provided that low-carbon assets are generated, the challenge of reallocating private capital to low-carbon investments does not seem insurmountable at this level of aggregation. Globally the problem lies elsewhere, with the assessment and perception of risk, which is exacerbated when correcting the current disparity in international distribution of capital flows. Because the perception of risk is uneven, to the detriment of most developing countries, the current distribution of capital flows matches neither the geographical distribution of the investment required for sustainable development, nor the potential for the cheapest mitigation options.

A problem of distribution of capital flows

Globally, 60 percent or more of total investment requirements are in developing countries with large discrepancies in actual versus required investment between regions (Grubler et al. 2018, Bibas et al. 2016). The uncertainty about these discrepancies is higher than the uncertainty about the global aggregate. These discrepancies concern not only the total volume of investment but also the macroeconomic context of their financing. For example, the investment effort is easier in fast-developing East Asia where gross capital formation has represented 39% of GDP over the past ten years, than in South Asia, Latin America or Sub-Saharan Africa where this indicator represented 30%, 20% and 18% of GDP respectively. In these latter regions, there is both a requirement and an opportunity to increase their levels of gross capital formation, including inward reallocation of part of the savings that these countries' high-income households and institutional investors invest in OECD countries, which they perceive to be safer. A successful climate finance initiative will have to contribute to this reallocation, by, among other things, ***building 'safer havens' for all investors*** concerned about risks.

Ultimately, bridging the gap between the preference for lower-risk, short-term cash balances over higher-risk, longer-term low-emission assets, and correcting the geographical distribution of risk-averse capital flows, cannot be a frictionless exercise of moving amounts of money from one line of economic stakeholders' balance sheets to another. Instead these transitions will require specific mechanisms that encourage this shift in asset allocation by all the stakeholders in the global financial intermediation system, by infrastructure industries, and by public policy makers.

1.2. Why use sovereign guarantees as de-risking instruments?

1.2.1. The limits to carbon pricing and alternative policy tools

In 'pure economic theory' well targeted financial flows will automatically result from the response of industrial corporations, small and medium enterprises, farmers, cities, households or asset managers to sufficiently high carbon prices. Climate being a world public good ***this price should be universal in order to efficiently co-ordinate decentralized actions*** throughout the world (Tirole, 2012) This would avoid free-riding behaviour, undersupply of an action based on national objectives only and the costs incurred by the potential economic arbitrariness of policies only grounded in technical standards and public funding.

However, despite these compelling arguments, paragraph 136 of the Paris Agreement Decision while recognizing carbon prices as one of the important instruments of the Nationally Determined Contributions (NDCs), applies them only to non-party entities. This means that there will be no coordination of carbon prices under the UNFCCC and no prospect of a 'universal carbon price'. The reason is that the compensatory transfers[11], be they direct or embedded in fiscal system and tariff policy reforms, required to tackle the distributional issues raised by any increase in energy prices are intrinsically a matter of domestic policy (Combet et al. 2010, Böeters 2014) [12].

Carbon pricing constrained by distributional issues

At the international level, as soon as the Kyoto negotiations ended, the G77 countries were sceptical about the willingness of developed countries to grant them emissions allowances generous enough to compensate for the adverse effects of a universal carbon price (Hourcade, 1994). This scepticism was reinforced when Annex 1 countries blocked the Brazilian proposal for a compliance fund (1997) and when it was decided to finance the capacity building of developing countries through a share of the proceeds of the Clean Development Mechanism (CDM) and not of the international carbon market. The US withdrawal from the Kyoto Protocol in 2001 and the failure of a world carbon market to emerge confirmed the initial doubts.

Indeed, compensation for the adverse general equilibrium effects of higher carbon prices in developing economies is out of reach of conventional (philanthropic) overseas aid, partly because such compensation needs to be given to countries that are ineligible for overseas assistance. Moreover, it runs the risk of being used as a windfall profit and its magnitude is difficult to assess *ex-ante* because the economic consequences of higher energy prices are critically dependent upon the policies of the receiving countries (Hourcade et al., 2003, Waisman et al., 2013).

The gap between carbon prices that can actually be implemented and those required to switch decisions towards low-carbon options is thus likely to persist. It could even become higher, because the gap between the 70 and 120 USD/TCO_2 marginal cost[13] of avoided emissions in 2035 given by the last IPCC report, and the USD 50-100 (Stern-Stiglitz, 2017) by the Stern-Stiglitz report might underestimate the carbon price at which switching will occur. Indeed, in these assessments, technologies are selected in increasing order of their levelized energy costs, assuming their regular deployment with no unpleasant surprises up to the end of their lifetime. But, in a context of uncertainty about the duration and cost of their construction phase and about the regulatory framework, decision-makers with limited self-financing will refrain from adopting options with high

[11] In 2016, only 15% of global emissions were covered by carbon pricing, three-quarters of which had prices below 10 USD tCO_2^{-1} (World Bank, 2016).

[12] This alternative option is to differentiate them 'à la Lindahl' (Chichilnisky and Heal 2000; Sheeran 2006; Böhringer 2009; 2013), but this differentiated prices raise concerns about distortions of industrial competition.

[13] The recent IPCC reports on 1.5°C states that the marginal abatement costs for a 1.5°C target might be 3 to 4 times higher than for a 3°C target.

A carbon pricing gap higher than commonly envisaged

upfront costs (including transaction costs). Unpleasant surprises, primarily during the construction phase, put them at risk of exceeding an implicit 'danger line' beyond which they could be penalised by onerous debt servicing and a loss of lender confidence. This underpins households' demand for very short payback periods for energy efficiency investments as well as the cautious behaviour of firms concerned by bankruptcy or hostile takeover in case of a collapse in their stock-market value. Carbon prices capable of counterbalancing the risks of this danger line increase sharply with the proximity of the danger line (Hourcade et al. 2018).

Other contractual arrangements are possible, such as guaranteed feed-in tariffs and long-term power purchase agreements. However, such arrangements risk a loss of cost control, due to lobbying of governments and utilities, and of lack of consistency with other policy instruments (García-Álvarez et al. 2017; Bhattacharya et al. 2017; Lecuyer and Quirion 2013). A higher feed-in tariff that helps utilities to recover their costs ultimately passes the burden onto public budgets, which is a source of regulatory uncertainty.

Alternative tools: regulatory instability and the limits of purely reputational effects

Climate-related risk disclosure of financial portfolios (UNEP 2015) is another option, on the agenda of the G20 Green Finance Study Group and of the Financial Stability Board, to encourage asset managers to refrain from investing in potentially stranded carbon-intensive assets (Andersson et al. 2016). This voluntary disclosure depends on individual insurance behaviours (CISL 2015) (Schoenmaker and van Tilburg 2016). However, in the absence of adequate incentives, asset managers, even those interested in decarbonizing their investment portfolio, would not necessarily invest in low-carbon infrastructure, preferring instead to invest in less risky and more liquid assets. As to those with a vested interest in carbon-intensive technologies, disclosure of financial portfolios offers them no positive incentive to contribute to the low-carbon transition.

1.2.2. De-risking through public guarantees: DFIs limited by their charters and scope

Ultimately, the core problem is that the 'reward' of explicit carbon prices comes too late and is subject to the risk of political uncertainty. The one logical response is to 'reward' low-carbon investments up front in a way that is decoupled from public institutions' annual budgets and their volatility. This can be achieved through a public guarantee mechanism, a pre-commitment to pay in case of failure or incomplete success of the projects based on a given value, a notional price given to expected avoided emissions.

In principle MDB and DFIs could deliver such guarantees and some of them are evolving in this direction such as the World Bank (Launay, 2016) ADB, AfDB, the European Investment Bank and others, offering an increasing suite of guarantee products. However, although initially established to play a role in providing such guarantees, MDBs as currently structured cannot, by themselves, organize such a move at the required scale, and similarly nor can most DFIs. They currently offer some guarantees, often as subordinated liquidity facilities to cope with potential delays in payment from public institutions, and first loss facilities. In addition, MIGA provides political risk insurance, covering potential events such as currency restriction, war, civil disturbances, and expropriation of foreign direct investments. However, between 2004-2015, all major MDBs, including MIGA, approved a total of only USD 40 billion in project guarantees, representing only 4.4% of their total financing.

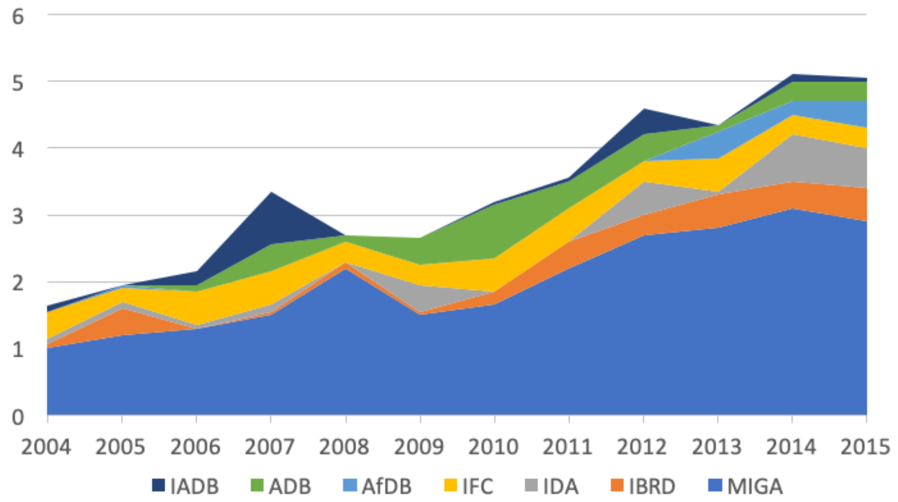
This prudence regarding public guarantees is rooted in the original charter establishing the IBRD (International Bank for Reconstruction Development) in 1945. The intention was that the World Bank would primarily extend loan guarantees to private financial institutions and commercial banks when they finance projects in developing countries, not that it would directly finance them, except in rare circumstances. The private financial sector was expected to be the main driver. However, faced with the circumspection of private financial institutions in the 1950s and 1960s, the World Bank decided to raise its own financing resources in financial bond markets, and to lend directly to projects in developing countries (including in today's developed markets, such as Japan). In 1983, it opened a B-loan programme in which commercial lenders could participate and in 1988 a programme for expanded co-financing arrangements, using partial risk guarantee operations, broadened in 1991 to commercial financing for private projects and further expanded in 1994.

But there was little use for these guarantees. First, they were ***conditional upon counter- indemnity by host governments*** guaranteeing repayment to MDBs if the guarantees were ever called upon by market participants. This meant that the guarantee liability was effectively passed on to the borrowing sovereign entity via the MDB. Second, the amount of the guarantee provided was counted at full face value in their country allocations of lendable funds — effectively providing no additional benefit to the country over a direct loan, while incurring additional costs — and only in 2008 was this lowered to 25% of face value. Reforms were re-initiated in 2013 to reduce these barriers.

Today, the Risk Capital Allocation of Guarantees continues to be treated as equivalent to loans. MDBs, by virtue of their charters and as assessed by the financial markets from which they borrow, are forced to include loan guarantees on a 1:1 basis in their internal accounts. They treat the risk exposure of a guarantee as 100%, the logic of such excessive risk-aversion being to maintain the MDB's AAA rating. For similar reasons, if a country chooses to use guarantees within the framework of the World Bank's country assistance strategy, they will be counted within that envelope up to 25% of the value of its portfolio (and limited to 20% of the total allowed lending envelope for any single IBRD country borrower), which is high cost for a guarantee. Use of guarantees under the soft-lending arm, IDA (International Development Association) grant conditions, are further restricted, for low-income countries: only partial risk guarantees are permitted, and not credit guarantees or policy-based guarantees.

In addition, the loan-to-capital ratio of MDBs is a conservative 25% (debt-equity ratio) to be compared to 14% for most private banks and financial institutions. MDBs must then put a higher price on capital than that from other sources. They also charge the same costs as loans (0.5% to 1% spread), depending on tenor, in addition to front-end fees (up to 1% of the amount guaranteed) and additional up-front commitment fees (0.5%-1%). For the borrower, these guarantee fees add to the fees and interest costs charged by the lending institutions. It therefore makes little sense for the client to use guarantees except in difficult circumstances unless the overall costs can be brought down. If we include in addition the cost of the indemnity provided by the borrowing sovereign entity (at least 1%), the cost of a guarantee from MDBs for the borrowing entity could be about 2-2.5% annually, a costly intermediation margin that comes in addition to the project's direct borrowing costs. It is therefore not surprising that guarantee instruments offered by MDBs/DFIs represent less than 4-5% of their total operations. In addition, there are also internal 'incentive-incompatibility' problems within MDBs/DFIs: management and staff incentives are heavily oriented towards direct lending because they bring much greater 'recognition' and direct client-engagement and are also more familiar to their boards and multiple shareholders.

FIGURE 3. Total Guarantee Commitments, Selected MDBs, 2004-15 (USD Billions)



Sources: Norton Rose Fulbright US LLP, Guarantees for investments in emerging markets, August 2016; World Bank Guarantees—Q&A, 2009, Finance & Guarantee Group/FEU; Kenneth Hanson, Anthony Molle, April 2016. World Bank Guarantees for Private Projects, Norton Rose Fulbright; Tomas Magnusson, 1999, Director and General Counsel, Swedish National Debt Office: Sovereign Financial Guarantees, Workshop on Management of a Debt Office, INCTAD, UNDP and UNITAR, Tblisi.

1.2.3. Sovereign guarantees needed to jointly unlock the supply of low-carbon projects and the availability of funds

Because of these limits on the use of public guarantees by MDBs and FDIs, these institutions cannot break the ***chicken and egg problem*** that limits both the supply of low-carbon projects and the supply of funds to support them. The current paradox is the co-existence of complaints about difficult access to capital and practitioners' observation of the lack of projects. This paradox comes from the systemic nature of the technical change implied by the low-carbon transition. None of the stakeholders in this transition – industry, project developers, banks or private capital – has the capacity to handle the uncertainty related to all the links in the decision-making chain. To help them to move simultaneously, an environment of trust is necessary in relation to low-carbon options, in order to lower not only their basic costs but also their transaction costs.

Creating an environment of trust: the responsibility of Sovereign entities

Only sovereign and sub-sovereign entities can create this environment of trust. They can do this by providing public guarantees, historically ones of the major forms of financial backing to projects that serve the public interest, but perceived as too risky because of their long duration and payback periods, high upfront capital costs, uncertainties due to immature technologies and public policy uncertainties, and scale and network requirements that deter individual project developers and their lenders. Sovereign backing is then crucial for building confidence to attract financial stakeholders, banks and insurance companies[14] when the borrower does not have strong financial backing and the type of project does not have a well-established track-record.

They offer an option for the benefitting lender to exit from the loan in the event that the project does not perform as expected, while not placing a large burden on the taxpayer. Indeed, they are only paid when called upon in case of default by the project beneficiary. They appear in the guarantor's books as contingent liabilities, so that a guarantee does not need to be recorded in the 'liability' column at 100% of its amount, but only at a conventionalised proportion, whose size depends on expected probabilities of default. From a fiscal cost-efficiency point of view, guarantees are inherently superior to direct public lending because they leverage much more investment from a given charge on the public budget, assuming that the same portfolio of projects financed either directly or through guarantees carries the same underlying risks of failure (see discussion below in Section 3) i.e. they do not lead to poor incentive behaviour by project sponsors and financial intermediaries. When funded properly out of a well-capitalized and managed fund, with explicit and transparent risk-management frameworks, they can be designed as 'self-extinguishing' funds and separated from annual budgets in terms of both funding and decision-making.

A guarantee is not an insurance

Note that although insurance, with which guarantees are often confused, also de-risks investment, it cannot do the same job. An insurance policy entitles the issuer to review a claim with respect to the interpretation of the cause of an event, while guarantees typically cover lenders or investors against payment defaults by a borrower and the payment is triggered automatically by default events specified *ex-ante*[15].

This is why Sovereign Guarantees have always been important in underwriting global transitions in technical systems throughout history (railways, electricity, telecommunications, and, in some respects, the worldwide web and information technology[16]). The low-carbon transformation is such a global transition, but of unprecedented urgency. It has one major difference to its historical precedents: it does not involve one specific technical

Managing a 'decentralisation' problem: the need for notional price to calibrate guarantees

[14] See also R. Gropp, C. Gruendl and A. Guettler, 2010. The Impact of Public Guarantees on Bank Risk-Taking: Evidence from a Natural Experiment, European Central Bank, Working Paper Series, Number 1272, December.

[15] UNDP, Public Guarantees.
http://www.undp.org/content/sdfinance/en/home/solutions/public-guarantees.html

[16] The development of the Internet required public support to networks in order to develop and agree upon basic protocols to permit coordinated inter-linking between different systems under development in the USA, the UK and France.

solution like railways, but the mobilization of a myriad of technical changes in multiple sectors and geographies to deliver a global public good, the mitigation of climate change. It thus ultimately raises a problem of decentralization. In the absence of universal carbon price, this problem of decentralisation can be solved by coordinating the issuance of guarantees trough common project assesment principles and the calibration of guarantees for cross-border investment carried out on the basis of a common notional price for the avoided GHG emissions. This notional price should express, as recommended by article 108 of the Paris Agreement decision, the *'social, economic, and environmental value of mitigation actions [and] their co-benefits to adaptation, health and sustainable development'.*

Ultimately this coordination is required for reasons of efficiency but also for reasons relating to the scale of the guaranteeing capacity and of creditworthiness since ***a collective of sovereign entities has the highest standing in global credit markets*** (hence, for example, the fact that MDBs are rated AAA).

1.3 De-risking low-carbon investments and the CBDR principle, a strategy:

Given their historical responsibility in the climate change process and their greater influence on the global financial system, developed countries have a specific responsibility to use their guaranteeing capacity to help ***developing countries switch towards a low-carbon development pathway*** and away from a carbon-intensive one.

Risk perception is systemic in nature and it is strategically important for the GICF to ***create not a new funding system for certain risks but an architecture providing open access to sovereign guarantees in all contexts.*** Based on this architecture, the concrete support cannot be the same for hydropower plants requiring an investment of several USD billion, photo-voltaic solar plants requiring several million, or a micro-grid in a remote village requiring only a few hundred thousand dollars. Nor can it be the same for more creditworthy countries with higher per capita incomes and therefore a greater capacity for self-financing and a lower reliance on traditional aid and for fragile states that have no direct access to finance. Beyond the specific risks of 'non bankability' of projects, the architecture encompasses those related to the credibility of countries' regulatory and legal systems. This explains why projects in some developing countries with higher return on equity than their OECD equivalents (after taking account of political risk insurance) fail to attract investors (Deau and Touati 2018).

The specifications of this open access architecture should thus be:

- ***Decrease the real and perceived risk of low-carbon investment in multiple contexts*** and ***hedge against the fragmentation and arbitrariness of low-carbon initiatives,*** via agreed SVMAs, common assessment procedures and pooling of financial partners in order to ***secure 'safe investment havens'*** that are robust to varying economic and political circumstances.

- ***Expand developing countries' access to global capital markets at lower cost and longer maturities*** through both AAA backing and assistance in improving the policy and regulatory environment of their Nationally Determined Contributions (NDCs*),* so as to enhance their assessment by credit-rating agencies,

- ***Mobilize the financial community that is seeking safer, sustainable and liquid assets*** to manage the massive amount of money in the savings held by households, sovereign wealth funds, pension funds and insurance companies. This concerns savers from developed countries as well as well as sovereign wealth funds in Africa, Asia and Latin America that invest in the OECD instead of in their own countries;

- Create the conditions for ***greater use of blended concessional loans by multilateral and national development banks*** and, thanks to the mobilization of private capital infrastructure that is bankable once de-risked, for ***better targeting of their support for difficult-to-market activities and public goods*** that are critical to basic needs;

- Strengthen project developers' incentives to help the ***emergence of new infrastructure business models;*** in new forms of joint venture between public authorities and private industrial and financial investors (Arezki et al, 2016); and using the high potential of replicability, standardization of terms, and pooling of a myriad of local projects to obtain economy of scale;

- ***Break the glass ceiling that works against small-scale projects*** in which transaction costs (legal procedures, costs of *ex-ante* design) often represent a higher proportion of total costs than for large projects and help create pipelines of such projects, sometimes aggregated to reach scale, through which cities and local communities can achieve their Sustainable Development Goals;

The key indicator of the GICF's success will be, subject to the compatibility of the selected projects with host countries' development goals, the 'multiplicative factor' from the sum of public capital that appears on the liability side of the public accounts, to the total quantity of financial investment mobilized. To keep it simple at this stage, before more in-depth scrutiny later, for every USD 100 of guarantee provided, the sovereign entity could be required, for its credibility in capital markets and with rating agencies, to put aside USD 20 in its public liability column as assured public capital, ready to pay the guarantee in case of project failure, given a pessimistic 20% failure rate. Because the guarantees never cover the entire size of investments, to encourage good project management, but a smaller proportion (say half) of total investments it could then help leverage USD 200. The multiplicative factor would thus be 10 times the size of the initial public capital (USD 20) set aside to provide sovereign guarantees.

In Section 3 we will see how to maximize this multiplicative factor by well-designed articulation between key interwoven parameters (credibility of the *ex-ante* assessment and of the MRV system, reduction of loan interest rates and project default rates). It is clear that the direct financing route used by aid agencies and MDBs currently achieves a 'multiplicative factor' of a much lower order of magnitude, usually 1.5 times, by blending their concessional direct lending with private sector financing. Things might change, but not to the required extent. The World Bank's recent 'Maximizing Finance for Development' (MFD) document[17] suggests mechanisms to go one step further, but mentions the term 'guarantee' only three times (no more than the more general term 'credit

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[17] World Bank, 2017. Maximizing Finance for Development: Leveraging the Private Sector for Growth and Sustainable Development, Paper to the Development Committee, Joint Ministerial Committee of the Boards of Governors of the Bank and the Fund for the Transfer of Real Resources to Developing Countries, September 19.

enhancement'), which underlies a recent (2018) USD 13 billion increase in paid-in capital and a USD 52.5 billion increase in callable capital, but whose multiplicative effect remains moderate and whose total impact on additional investments is likely to remain a small fraction of total requirements[18].

Another key constraint is that most concessional aid expenditure allocations to these agencies are incurred as annual or periodic multi-year commitments and disbursements of budgetary funding, meaning expansion comes only in the form of periodic capital injections. The constraints are tighter for bilateral government aid agencies: **a)** most funding is achieved through annual budgets **b)** programs are driven by multiple strategic and political objectives such as targeting aid allocations to specific areas and sectors **c)** their effectiveness is hampered by having to show that the spending is allocated to their own national institutions or companies, usually at higher cost than under more effective and open competitive bidding and procurement[19]. As a result, in many cases, the real leverage of such public capital on investments actually mobilized can even fall below 1.

Increasing the multiplicative factor of public support relative to current practices

This is the picture that must be dramatically changed. Only a large enough 'club' of governments can achieve this, through credible precommitments using the following message: *We, governments of …… recognize that avoiding carbon emissions is of social value. In order to encourage investment to achieve this value on a greater scale and at a faster pace, we will commit jointly provide investors and their financial partners with a guarantee equivalent to a proportion of the social value of mitigation actions undertaken by projects subject to otherwise normal standards of market assessment of their financial and economic viability.*

[18] In the press statement 'World Bank Group Shareholders Endorse Transformative Capital Package' (Press Release, April 21, 2018), this increase in paid-in capital and callable capital (as well as periodic multi-year replenishments of the International Development Association, IDA), was expected to scale-up the total annual financing capacity of the Bank Group to about USD 100 billion between 2019 and 2030, as compared with its financing of about USD 60 billion in 2016-2017 (of which direct lending of USD 40 billion was the main component), or an increase in annual financing capacity of about USD 40 billion over the next decade. The implied 'leveraging' of paid-in capital contributions by shareholders to increase the institution's lending capacity was thus about 3, ignoring the effects of continuing IDA replenishments (which contribute to about one-half of total lending capacity). The investment needs for the SDGs, including climate, by contrast, are estimated to be about USD 1.4 trillion annually for the low and lower middle-income countries, about one-half of which has to be met from enhanced private financing (G. Schimidt-Traub, 2015. Investment Needs to Achieve the Sustainable Development Goals, UNSDNS.

[19] The aid-effectiveness literature is extensive, and we are interested only in pointing to constraints on outcomes from the point of view of the effectiveness of fiscal expenditure with respect to global actions. For a balanced discussion, see S. Radelet, M. Clemens and R. Bhavnani, 2005, Aid and Growth, Finance and Development, September, IMF.

2. An Architecture for Public Guarantees

Main findings

The architecture proposed by a GICF must tread the narrow path between accelerating the number of proposals for LCIs and securing both their environmental integrity and their contribution to sustainable development, above all because risk-averse institutional investors will only inject massive funding into long-term low-carbon assets if the integrity of projects is as uncontroversial as possible

- The first pillar of this structure involves calibrating guarantees on notional carbon prices that express, as recommended by article 108 of the decision arising from the Paris Agreement, the "social, economic, and environmental value of mitigation actions" (SVMAs). The SVMA per ton of avoided carbon emissions used by the 'Northern' members of the GICF should be the present value, over the lifetime of a project, of an agreed global trajectory for the marginal costs of reaching a 2°C target, discounted at a given rate. This SVMA, in addition to hedging against the arbitrariness of project' selection, will recognise the value of long-term infrastructure investment because the growth in the marginal cost of carbon abatement over time counterbalances the penalisation of such investment by discount rates. Negotiating this discount rate and a carbon cost trajectory within the scenarios reported by the IPCC will be easier than the selection of carbon prices because SVMAs, instead of adversely affecting existing capital, open access to new financial facilities. The 'Southern' members of the GICF could calibrate their guarantees on domestic SVMAs that represent their willingness to pay for lower GHG emissions given the development benefits of mitigation activities (section 2.1.1)
- The second pillar involves securing the development contribution and the mitigation additionality of the system by (section 2.1.2)
    - ensuring that only projects that contribute to host countries' NDCs and allocate a minimum percentage of funds to high-priority basic needs are eligible for GICF facilities;
    - maximising the statistical environmental additionality of the portfolio of projects supported by the GICF by reducing the cost of the assessment process that penalises small-scale projects through a) standardising how information is presented, b) third-party auditing that uses modelling and expert-based data to determine the volume of avoided carbon emissions associated with given types of project in given geographical contexts and c) the use of an uncertainty discount factor on the expected value of avoided emissions;

- a transparent verification process in order to gradually improve the governance of the system and, ultimately, generate a new class of recognised Climate Remediation Assets (CRAs).

- The third pillar involves enhancing the creditworthiness of LCIs in host countries through a) the guarantors' AAA credit rating that will allow for lower spreads in bond markets or bank interest rates and increased maturity of loans and b) access to credible CRAs which, appearing on the asset side of their public accounts, will counterbalance what the credit rating agencies see as the negative impact of the increase in host countries' foreign debt (section 2.1.3)

- These three pillars would support a new form of 'where' flexibility (avoiding emissions where it is cheapest to do so) and turn the 'problems' of heterogeneity between countries into opportunities for cooperation. Cheaper abatement opportunities will be seized in host countries not through a universal carbon price that triggers adverse redistributive effects, but thanks to the higher creditworthiness of the guarantors and a higher valuation of the avoided emissions thanks to global SVMAs. A critical parameter is the discount rate used to compute SVMAs. The lower the rate, the higher the SVMAs, the guaranteed share of up-front capital, the spread with respect to market interest rates, the risk-weighted efficiency of mitigation options and the carbon price needed to secure their adoption (section 2.2)

- In addition to access to cheaper loans and lower risk-weighted profitability of LCIs, to the spill-over effects of investments and to improved access to basic needs, development benefits for fossil-fuel-importing host countries will come from the reduction in energy imports that, for a constant balance of trade, leads to higher economic activity through the so-called foreign trade multiplier and to easier balancing of public budgets (section 2.2.2)

- The fiscal revenues induced by way of additional exports are critical to balancing the risk provisions for the public accounts of guarantor countries. Historically, default rates of projects operated with guarantees are low but might rise if investment in less mature, more capital-intensive options was to accelerate. This risk can be controlled through (a) the 'uncertainty discount factor' applied to the SVMA per ton; (b) minimising political interference during the project selection process; (b) standardising the transaction process and possibly 'bundling' classes of projects into scaled-up proposals; (c) transforming the optional reporting recommended by the Taskforce on Climate-related Financial Disclosure (TCFD) into auditable mandatory reporting and implementing Project Rating Standardised Methodologies (PRSM) with due reassessment in respect of market information. (section 2.5.2)

- Credible pre-commitments are a powerful tool to make opportunistic exit very difficult and to attract capital markets to LCIs. Their institutional design is critical to maximising the multiplier effect. In a Distributed Guarantee Mechanism (DGM), each country decides what the contingency risks are and how much to set aside as dedicated funds on their books. In a Multilateral Sovereign Guarantee Mechanism (MSGM) the sovereign partners would provide the same initial capital i) half as 'paid-in' cash to this agency that will appear as an equity on the asset side of their books and ii) half as 'callable capital', registered on their books as a contingency liability to be paid on demand. The MSGM has three advantages when compared to the DGM: a) a higher multiplier effect, b) greater financial strength, increasing over time thanks to the interest on its accumulated capital that is the difference between paid-in capital received and pay-outs from its guarantee operations and c) the speed and automatic nature of payments in the case of default. (section 2.5.3)

- the MSGM will not be an intrusive institution but a fulcrum for cooperative behaviour between existing development stakeholders to progressively reduce the fragmentation of the development finance system. It could accommodate guaranteeing entities and project platforms, bundling small-scale projects in order to bring scale and degree of simplification to reduce transaction costs, to design standard contracts tailoring the risk profile of projects, to maximise the reduction of the spread and to establish complementarity with insurance mechanisms like MIGA. The emergence of regional/sectoral pooled assets, possibly formal 'climate remediation assets' (CRAs) with a pre-established face value per ton of avoided emissions (the SVMA), important for the creditworthiness of host countries and for all stakeholders, could be a strong incentive for good project management, (section 2.6)

Low-carbon investments face the same risks that apply to any long-term investment: **(a)** *commercial* (uncertainty about future markets, new competing technological and business models) **(b)** *regulatory and contractual* (modification of legal standards and contractual payment mechanisms), **(c)** *macroeconomic* (volatility of overall economic conditions, energy prices, exchange rates and debts) and **(d)** *political* (expropriation, commercial conflicts). In addition, however, they face specific commercial and creditworthiness risks related to: **(e)** higher up-front capital costs combined with uncertainty of less mature options during their construction stage **(f)** volatility of oil prices and uncertainty about carbon prices **(g)** frequent scaling risks and **(h)** high transaction costs amplified by the limited past performance history of such projects.

An almost infinite number of financing structures can help project developers to deal with these risks. They combine, in varying proportions: **(a)** self-financing or equity by the project leader who is the primary risk-taker and by foreign or venture capital partners; **(b)** 'mezzanine' or subordinate debt, convertible into equity; **(c)** standard loans in local or foreign currencies granted by local or foreign financial institutions, on a relatively short time-horizon but with implicit roll-over provisions to extend their term; and **(d)** long-term bond issuance on international financial markets by larger financial entities. Relationship-based international banking and domestic banking sources also can provide effective risk financing, but the interest costs they charge is inversely correlated with the creditworthiness of borrowers. Long maturity loans are typically provided by the banking system and some blended long-term finance is available from national or international development banks. If the project leader is a State or has sufficient international creditworthiness, it can also tap into domestic or international long-term bond markets.

For high-profile, large-scale projects these combinations are sometimes backed by guarantees offered by States or Development Banks to minimize *ex-ante* the risk of failure, especially public regulatory and contractual failure, that are often sticking points to negotiation in the case of long-term investment. Creditworthiness and commercial risks may also be covered by partial credit risk guarantee or credit enhancement offered by States and Development Banks but are again difficult to obtain. Very limited foreign exchange and macroeconomic risk insurance can also be obtained in the financial markets but are again typically costly or simply unavailable. There are, in addition to these options to deal with *ex-ante* risks, a few multilateral sources such as MIGA, and private risk agencies that provide insurance against political risks, which can be activated *ex-post*, but do not address the other basic risks. The only option existing to deal with the specific risks of low-carbon investments is greater access to longer-term borrowing by exceptionally well-placed, creditworthy borrowers in global 'Green' bond markets.

In short, the risks and costs facing low-carbon projects in most developing countries deter a lot of investment, except for a very few types of scalable investment in particular sectors and countries.[20] This is why, risk being ultimately systemic in nature, the GICF ***must propose an open access architecture, undifferentiated as regards to the type of risk covered*** and backing a decentralized learning process that capitalizes on all financing and insurance experience.

2.1. Three pillars to jointly de-risk, scale-up and certify low-carbon investments

Such an architecture must help to find ***a positive way out of the contradiction between*** **a)** ***accelerating low-carbon project proposals*** and facilitating the task of project developers especially their transactions with public authorities and credit-providers; and **b)** ***securing the environmental integrity*** of the investments together with the ***efficacy of their contribution to development***. This contradiction can be overcome because ***institutional investors*** are risk-adverse (they have to be, by their very nature, as in the case of pension and insurance funds who can only invest significantly in investment-grade rated financing) and they ***will invest massively in long-term low-carbon assets only if the investments are low-risk and liquid*** (liquidity means low spread between 'bid' and 'ask' rates in any transaction and the existence of secondary markets to allow exit transactions at low cost) which ***implies that the financial integrity of projects should be as uncontroversial as possible***. In the same way, unleashing low-carbon initiatives requires a ***business environment with low transaction costs*** and as immune as possible to administrative and political arbitrariness.

Credibility and trust are the key words here and the three pillars of our proposed architecture aim basically at **(a)** ***preventing adverse selection*** (guarantees should avoid incentives to lenders to select projects that have a significant probability of default), typically by covering only a part of total loans, the lower the better, but not below certain levels that might fail to attract any takers; **(b)** ***avoiding moral hazard*** (project selection criteria do not lead to lax repayment behaviour) typically by covering only a part of project costs, maintaining strict screening criteria and charging for such guarantees; **(c)**

[20] For example, China has become by far the world's largest player in clean energy investment, especially wind and solar energy projects. Globally, renewable solar and wind energy is one of the few sectors that has benefited from greater familiarity with the technologies and falling prices and costs, leading to its growing pre-eminence across all climate mitigation strategies in recent years.

securing the payment of guarantees through an adequate capitalization of the funds operating them including contingency reserves in case of an unanticipated rise in losses; a well-run public guarantee operation will keep calls on the funds guaranteed to below 5-6 percent of the outstanding guarantee amounts, with prompt remedial action if this figure starts to rise; and **(d)** ***securing transparent governance*** that is free from political interference, and is based on close knowledge of sectors, technologies, countries and financial institutions.

2.1.1. Calibrating public guarantees on agreed SVMs and SVMAs:

SVMs, a surrogate for carbon prices to secure economic efficiency

The SVMAs used to calibrate the guarantees provided by 'Northern' members of the GICF to low-carbon investments in the South operate as a surrogate to carbon prices **a)** to secure the overall economic efficiency of their support to mitigation projects and **b)** minimize, at low transaction costs, the influence of political arbitrariness on project selection. In practice, they have to be derived from ***trajectories of Social Values of Mitigation*** (SVM) that aggregate the benefits attached, at each point in time, to reducing climate change impact with the development of co-benefits of mitigation activities. These trajectories can be capitalized upon at two levels:

- ***At the country level,*** they aggregate the country's willingness to pay for lower GHG emissions and its assessment of the development co-benefits of mitigation activities. For example, (Shukla, 2015) gives an SVM trajectory for India where mitigation objectives are aligned with development objectives such as reduced air pollution, energy security, and urban transport. This value amounts to USD 20 in 2020 reaching USD 70 in 2040 whereas the carbon prices judged applicable in this country would be only USD 3 in 2020 and USD 18 in 2040 in 2040[21].

- ***At the world level***, the SVM trajectory reflects the value attached by the international community to protecting the climate as a public good and to producing other joint public goods like the reduction of forced migration and global security (Stern 2006). It is possible to frame the negotiation of the climate component using a fairly solid scientific basis such as the low and high bounds of the maximum likelihood space of the 900 trajectories of the shadow prices required to meet a 2°C target given by the IPCC's 5th AR. There is no such comprehensive, IPCC-reviewed basis for the money-metric assessment of co-benefits and we suggest leaving these out when fixing the global SVM, at least during the initial phase, to avoid endless controversies. It can actually be argued that these co-benefits will be implicitly internalized as one of the decision parameters of countries joining the GICF.

SVMs negotiated within scientifically based corridors of values

[21] These orders of magnitude should be interpreted considering the marginal utilities of income. For example, utilizing the per capita incomes at purchasing power parity given by the World Bank Atlas and a logarithmic utility function of income, USD3 / tCO_2 in India corresponds to USD70 / tCO_2 in France.

TABLE 2: TEMPORAL TRAJECTORIES OF SVMS (IN 2016 USD/TCO_2)

Year	World SVMA (opt)	World SVMA (pess)	Indian SVMA
2020	39	66	22
2030	68	154	55
2050	154	286	116
2100	1078	2530	-

For reasons of economic rationale, the guarantee given to a project *ex-ante* will depend on the volume of emissions it avoids yearly and over its lifetime. A piece of equipment avoiding one ton of emissions over a five-year period will deliver less 'social value' than a piece of infrastructure with a 50-year lifetime. Per ton of avoided emissions, the guarantee should then be the present value of a given SVM trajectory for the lifetime of the project. Denoting this $SVMA_L$ for the Social Value of a Mitigation Activity with a lifetime of L years and r denoting the public discount rate, the amount guaranteed per ton is written: $SVMA_L = \frac{1}{L} * \sum_{i=0}^{L} \frac{SVM_{2020+i}}{1+r)^i}$.

For example, Table 3 gives $SVMA_L$ for four project lifetimes with the world values derived from the trajectories of world SVM given in Table 2 with discount rates of 3% and 5%. Given that 3% is approximately the world growth rate in the underlying scenarios, these discount rates correspond respectively to pure time preferences equal to almost zero (Stern 2007) or 2%, the value more generally used value. For India, we used a 7% discount rate (5% long-term growth rate and 2% pure time preference).

TABLE 3: FROM THE SVMS TO THE SVMA PER TON FOR PROJECT LIFETIME T IN USD 2017

	World SVM				Indian SVM
	Technologically pessimistic pathway		Technologically optimistic pathway		
Discount rate	5%	3%	5%	3%	7%
$SVMA_{T=10}$	73.5	79.1	36.7	39.2	10.5
$SVMA_{T=20}$	75.8	86.1	36.5	41.3	7.4
$SVMA_{T=30}$	72.3	86.1	35.6	42.5	5.1
$SVMA_{T=40}$	68.8	85	34.3	43.5	

The first important information from this table is that the calibration of the guarantees on the *SVMs* allows, by construct, ***the value of long term infrastructure investments to be recognised.*** The growth of the SVM over time indeed counterbalances the adverse effects of the discount rate on long-lived projects. As the project lasts longer, more tons of carbon are abated, and the $SVMA_L$ increases if the discount rate is lower (or decreases if it is higher) than the rate of increase of the *SVM*. In both the optimistic and pessimistic pathways, the world $SVMA_{50}$ is higher than $SVMA_{10}$ with a 3% discount rate whereas it is only 7% lower with a 5% discount rate.

Ending the curse of discounting on long term projects

The second important piece of information is the significance of the gap between the global and Indian $SVMA_L$. The longer-lived the project, the greater the gap. This gap stems from the fact that the Indian SVM trajectory is logically lower than its global equivalent combined with a higher public discount rate. This confirms that, using its own capacities alone, the Indian government cannot fund low-carbon investments at a level and with a structure (percentage of long-lived projects) consistent with the objectives of the global community.

The third important piece of information is that differences in discount rates matter less, for a given value of the SVM, than the degree of technological optimism. This confirms that the disputes about the choice of discount rate (from Stiglitz et al. 1995, versus Nordhaus 2006 and Manne 1992 to Stern 2006 versus Weitzman 2007) should not be overplayed in a cost-efficiency framework where emissions budgets, ceilings on the atmospheric concentration of GHGs or temperature targets are set (Ambrosi et al. 2003). Reducing the corridors of the SVM is then a more efficient way of framing the negotiations. At the global level, this is possible by mandating a group of Integrated Model specialists to exclude those scenarios whose purpose was purely normative or heuristic and that explore extreme cases with no ambition of achieving realism. At the national level this is possible by mobilizing 'state of the art' modelling of interfaces between energy, technical change and development that is more advanced than is generally thought, as demonstrated by the Deep Decarbonization Pathways Project (DDPP) program.

The logical remaining question is whether negotiations about SVM_s would be more likely to be successful than attempts to coordinate world mitigation efforts through a universal carbon price. The response is positive because an *SVM* does not directly penalise existing capital stock and does not require an adversarial negotiation exercise around the sharing of the remains of a carbon budget. Instead, it is one element of a cooperative exercise to reorient future capital stocks, to facilitate access to new financial facilities and, as we will see later, to turn the obstacle of between-country heterogeneity into an opportunity for reciprocal gains.

2.1.2. Securing projects' development contribution and mitigation additionality

The benefit of sovereign guarantees could be lost, if, because of lower costs to public budgets per unit of induced investment, the system leads to lax project selection and is a source of windfall profits, with cheaper loans for many projects that would have been carried out anyway, thus providing neither additional development benefit nor additional emissions reductions.

This is ***the 'Gordian Knot' of development finance*** and carbon saving offers a potentially powerful tool to untie it by providing ***a clear metric*** that calibrates the percentage of guarantees to be given, ***uncertainty in tons of avoided emissions and SVMs.*** To avoid this metric generating a climate-centred bias to the detriment of other dimensions of sustainable development, a simple solution is:

(i) ***to restrict eligibility*** for GICF-supported facilities to projects contributing to host countries' NDCs. The NDCs would act as a filter preventing the funding of environmentally efficient projects that do not match the host country's development priorities;

(ii) ***to dedicate a minimum percentage of funds to priorities*** agreed within the GICF (e.g. basic needs or transportation infrastructure) to avoid financial assistance being over-focused on certain sectors with a concomitant loss of learning opportunities from activities critical in the long term for aligning development and climate objectives.

The efficient delivery of additional avoided emissions will depend critically on both the rigour and the cost of the MRV process. The experience of the Clean Development Mechanism (CDM), the largest carbon offset mechanism in the world (over 7 000 projects), has helped the emergence of an impressive expertise (and operational data) in the assessment of low-carbon projects. This experience has confirmed that transaction costs (project design, assessment of avoided emissions, UNFCCC registration fees and cost of the monitoring system) can represent a high proportion of total costs in small projects, with the risk of crowding them out (Shishlov and Bellassen 2012). It also shows that the proof of the additionality of the project often represents the first category of upfront transaction costs (Guigon et al. 2009) and impedes projects in sectors where the additionality is difficult to demonstrate (e.g. transportation or forestry).

A paradigm shift is needed. Since ***triggering a wave of investments at scale in all sectors*** is unattainable using a project-based approach, the GICF should aim to maximize the ***statistical environmental additionality*** of the project portfolio it supports in a context of ***imprecise knowledge of the performance of each project***. Funding twenty projects, with the risk that one of them would have been launched anyway is preferable to funding only two projects with uncontroversial additionality.

From project-based to statistical additionality; a paradigm shift

Accurate project-based allocation of certified emissions reductions (CER) was needed in the CDM because the CER were to be sold on a carbon market. In a system aiming to maximize the statistical additionality of emissions avoidance, the trade-off is between the risk of freezing investments with too strict MRV procedures and the risk of supporting many projects with no additional emissions reductions. This trade-off can be operated at far lower cost than in the CDM through the production of standardised information, consistent with the IPCC guidelines, third-party audits and the mobilisation of scientific modelling and expert-based data to provide guidelines for determining:

Third Party Auditing informed by two scientifically-based safeguards

- ***the upper and lower bounds of the avoided carbon emissions*** associated with a given type of project (hydropower, solar or wind power plants, transport infrastructure, building insulation, etc.) in a given country and/or region for various growth scenarios and oil prices.

These bounds can be provided, under the authority of an independent scientific body, by mobilising available global and national models whose results are published in peer-reviewed literature and synthesized in IPCC reports. These bounds might not be immediately available at the desired level of granularity (technologies, countries and regions) but they can be improved over time, including by capitalizing on expert-based data in a transparent manner. Their role is to frame the work of the Third-Party Expert body that will use complementary sector-specific and local analysis to fix the quantity of emissions expected to be avoided.

- ***An uncertainty discount factor on the expected present value of avoided emissions as a function of uncertainty revealed by scientific analysis***. Let A(t) be the CO_2 abatement yielded by the project at each point in time, t_0 the launch date of the project, N the project life-time, i the discount rate and SVM(t) the social value of avoided emissions at time t, the present value of the CO_2 abatement is $SVMA = \sum_{t_0}^{t_0+N} \frac{A(t).SVM(t)}{(1+i)^t}$. The amount guaranteed should only cover a portion of this value, $\alpha.SVMA$ where **α** captures the uncertainty over the performance of a given type of project in a given country or region. Typically this will lead to lower support for projects with lower 'measurability' of their avoided emissions (transport infrastructure for example). However, even when discounted, the SVMA will help some of them to cross an economic viability threshold, all the more so because they have a long term mitigation effect and a high SVMA (see above).

The overall rationale is to launch a ***collective learning process*** with ***revisions of the assessment parameters*** every three years, thanks to feedback from experience and to progress in the modelling assessments of SVMs in order to adapt the system to changes in the economic and policy contexts. To stabilize the decision-makers' business environment, these revisions must be adopted without retroactive effect on projects that have already been adopted. The boundaries of expected avoided emissions will be part of this revision process but, ***the uncertainty discount factor α is the most critical control parameter***. If it increases it will indeed allow more projects to be fostered (and vice-versa) if it appears that it was set at too low (or high) a level in the first place.

The quality of the ***ex-post verification process*** is also critical to good political governance of the system by the GICF. One major hedge against mismanagement of the project is to ensure that a significant proportion of capital costs (say 40 to 70 percent) are funded by private entrepreneurs in the form of equity or by the public funds of the host countries so that they remain the primary risk-taker. But this concerns the overall profitability of the project, not its environmental contribution. In the launch phase, the cancellation of the guarantees being the only possible penalty in case of fraud, the *ex-post* verification of the completion of the projects and of their environmental efficiency will be useful to provide information about the degree to which projects actually come to fruition and will ***allow the collection and archiving of all data necessary*** to check, with a view to improving the quality of the *ex-ante* assessment of future projects, the gap between the project description and its implementation in terms of anthropogenic GHG emissions and development dividend. This would allow for gradual improvement in the governance of the system and the behaviours of both host countries and private investors who are sensitive to effects on their reputation.

Things will and should differ if the ambition is to generate a new class of long-term asset, be they informal or formally certified. Section 2.5.3. discusses why such Climate Remediation Assets (CRAs) might have a critical macroeconomic role, offsetting the consequences of the devaluation of stranded carbon-intensive assets in all countries and maintaining the creditworthiness of host countries despite the increase in their foreign debt. What matters at the microeconomic level is that their issuance, conditional upon the result of the *ex-post* MRV process, will provide a powerful positive incentive both for good strategic selection and good project management. This would demand accredited auditors, paid out of a share of the proceeds levied on all projects and not directly paid by the verified entity to avoid any potential conflict of interest arising from auditors being complaisant with their clients (Cormier and Bellassen 2012).

2.1.3. Enhancement of creditworthiness and access to low interest loans

The third pillar for accelerating the supply of projects is to organize access for developing countries that are members of the GICF to better loan terms and conditions and to overcome the obstacle of a low creditworthiness of the host country.

The basic parameter is that private investors are naturally risk-averse and, to avoid exceeding their risk-bearing capacity, 'ration' their supply of finance (Stiglitz & Weiss 1981). First, they can charge higher interest rates for projects they perceive to be risky in an overall context of country risk (Dadush, Dasgupta and Ratha, 2000), second, they can reduce the term of their loan (lower maturity) and third, they can refuse to finance projects below a certain credit rating threshold. Typically, anything rated lower than investment-grade (or 'BBB' in common credit parlance) is judged 'junk' or 'highly speculative'. These ratings, a measure of underlying credit default risk, are typically determined by global credit–rating agencies or in-house risk managers within financial institutions based on both the overall country risk-rating for the host sovereign entity, and the risk ratings for specific projects and their sponsor (always rated riskier than the overall host country risk-rating).

We will discuss later, in Section 2.5.2. the critical link between the project default rate and the leverage effect of public funds on private capital and the volume of projects funded. What matters here is the improvement in the country component of the risk perception. Developing countries have a highly skewed distribution of GDP and credit ratings (see Figure 1). Seven large emerging economies account for some 60% of developing country GDP (and GHG emissions), and the majority of these seven countries have investment grade ratings. The next fourteen middle-sized economies account for roughly 30% of developing country GDP and have, on average, speculative credit rating. The remaining 60+ countries are very small economies, mostly rated as highly speculative or unrated.

If sovereign governments with very high credit standing in global markets (AAA or AA) back these projects under the qualifying criteria already laid out in developing countries (eligibility thanks to their contribution to NDCs, domestic risk guarantees) this would sharply, as depicted in Figure 2[22], shift the distribution of low-carbon project assets leftwards to improved effective credit ratings for the projects. Together with this leftward shift a new class of more secure assets should emerge. In principle, the reduction of the credit spread above Libor (interbank interest rate) or benchmark risk-free assets is

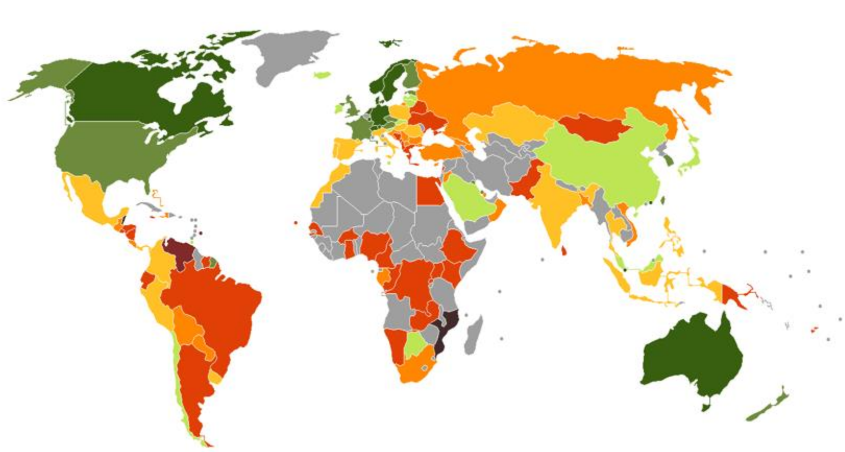
[22] The methodology for calculating the improvement in 'risk-ratings' of standard loans or bonds when combined with guarantees is more complicated, because it depends on how the terms are specified. But the broader principle of 'pooling' risks remains. In general, institutional investors in bond markets may limit the improvement in possible risk ratings of any project or bond to a maximum of 3 'notches' after pooling with guarantees, which means that only projects that were BB- or above before guarantees can become eligible to move into investment grade category. Banks are less constrained, because they use their own internal risk ratings. For more details on calculating the effects for bond markets of a bond with guarantees in the case of Ghana, see Vincent Launay, 2016, Pricing partially guaranteed bonds: valuation of bonds benefiting from a World Bank partial guarantee, Financial Solutions Occasional Paper 0001/16, World Bank, Washington DC.

independent of credit market conditions prevailing in global markets, but this is often not the case: impacts are also influenced by periodic cycles of risk-taking or risk-aversion in global markets. Abstracting from this, the largest emerging economies with investment grade ratings could, for example, benefit from guarantees by cuts in their spreads in bond markets or bank interest rates by about 100 basis points, and from longer maturities extended to 12-18 years, instead of the current 3-5 years (which has an equivalency in terms of interest rate reduction). These gains should be even larger for the next category of middle-sized GDP countries, for example, reducing their spreads by 150 to 200 basis points, and taking unrated projects into the investment grade category when combined with guarantees. The 60+ smaller countries could benefit from an even greater reduction of spreads, some 300 basis points. These illustrative gains are consistent with the 50-500 basis point reduction in interest rates and the 5-15-year lengthened access to long maturity financing observed in a sample of seven projects in various countries thanks to partial credit guarantees issued by development banks[23].

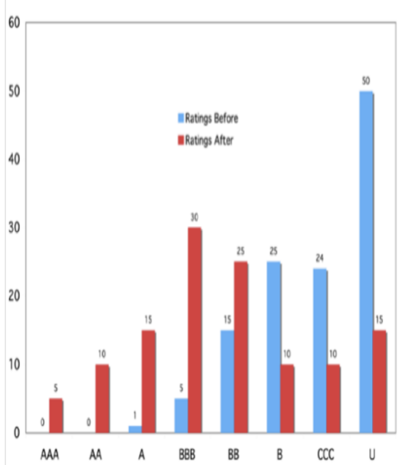
But this reduction of spread is not automatic because financial institutions may continue to apply higher spreads even with guarantees, and these might provide them with an opportunity of windfall profits. It is thus critical that the GICF equips itself with the means to introduce competition, innovative pooling, MDB engagement, moral persuasion and discussion, including with global credit rating agencies. There are also possibilities of greater country risk as more debt is carried by countries when they borrow to finance larger numbers of low-carbon projects, even with guarantees. Discussions are also therefore required on how higher external debt caused by larger borrowings for climate projects in the context of the GICF is compensated for by the creation of 'safer' new global asset classes. All this refers to enabling institutional conditions, to which we return later (Section 3).

[23] James Winpenny, Guarantees and Risk Mitigation Instruments, OECD. https://www.oecd.org/investment/investmentfordevelopment/39774419.pdf

FIGURE 4 Lowering Risk – Illustrative Effects of Sovereign Guarantees on Credit Ratings of Low-Carbon Projects



Countries by Standard & Poor's Foreign Rating (September 2017)



AAA	AA	A	BBB	BB	B	CCC	CC/D

2.2 Towards a sustainable form of 'where flexibility'

Since the 1990s, 'when and where flexibility' has been the watchword in climate economics (Manne, Richels, 1990) to equate the marginal costs of emission control across time and geographies. The 'when flexibility' relates to the timing of action (Wigley et al. 1996 versus Ha-Duong et al. 1997), and the 'where flexibility' relates to the efficiency gains of avoiding emissions where it is cheapest to do so (Manne and Richels). The implementation failure of 'where flexibility' based on a universal carbon price is due to its climate-centred bias that disregards the overall development benefits and costs, including the adverse redistributive effects of explicit carbon prices. This should not lead us to forget that minimizing the costs of climate policies is critical to securing political acceptance for their scaling up across geographies. (Hourcade and Shukla, 2000).

he architecture we have just described allows a 'where flexibility' that turns the heterogeneity of countries into opportunities for new forms of cooperation instead of being an obstacle to the deployment of climate policies as in the case of a universal carbon price. ***If developed countries are consistent in the value they attach to meeting the 2°C target,*** it is in their interest to provide guarantees to projects throughout the world that contribute to this aim at the lowest abatement costs. They have two tools for doing this, ***global SVMAs higher than in developing countries, and higher creditworthiness that can facilitate access to lower-cost loans***.

Let us then unscramble the basic mechanisms through which the SVMAs, carbon prices and enhanced creditworthiness can deliver this new form of 'where' flexibility and introduce, through a highly stylised case study, the institutional discussion about how to avoid the same implementation gap that characterized the conventional '*when' flexibility* approach.

2.2.1. The basic mechanisms: de-risking and switching carbon prices

Awarding public guarantees for mitigation projects in proportion to their SVMA allows their Weighted Average Capital Cost (WACC) to be decreased. Public guarantees provide access to bank loans or funds from global capital markets at interest rates lower than those that would be charged in their absence. Their lower bound is the discount rate charged by the Central Banks of the guaranteeing countries (they are lenders in the last resort) which is the discount rate used to compute the SVMA. The level of this discount rate is thus critical. The lower it is, the higher the SVMAs, the guaranteed percentage of up-front capital and the relationship of spreads to market interest rates.

One major consequence of increasing the risk-weighted profitability of mitigation options is to lower the explicit carbon price needed to secure their adoption (Steckel et. al, 2018). Let us illustrate this considering two electricity generation projects: a coal plant with carbon capture and storage (CCS) and a solar electricity project. All the up-front capital is borrowed on private capital markets at interest rates of 8% or 15% in a low- and high-risk business environment respectively.

Value of the SVMA, weighted average capital costs and switching carbon prices

Taking the SVMAs discount rate as the interest rate on the guaranteed percentage of the up-front capital we can compute, for each level of this percentage, the explicit carbon price that switches the decision in favour of the low-emission project. They are reported by the upward sloping isocurves in panels a) and b) of Figure 5 for the two risk contexts. When there is no public guarantee, the explicit carbon price is USD 38/tCO_2 and USD 108/tCO_2 in the low- and high-risk cases respectively, levels that are politically unattainable at short notice in many developing countries. In the same figure the downward sloping curves indicate the greatest percentage of up-front capital that can be covered as a function of the level of the SVMA discount rate. A discount rate lower than 3% gives an SVMA that covers all the up-front capital. ***The lower the SVMA discount rate, the higher the percentage of public guarantee, and the lower the required explicit carbon price for switching decisions*** towards the low-carbon option.

Despite a politically acceptable carbon price of 20 USD /TCO_2 in a developing country, switching towards the low-carbon option in the low-risk case would be possible assuming a public guarantee of 45% of investment expenditure with a 3% discount rate to the global SVMA and 52% for a 5% discount rate. These figures become, in the high-risk case, 78% of investment should be guaranteed with a 3% discount rate and 82% with a 4% discount rate.

FIGURE 5: Iso-Curves Of The Explicit Carbon Price For A Mitigation Project In India In Two Risk Contexts

Risk context: 15% interest rate on loans **Risk context: 8% interest rate on loans**

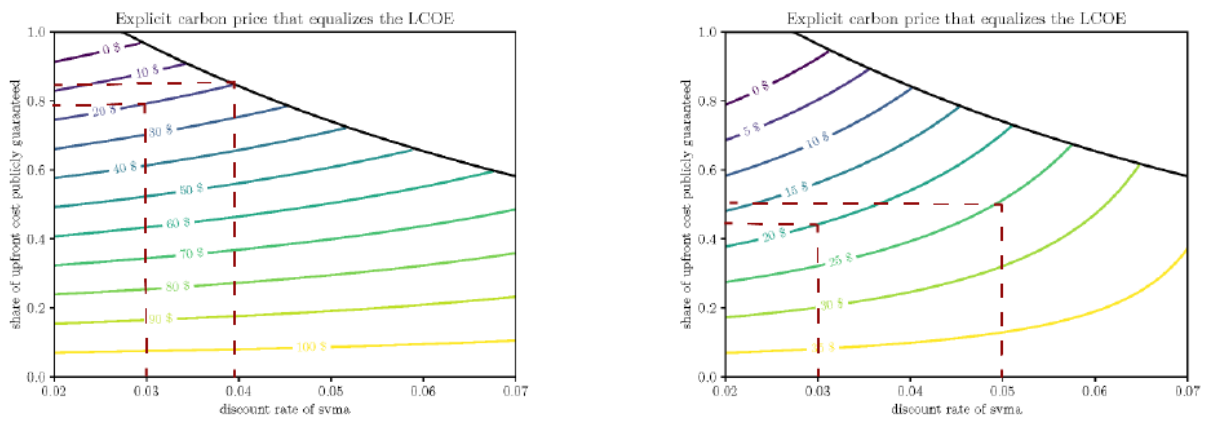
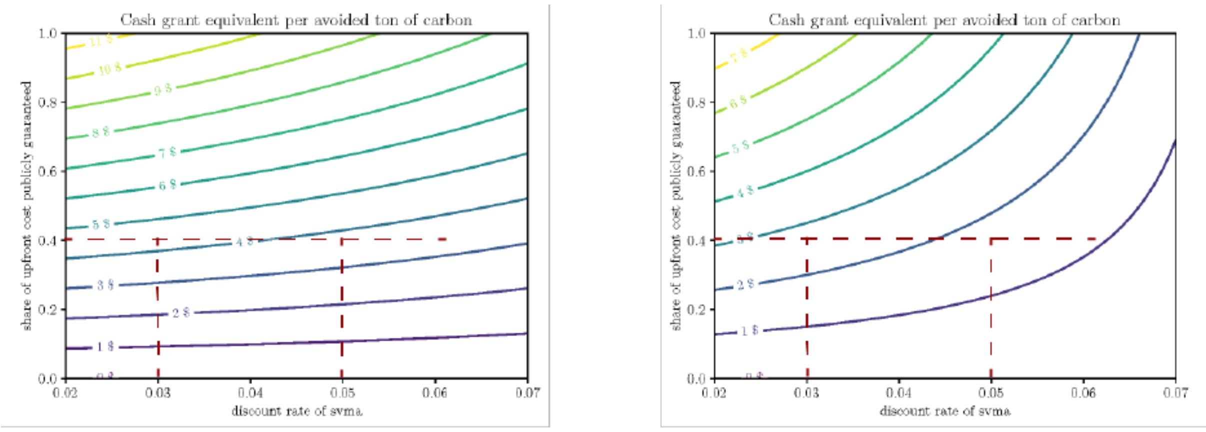


FIGURE 6: Cash Grant Equivalent



In Figure 6 we translate into cash grant equivalents, in USD/TCO2, access by developing countries that are members of the GICF to cheap loans thanks to the guarantee provided by countries that benefit from higher credit rating agency ratings. In fact, there is a volume effect on economically sound projects thanks to de-risking and a decrease in project debt servicing that can be interpreted as a 'cash grant equivalent'. Figure 6 shows these cash grant equivalents. They are of course larger in high-risk cases as a consequence of a larger spread between the interest rate of public guaranteed loans and that of private capital markets. If we assume that 40% of the upfront costs are covered by the guarantee, the cash grant equivalent in the high-risk case is between 4.3 USD/TCO2 and 3.8 USD/TCO2 for a 3% and a 5% SVMA discount rate respectively. It would be lower, between 2.7 USD/TCO2 and 1.7 USD/TCO2 in the low-risk case. Actually, as the numerical exercises in section 3.2.2 demonstrate, most of the gains will come from the GICF's ability to create a shift in project ratings from high- to low-risk.

2.2.2. Implementation conditions: insights from a stylized case

The success of the GICF depends on its capacity to change the practices of the stakeholders in low-carbon projects, including the rate of return they expect, and to involve new financial partners, including bond markets. Let us illustrate this through the case of *Emergiland*, a medium-size, fast-growing country, net importer of fossil fuels, classified as a low-middle income economy by the World Bank and in the BBB investment-grade category by the credit rating agencies.

Given the saturation of its hydropower potential, this country has to make a choice between a coal plant and wind farms to expand its electricity generation capacities. Not to build new capacity is not an option given the fact that electricity demand is growing faster than GDP. However, this country has adopted a public finance rule that sets an upper limit on its public deficit of 70% of its GDP. Since this constraint is becoming binding, it tries to entice international private investors to invest in its electricity system. It can do this by selling shares in public power-generation companies or by using 'Build Operate Transfer' financing, whereby private investors receive a long-term concession (say 50 years) to finance, construct and operate new generation plants. But it is interested in minimizing the use of these options because of their quasi-irreversible nature and of the risk of granting excessively high rents to private investors.

The technical parameters of the competing coal-based and wind-based option are given in Table 4:

- 72.2 MW of installed capacity for the coal-fired power plant coal and 144.4 MW for the wind power plant to provide the same amount of electricity to 250,000 households, given a capacity factor of 70% for the former and 35% for the latter
- an investment expenditure per MW for the coal-fired plant that is 38% lower than that of the windfarm, which leads to a total unitary investment expenditure for the windfarm that is 3.2 times higher than that of the coal-fired plant
- a rather pessimistic substitution factor of 50% between the windfarm and coal because an amount of additional coal capacity is required in the expansion of the system to compensate for the volatility of wind-generated electricity.

Thirty percent of the investment in the coal option is covered by private equity, 70% by loans (50% in an MDB loan at 9% interest and a bank loan at 15% interest). The sale price of electricity is set in relation to customers' purchasing power (around USD 69 per Mwh) and, since this does not allow the company a positive net return for ten years, the government adopts feed-in tariffs. However, thanks to the taxes on electricity sales, the net impact on public finances over the period is positive.

The windfarm project is not economically viable in the absence of public guarantees with the same sale price of electricity as the coal option. Thanks to the guarantee, it becomes possible to borrow more. The project would receive a five-year loan at 6% interest but, after two years, the windfarm being perceived as safe, 25% of the capital not yet repaid over the two first years would be taken by bond markets at 3% interest and the rest by short-term rolling loans at 5% interest. This access to cheap loans would allow the proportion of private equity capital to be reduced to 15% and, because the investment is far less risky for the private investor, the latter accepts an 8.8% return instead of 13.2% for the non-guaranteed coal option.

TABLE 4: COAL WITHOUT GUARANTEES VERSUS WIND WITH GUARANTEES, AN ILLUSTRATIVE EXAMPLE

	Coal	GICF-backed Wind
Installed Capacity (MW)	72.2	144.4
Investment in MUSD	72.2	231.0
Capacity Factor	70%	35%
Total energy imports (ktoe)	**2 790**	0
Total AVOIDED **energy imports (ktoe)**		**1 347**
Debt service	71	99
Total energy imports (MUSD)	**319**	0
Total AVOIDED **energy imports (MUSD)**		**154**
Public Finance variation (MUSD)	**26**	**-41**
Public Budget variation after macro feedbacks (MUSD)	**26**	**26**
Percentage of private equity	30%	15%
Net Annual Return to the private investor (NARR-SF)	13.2%	8.8%
GDP gain from lower coal imports (MUSD)		**223**

Obviously, many parameters can be changed in this exercise (capacity factors, substitution rates, coal prices, unitary investment expenditure, loan differentials, changes in financial structure). For example, it would be possible to take advantage of private investors' lower risk-perception to increase the percentage of equity and the overall debt service, but it would make no sense to carry out sensitivity tests around a very stylized exercise that has no claim to realism and for which only the key parameters of the new 'where flexibility' allowed by the GICF can be used.

What we present is rather a numerical 'thought experiment' to point out the mechanisms at play to make the windfarm option compatible with two arbitrary constraints, the same balance for public budgets and the same tariffs of electricity for consumers. Three of these parameters are directly linked to the de-risking of investments by AAA sovereign guarantees: the reduction of the spread in interest rates, a higher maturity of loans and a lower nominal profit margin for private capital. They allow for a debt service passing from 71 to 99 MUSD only between the coal option and the windfarm while the loans double. The fourth parameter is macroeconomic in nature. Indeed, a higher feed-in tariff in the windfarm option generates a 41 MUSD increase in the public budget deficit and the same balance in public finances (+26 MUSD) is reached thanks to 67 MUSD of additional fiscal revenues generated by the 223 MUSD reduction in coal imports. This reduction allows, for the same balance between exports and imports, a higher economic activity whose magnitude can be captured by the conventional foreign trade multiplier of the country $1/(s+m)$ where s is the marginal propensity to save and m the marginal propensity to import (out of exports), which is 1.41 in Emergiland[24].

It remains now to examine what institutional framework can maximize the economic and climate dividends of the interplay between these parameters.

2.3 Institutional conditions for a self-reinforcing virtuous circle of confidence

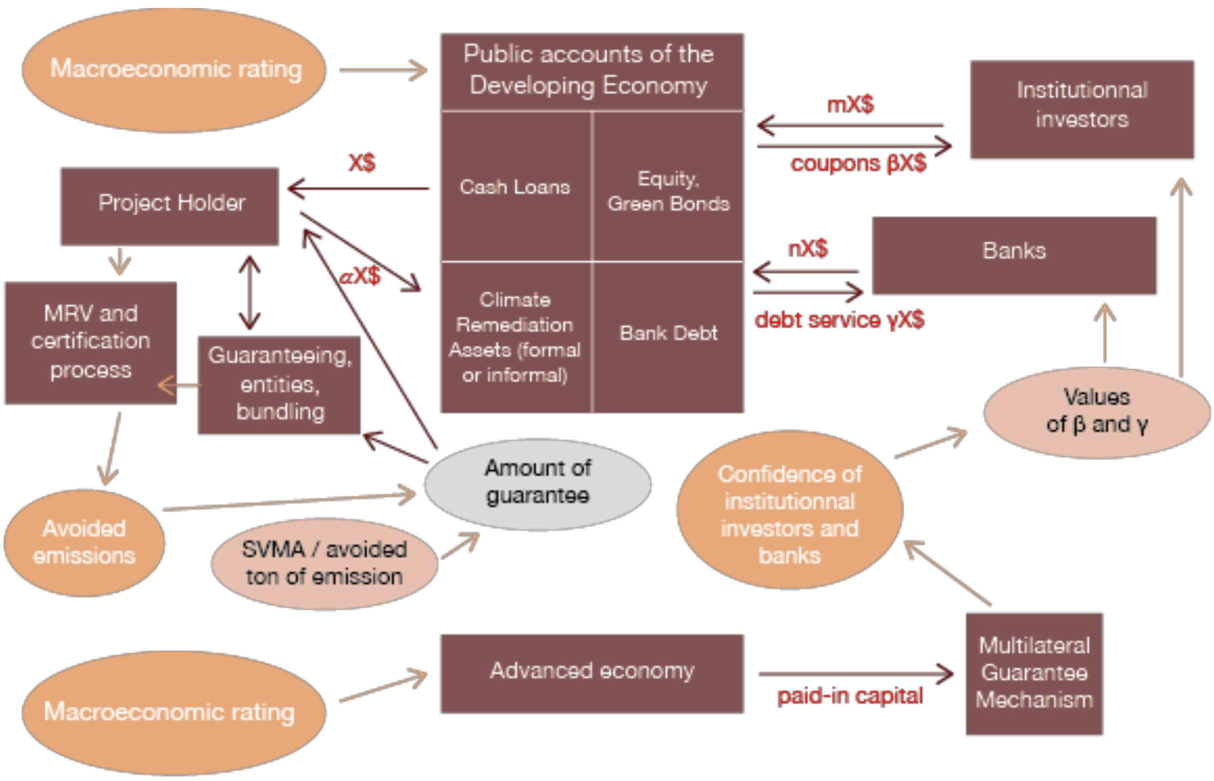
The components of this institutional framework are sketched out in Figure 7:

- the governments of the advanced economies issue guarantee and their challenge is: **a)** to preserve their economic rating by minimizing the net public cost of the guarantees and possibly turning it into a gain and **b)** maximizing the degree of confidence among institutional investors and banks in the government's capacity to pay a high enough level of guarantee if the project defaults
- the banks and institutional investors will decide the interest rates of the β of the loans and γ of the coupons in relation to their perception of the system's credibility
- developing economies will also pay attention to their public accounts since any loan will ultimately increase their debt level, which can be compensated for by the tax revenues generated by a higher economic growth rate and by access to credible low-carbon assets
- the project sponsors, who will ultimately be beneficiaries of the guarantees through lower investment risks and access to cheaper loans, depending on the value of avoided emissions at the agreed level of the SVMA

Let us now review the conditions for the mechanisms involved in the proposed architecture to create as powerful a virtuous circle as possible to scale up low-carbon investments.

[24] 1.41= 1/(0.15 +0.55), with the marginal propensity to save at 0.15 and the marginal propensity to import at 0.55.

FIGURE 7 The Mechanisms At Play



2.3.1 The hidden obstacle: macroeconomic concerns and creditworthiness ratings

The GICF is at risk of implicit vetoes against massive ramping up because of the consequences of the proposed architecture for the macroeconomic rating of both guarantor and host countries. Guarantor countries might refrain from committing to significant amounts of sovereign guarantees given the risk provisions that will appear on the liability side of their public accounts if, meanwhile, they introduce unpopular policies to reduce public deficits. Although host countries will benefit from capital inflows, they might be concerned by the macroeconomic adjustments required if new borrowing negatively affects their creditworthiness as perceived by the rating agencies.

Creditworthiness of the guarantor: provisions at loss vs export-induced fiscal revenues

For the guarantor country, the response lies in the ***balance between the percentage of the guarantee that has to be set aside as potential loss given the project default rate and the positive impact of investments on its tax revenues through exports***. Assuming a pessimistic 1 in 5 project default rates, the amount set aside for expected losses should be 20% of the value of the guarantees issued. This cost to the public purse has to be compared with the tax revenues from the exports induced by the construction of low-carbon facilities in the host country. This depends on the country's foreign trade multiplier. A marginal propensity to save of 0.15 and a marginal propensity to import of 0.3 gives a foreign trade multiplier of 2.22 (1/0.45). With tax revenues representing 45% of its GDP, France could fully offset the fiscal burden of a risk-provision set at 20% of the guarantee, with exports equal only to 6.75% of the induced investments, if the leverage factor of one dollar of guarantee to project investment is only 3[25]. This 6.7% has to be compared with the observed import content for infrastructure projects (design, construction, capital equipment) in developing countries: about 40-60% for middle-income countries, and 70-80% for low-income countries. Without overestimating the predictive value of this type of rule of thumb, the difference is enough to conclude that there is a ***high likelihood of a positive balance***.

Creditworthiness of the host country: higher debt vs low-carbon assets and growth dividends of lower energy imports and better infrastructure

For host countries, the appropriate response lies in the growth benefits of lower energy imports as in our stylized case study, greater domestic energy security, spill-over effects of investments and improved access to the basic needs of poor populations. In addition to the positive impacts of higher growth on public finances, the value of certified collaterals recorded on the 'asset side' of their consolidated public accounts should partially offset the increase in their external gross debt. However, without a high enough explicit carbon price and the possibility of trading such credit across borders, the value of certified collaterals is only notional. Therefore, additional features are needed to making these certified collaterals 'bankable' and tradeable under the ***voluntary mechanisms*** of Article 6 of the Paris Agreement, which sets out the broad parameters and accounting rules to avoid double-counting in such mechanisms. This implies the emergence of ***Climate Remediation Assets (CRAs)*** to which we will return later.

2.3.2 Hedging against default risks and maximizing the leverage effect of public funds

Default risks in the case of guarantees are well documented. USAID for example has operated a global guarantee fund for SMEs (with 50 percent credit guarantees) of USD 5.4 billion, across 80 countries and 474 financial institutions during the period 1999-2017, with a default rate of 2.4%[26]. MIGA, World Bank, IFC, ADB and other MDBs have operated guarantees with near-zero default claims. Moody's have estimated 10-year cumulative default rates of 6.7% for over 6 500 unrated infrastructure projects financed by bank loans throughout the world over three decades (1988-2017), with high rates in lower middle-income countries (10.2%), medium for upper middle-income countries (7.5%) low in advanced economies (6.5%), and with an ultimate recovery rate close to 100% after restructuring[27]. The

[25] Thanks to the 2.2 export multiplier, 10% of the USD 200 of generated investments would end up as a USD 44.4 increase in GDP and a USD 20 increase in tax revenues (44.4 * 0.45).

[26] USAID, The Development Credit Authority, Impact Brief 2017.
https://www.usaid.gov/sites/default/files/documents/1865/dca_impactbrief2017.pdf

[27] Moody's Investor Service, Default and Recovery Rates for Project Financed Bank Loans, 1983-2015.
https://www.globalinfrafacility.org/sites/gif/files/Moody%27s-Project%20Finance%20Default%20Study%20%281983-2015%29.pdf

construction phase concentrates most of the risks and default rates decline rapidly to near-zero after the first few years, making them amenable to bond financing[28]. For small and medium-sized enterprises (SMEs), Chile has had a default rate of 7%, and most sustainable SME guarantee schemes had default rates lower than 5%[29].

It may be suspected that the acceleration of low-carbon investment in less mature and more capital-intensive options will increase default rates. To control this risk a high-quality selection process is needed, organized around the four key pillars of risk management of any efficient public guarantee system, conveniently adapted to the specifics of low-carbon projects (as set out earlier in 2.1.2):

(a) ***guarantees should never cover full credit risks*** and the *extent of risk coverage* should be set, through the ***'uncertainty discount factor'*** applied to the SVMA per ton, at a level that is neither too high to avoid adverse selection and moral hazard risks nor too low to deter private capital.

(b) ensuring at all times that, once the strategic decisions of the governments participating in the GICF (prioritization of some NDCs or a minimum share of projects dedicated to basic needs) have been made, ***the project selection process is kept free of interference and political lobbying***;

(c) ***setting costs of guarantees at an appropriate level that strikes*** a balance between administrative costs and contingency reserves against losses on the one hand and a level that might deter use on the other;

(d) ***standardizing the transaction process,*** including the 'bundling' of classes of projects into scaled-up proposals, differentiated by sector, degree of technological advance, nature of risks, and geographical location, to lower the costs of preparing and submitting proposals. Standardization issues are addressed further in Section 2.6 together with the ***ex-post verification*** of the degree of conformity of the projects.

On this basis, the GICF could eventually transform the optional reporting recommended by the Taskforce on Climate-related Financial Disclosure (TCFD) into ***auditable mandatory financial reporting and implement Project Rating Standardized Methodologies (PRSM)*** with due reassessment in respect of market information. Because reputational effects are critical, this would provide an initial basis for transforming low-carbon infrastructure into a credible class of CRAs by securing the recognition of their value by the GICF members' financial institutions.

2.3.3. Credible pre-commitments and a common guarantee mechanism

However, once the project default risk has been minimized the core risk will remain that, be they providers of public guarantees, or host countries, significant numbers of GICF members may renege or seek to exit opportunistically from their commitments. This might be the case because of changes in the political orientation of governments or of unexpected public budget deficits. Because failure of any one individual partner to meet its commitments endangers the overall credibility of the GICF, the design of its architecture needs to make opportunistic exit very difficult and costly and provide

[28] T. Ehlers, 2014. Understanding the challenges for infrastructure finance, BIS Monetary and Economic Department, Working Papers 454.
[29] J. Levitsky, 1997. Credit Guarantee Schemes for SMEs---an international review, Small Enterprise Development, Vol. 8, No. 2.

incentives for parties to remain committed.

Hedging against the exit temptation of a guarantor: Pre-commitments through paid-in and callable capital

Credible pre-commitments are a powerful tool in these 'game-theory' settings. Guarantor countries can pre-commit sufficient funds to an institution from which an opportunistic exit is made difficult. At one extreme, this could take the form of pre-committing the entire funds necessary to make the GICF guarantees. Because of their long duration, infrastructure projects will require long-term guarantees and funding. In a context of constrained public finances, most contributing governments are unwilling to pre-commit large amounts of funds for a long duration, especially where the level of risk looks very uncertain in relation to the volume of calls for funding. The alternative *is* ***providing capital funding in a mix of two forms: (a) 'paid-in' capital,*** in sufficient quantity to lend credibility to the capacity to meet likely demands for funding and **(b)** ***'callable' capital,*** where the GICF institution is able to call on additional capital, should the need arise. Hence the pre-committed funding is there in case of an unexpected rise in defaults of GICF-guaranteed projects. Such mixed forms of 'paid-in' and 'callable' capital have been used in the ESM (European Stabilization Mechanism) for example with a paid-in capital of €80 billion and callable capital of €620 billion to pre-commit to the ESM's ability to lend up to €500 billion[30] and similarly, by the World Bank and most other multilateral financial institutions.

In host countries, pre-commitments may have to take a slightly different form. Any host country partner might be tempted by an opportunistic exit in case of failure to respect its commitments to policy and regulatory conditions (feed-in tariffs, assured payments by state-owned utilities, regulations to ensure that long-term contractual arrangements are maintained, including financial contracts). In fact, the biggest incentive to remaining committed is the possibility of being deprived of the advantages of obtaining continued support for future projects. The GICF's staying power is thus itself an incentive that is dependent on the strength of its cooperative character. Any unexpected exit would also weaken the credibility of governments not just in respect of GICF projects, but of all financial transactions. In addition, the value of the certified assets, especially once transformed into formal CRAs, would also be dependent on being an upstanding member of the GICF. This makes exit by host countries because of non-performance in enabling conditions much less likely.

Unlikely exit temptation of hosts if the GICF performs correctly

The remaining question is how can a ***sufficiently well-capitalized initial guarantee agency, independent from the management of annual public budgets*** ensure that the guarantee will be paid out if necessary while at the same time increasing the political and economic costs of non-compliance.

[30] Joseph Cotterill, 2011. Why Europe's Bailouts are Turning to Callable Capital, Financial Times, March 23.

2.3.4. Distributed Guarantee Agency or Multi-Sovereign Guarantee Mechanism?

For a typical project involving 30% equity and 70% loans, and a guarantee covering say 70% of these loans, one dollar of guarantee leverages about two dollars of investments (1/(0.7*0.7)). The critical question for each Treasury of a guarantor country is: **(a)** how much money to set aside as contingency liabilities for the guarantees **(b)** where to keep it and **(c)** how to 'score-it to market'. The response can take one of two forms: a ***Distributed Guarantee Mechanism (DGM)*** in which a guarantee fund is created by each country individually or a ***Multi-Sovereign Guarantee Mechanism (MSGM)*** created by all the GICF partners collectively.

- ***In the context of a DGM,*** each government's own auditors might decide what the contingency risks are and how much to set aside as dedicated funds on their books. Let us assume that the typical Treasury judges that one out of every four projects could eventually fail. This is very pessimistic, but the national auditor may recommend staying on the safe side with respect to financial institutions. Then, each government will set aside 25% of the committed guarantees as contingent liability. If one dollar of guarantee leverages two dollars of investment, the multiplier to the budget cost is then potentially 8. Where would these contingent funds be kept? If all the partners are comfortable with each other's sovereign commitment to perform, they could simply accept each sovereign entity's accepted national procedures for such funding set-asides in their general Treasury operations and obligations (DGM in Table 5). But, in the case of non-performance by one member, the whole system would be jeopardized, unless, in a form of a joint liability, other members increase their contributions in such an event. Most financial market participants would judge the risk of such an arrangement to be very high and prone to rapid failure.

If partners recognize this risk and want to reassure the financial institutions, they may envisage the creation of a dedicated contingency fund into which each government will put their share of the 25%, up-front and in cash, as a Contingency Liability Against Guarantee Fund. The pre-commitment and its assurance is strictly limited to the initial 25% set aside. This is a relatively rigid 'rule' since the contingency fund cannot guarantee investments beyond the ceiling of 8 times the initial fund without fresh calls for expansion of funds. As public resources are scarce, member governments will try to minimize their initial contributions, and the initial size may well be relatively small for a given number of members. The impacts of the GICF will be, in absolute size, limited by the members' initial contribution, until a second and further funding call after, say, an initial five-year period. This is why we have excluded this option.

Starting from a theoretical multiplicative factor to public budgets of 8, the effective factor will also be determined by other costs related to the management of the system. Examining each project proposal on a case-by-case basis would be very costly in transactional terms for a small GICF secretariat. So, other external agencies will be required to 'pool' these projects, assess their viability, test them against benchmarks, and establish a framework to *ex-post* MRVs, before they come to the sovereign entities to obtain guarantees. In other words, these agencies will need to do all the required financial due diligence and deal with the project proposers and the financial institutions. Typically, this can be done by the MDBs, the national DFIs, and the national bilateral aid agencies, which will charge for the accounting, auditing, due diligence, legal and other costs. Some significant up-front initial guarantee assessment and preparation costs may have to be paid to these external agencies by the sovereigns, typically by about a one-time 7% cost as initial administrative and due diligence charges. That will bring the multiplier effect of the guarantee fund down from 8 to about 6 times (see table 5).

TABLE 5: EFFECTIVE INVESTMENT MULTIPLIERS UNDER ALTERNATIVE INSTITUTIONAL MECHANISMS

	DGM	MSGM
A. Effective Multiplier (B/Fa vs B/Fb)	**5.7**	**16.3**
B. Total Project Investment (Ba + Bb)	***204.1***	***204.1***
Ba. Private Sponsor Equity (3/7 x Bb)	61.2	61.2
Bb. Private Financing (C / 70%)	142.9	142.9
C. GICF Guarantee (4 x D)	**100.0**	**100.0**
D. Net Guarantee Capital (F - E)	25.0	25.0
E. Payment to External Agency	10.7	0.0
F. Total Guarantee Capital (Fa + Fb + Fc)	35.7	25.0
Fa. Set aside in Special Pool Fund	**35.7**	0.0
Fb. Paid-in Equity Capital	0.0	12.5
Fc. Callable Equity Capital	0.0	**12.5**

In an MSGM context, the sovereign partners would provide the same initial capital (25%) **i)** half as 'paid-in' cash capital to a dedicated agency, the MSGM; this would appear as a share in this MSGM on the asset side of the guarantor's books and **ii)** half as 'callable capital', registered on the books of the sovereign partner as a contingency liability to be paid on demand by the MSGM. The multiplier effect would now be about 16 times the actual paid-in capital (see Table 5). USD 1 of paid-in capital would thus generate the ability to provide USD 8 in guarantees, which would in turn generate about USD 16-worth of projects.

The MSGM' s dynamic of capital formation hedges against exit temptation and helps to balance public budgets

The key advantage of the MSGM, in addition to a higher leverage effect, is its financial strength, beyond the reach of a DGM, that would enable it to compensate automatically for the non-compliance of a partner. The ***automaticity and speed of payment in the case of default*** is critical because the payments have to be made within one to two weeks maximum after any defined default event. In a Contingency Fund, a consensus is needed within the Board which is uncertain in times of crises. Under an MSGM with a clear shareholding structure, decisions are made according to an agreed up-front governance arrangement and the

MSGM will have sufficient financial strength to make the expected payments.

This financial strength would increase over time. Indeed, like all financial institutions, the MSGM would invest its liquid reserves of capital funds. Let us assume that these funds earn a 5% annual return through normal internal Treasury operations and that they directly charge 0.5% of guarantee 'fees', instead of paying the external agencies. These fees, assuming the 8 times leverage ratio between the guarantees and the initial paid-in capital, will yield amounts that are equivalent to another 4% return on paid-in capital (8 times 0.5%). If, say, half of this covers operational costs, then, net of these costs, the GICF will still ***accumulate more cash every year on top of its paid-in capital*** and, assuming no pay-outs from its guarantee operations, and ***without additional injection of capital by sovereign partners***, to the extent of 7% annually (5% + 4% - 2%). Over a ten-year period, the reserves of the GICF should then nearly double in size compared to the initial paid-in capital with no default and increase by about 24% with a 5% default rate. This shows that the size of the initial paid-in amount matters and that the GICF would operate cautiously in its first phase to build up a sizeable amount of initial paid-in capital plus accumulated reserves.

MSGM preferable to DGM in the eyes of capital markets

The paid-in capital (plus internal reserves) of the MSGM could also be actually treated as a provision to end the fund at any point in time without requiring any further cash outlays from shareholders if events turned out worse than expected. A 16 times multiplier can also be thought of as a 'self-extinguishing capability' of the MSGM to handle a life-time default risk of 6.25 percent of its total guarantee portfolio, and 9 percent of the total value of guaranteed projects, without requiring any more than its initial paid-in capital.

From a purely public accounting perspective, the dynamic nature of the MSGMs capital formation will increase the value of the share of its capital appearing as equity in the books of the guarantor countries and will be a hedge against the temptation to exit since the exiting country would immediately lose its ownership right to a profitable, high value asset. This is important for obtaining the confidence of capital markets since, although it is extremely rare for any sovereign entity to renege on its legal commitment to callable capital because of the risk of downgrading its entire financial standing and its creditworthiness in global financial markets, ***exit risk cannot be entirely excluded because of the compelling strength of political uncertainty.*** For the bond markets and institutional investors, there are four complementary reasons why an MSGM system would be more likely to increase the attractiveness of investments made under the GICF than a DGM:

- much ***greater transparency*** with respect to contingency funds if events generate a requirement for more capital: the paid-in capital of the MSGM and its internal accumulation from guarantee charges over time would remain the front-line buffer for these calls for a considerable length of time

- ***project priorities and funding will be more transparent*** and less open to various forms of lobbying whereas each such agency in a DGM arrangement would be driven by their own strategic logic and priorities,

- pre-commitment to the objectives of the GICF for a ***substantial length of time, without requiring any further capital injections*** nor operating on a project-by-project basis;

- ***longer-term 'pre-commitment'***; in a DGM, a 'pay-as-you-go' approach to committing financial resources reliably to guarantees would be mirrored in a politically determined and constrained 'granting guarantees-as-you-go' approach with significant transaction costs and further uncertainties each time a substantial number of guarantees came up for approval.

2.4 Guaranteeing entities, project platforms and climate remediation assets

The choice between a distributed and a multi-sovereign guarantee system will be made at a high level of political decision-making. Agreeing on governance principles prior to the launch of the system is simpler with a DGM-style Contingency Fund (every country has an equal decision-making power, and decisions are taken by full consensus), and more complex with an MSGM, the basic issue being how to determine each country's weight in the decision-making process. Should it be determined in relation to their share of the capital, with the risk of stifling the voices of developing countries or in relation to other criteria with the risk of re-creating 'donor fatigue'? Should an MSGM take the form of a department of an existing multilateral institution once the risk of incentive incompatibility has been removed (conflicting objectives of normal direct lending versus guarantees)? Or would it be possible to reshape an existing body (AfDB, IBRD, MDBs, GCF), giving it new missions and renewed governance[31]? Or, should it be a new, independent entity, capable of concentrating on its sole mandate, but with an associated establishment cost?

Against the pitfalls of the multiplication of financing interlocutors, a fulcrum for cooperative behaviour

The fear of creating new institutions should be addressed clearly up-front before launching a pilot phase so that it is not bogged down later in inevitable and complex influence peddling. A system between sovereign entities not belonging to the same political organisation, will in any event be placed in a close relationship with the designated bodies of each member state responsible for the coordination of its initiatives within the GICF. Now, experts from these bodies are fully aware of the pitfalls of the multiplication of financing interlocutors over the past decades such as **(a)** the limited expertise in many host countries about the relevance of each type of instrument or procedure **(b)** the issue of scale coming from the financial limit of each fund and **(c)** the cost and risk for each fund when it goes beyond its capitalised know-how.

In such a context, provided that its management is protected from political pressure and business lobbying, the MSGM will not be perceived as a new intrusive institution but as a fulcrum for cooperative behaviour between existing development stakeholders, gradually reducing the fragmentation of the development finance system. It could for example ***accommodate guaranteeing entities*** (syndicates of banks, financial stakeholders and public entities) and ***project platforms*** for classes of projects in certain regions in order to ***increase the scale and the degree of simplification, thus reducing transaction costs and uncertainty, maximizing the reduction of the spread and***

[31] The option chosen by the Junker plan has been to place it on the same physical premises as, but independent of, the European Investment Fund, with its own Board and DG.

establishing complementarity with insurance mechanisms such as MIGA. The experience of Scaling Solar (a suite of services from the World Bank, MIGA and IFC) is interesting in this respect. Established to create viable markets for solar power in different countries, it helps to support and design the public tendering process, ensure strong participation and competition from industry and financial stakeholders, and provide templates of bankable project documents that can eliminate case-by-case negotiations and speed up the process, through pre-approved insurance and guarantee terms, of obtaining access to lower financing costs.

Project platforms and new business models

These 'project platform initiatives' may well be critical for solar energy, electric vehicles, energy efficiency in buildings, bio-energy, the cement and steel industries, transportation infrastructure and waste management and the circular economy. Such platforms could support learning-by-doing processes for sector-specific and geographically appropriate business models including those of cities, non-state public entities, professional networks and high-impact social enterprises. (Touati, 2018). The design of standard contracts and help with tailoring project risk profiles could support the ***bundling of small-scale projects*** through specific financing interlocutors, and the emergence of regional/sectoral pooled assets. All of these possibilities exist, but are underused in current market arrangements and could be unleashed by an MSGM. They would generate the right type and scale of business environment adapted to each class of project in different types of country in order to ***break the organizational glass ceiling against the emergence of projects*** in many sectors and geographical contexts (see 1.3.).

Together with the gains in operational efficiency and support for new business models, the main contribution of an MSGM might be to provide the ultimate weapon in the climate battle, the use of low-carbon infrastructure projects as low-carbon assets. We have seen that this transformation is possible because the SVMAs gives a premium to long-term investments. We have also seen that, despite progress in MRV processes, there will be pressure to keep the uncertainty discount factor 'α' low when calibrating guarantees in order to secure the valuation of CRAs by market stakeholders and rating agencies. This would be at the cost of restricting the number of projects funded.

The way to overcome this obstacle is to ***issue formal 'climate remediation assets' (CRAs) with a pre-established face value per ton of avoided emissions (the SVMA)*** instead of letting their value float as a function of eternally-volatile reputational effects. The project developer could then use these CRAs to reimburse part of its loans to the banks or institutional investors, or keep them on its own balance sheet to improve its WACC (CIRED, 2015). ***Such CRAs would provide a very strong incentive for good project management,*** since they would be issued as a function of the degree to which projects comply with their initial plan (physical completion, utilisation rates, carbon emissions) up to the end of their agreed economic lifetime. In case of non-certification of CRAs, project owners would be in a weaker position and would be under pressure to reimburse loans as stipulated**.**

Formal or informal CRAs

This option is critical to responding to concerns about the increase in host countries' debt since the collateral of their new debt would have a minimum value, that of the CRAs. The benefit is indirect, but also critical for developed countries and their financial institutions. Their banks, institutional investors and large companies making loans to the projects in the host countries could be partly reimbursed through

CRAs which implies that, ultimately, these CRAs would be recognized by their central banks. This implies in turn that CRAs would be recognized in interbank payments between members of the GICF and that the banks would use them to fulfil the liquidity requirements that are stipulated in the Base III and Solvency II Agreements. For the country's public accounts, this would drastically limit the default risk since the guarantee would be paid only if the project owner cannot reimburse its loans, neither in cash nor in CRAs, which means in turn a lower probability of failure. Obviously, the impact of the system would be greater if the developed countries that become members of the GICF were to adopt a similar system to scale up their mitigation policies with additional guarantees (Aglietta and Hourcade, 2012).

3. A dynamic of reciprocal gains

Main findings

In addition to deploying cost-efficient climate policies at scale, the 'raison d'être' of the GICF is to provide 'equitable access to sustainable development' and to unleash reciprocal economic and political gains between 'North' and 'South', a pre-condition of the pursuit of shared climate objectives.

- The size and scale of the commitments of the pioneering group of countries are critical to demonstrating that the GICF architecture is a 'game changer' and has the potential to fulfil the 'USD 100G and beyond commitment' (para 53 Decision of the PA 1/CP.21). Pre-commitments by sovereign entities are constrained by the funding capacity of their public budgets and limited by technical and organisational constraints to the scaling-up of sound projects. The volume of pre-commitments required during the first period in order to launch a self-reinforcing circle of confidence depends on a) the chosen chronogram of guaranteed LCIs between the first and subsequent periods to reach the total investment requirement, b) the investment/paid-in capital multiplier whose variation is related to project default risks and c) the capitalisation method selected for the MSGM (section 3.1)

- The three possible designs for the GICF architecture to leverage the required annual averages of 544 and 989 billion 2016 USD over the period 2016-2035 show a robust hierarchy. With a DGM, the average amount of risk provision would be between 20 and 46 over the first five-year period and between 828 to 2 121 cumulative over the period. In a variant of the MSGM where the paid-in capital is deposited yearly, the equivalent figures are 7 to 17 and 255 to 626 respectively, the main reason being a higher multiplier, a second being the accumulated returns of the MSGM capital that enables the required amount of new paid-in and callable capital to be reduced. This parameter enables a further reduction of 15 to 17% of these amounts in a variant of the MSGM where the paid-in capital is deposited up-front every five years. The accumulated gross public cost for the two MSGM variants is between 119 to 300 and between 97 to 252 respectively and could be offset by fiscal revenues for the guarantor countries from induced exports representing between 3,48% to 3,73% and 2,92 to 3,12% of LCIs. An alliance of the economic size of the Eurozone could easily meet the required pre-commitments and make the system credible, even in the absence of the USA (section 3.1)

- These amounts of guarantees would generate massive capital inflows for developing countries. The additional inflows in the form of equity would represent a large proportion of the 128 to 303 USD billion from foreign private investors and national savers who will reallocate to their country funds they would otherwise have invested elsewhere. A second form of equity that can be considered as contributing to the 'USD 100G and beyond' commitment is the 66 to 157 USD billion annual cash grant equivalents from the reduction in loan interest rates, the difference between interest actually paid and that which would have been paid otherwise. It is particularly noteworthy that, assuming that A rated countries, being financially less constrained, use the GICF facility for only 5% of their emissions, the low-rated countries, benefiting from higher spread reductions, will receive a percentage of these grant equivalents that is higher than their percentage of the total GDP of developing countries (section 3.2.1)

- The GICF will contribute to the satisfaction of basic needs and the improvement of adaptation capacities by a) transforming part of the projects targeted on basic needs into 'marketable' activities; b) improving the overall quality and quantity of infrastructure and c) enabling development agencies to allocate more funds to straight grant-based adaptation support, as expected from a 'pure public goods' viewpoint, since the 'crowd in' of more private investment lowers the need for direct funding of mitigation projects close to the bankability threshold (section 3.2.2)

- The macro-economic creditworthiness of host countries will be improved by greater inflow of foreign equity with no debt implications, by national savers injecting part of their assets into 'safe havens' in their own country and a reduction in energy bills for oil importing countries. The GICF could, in addition, consolidate mechanisms to reduce foreign exchange risks in the financing of long duration mitigation projects. Access to CRAs, placed in the asset column of their public accounts, will be important for all countries but critical for participating oil- and gas-exporting countries. Substituting this new class of assets for their potentially stranded fossil-fuel-based assets will help them to reinvest their export revenues into environmentally safe, low-carbon options and carbon-capture & storage capacity, domestically and abroad, and to thoroughly diversify their economy (section 3.2.3).

For the developed countries initiating the GICF, the first benefit will be to demonstrate that, far from being a burden, climate policies can help to create jobs and balance public budgets thanks to the export revenues generated by LCIs in developing countries. This will reinforce the credibility of climate policies a) domestically, by responding to the argument that domestic efforts are useless given the emission trends in developing countries and b) internationally, by clearing up the long-standing North/South misunderstandings about how to implement CBDR policies, the suspicions of 'green-washing' of ODA and bond markets and by reducing the gap between the propensity to save and the propensity to invest in productive assets, which is one of the major 'fault lines' of the world economy which also includes the 'tragedy of the horizons' that is weakening our financial systems.

The obvious benefit expected from the GICF initiative is to deploy cost-efficient climate policies at scale to meet a 2°C target, given the constraints acting on the global economy, including those coming from huge disparities in development levels. However, the raison d'être of the GICF is more broadly to provide 'equitable access to sustainable development' and to unleash reciprocal economic and political gains between 'North' and 'South', which is the key enabling condition to the pursuit of ambitious climate targets as a shared objective. The GICF can achieve this thanks to four factors:

(a) the potential size and scale of sovereign guarantees needed to make inroads into global mitigation needs, which in turn depend upon the size of the initial group and its capacity to expand;

(b) the ability of the architecture to sufficiently reduce the risks faced by private financiers when investing at scale in developing countries;

(c) the size of possible gains for developing countries, which face very high interest costs and limited access to long-term financing;

(d) the size of gains to be obtained by the developed countries, which face highly constrained public resources and slow economic growth.

On the basis of these four factors the dynamics of mutual gains are likely to be very strong. However, if one of them is questionable or weak, then the others will not resist.

3.1. Size of the initial financial challenge and size of the pioneering group

The size and scale of activities of the pioneering group of countries engaged in low-carbon investment de-risking will be critical for the initiative's credibility. The core question is whether the dynamics launched by the proposed architecture have the potential to fulfil the promise of USD 100 G +.

Table 6 is built on Section 1' findings that the global average annual investment in energy and transportation infrastructure necessary for a transition capped at 2°C is between USD 1 358 billion and USD 3 206 billion up to 2035. Around 63% of this total should be invested in developing countries plus China. Assuming that 50% of this 63% will come from the national public sector and that 30% of the remainder will be funded by equity capital, then the financing requirements through bank loans or bonds will be 63%x70%x50% = 22.05% of the initial range, i.e. between USD 299 and 707 billion annually. The size of the guarantee capital needed to back them is obviously conditional upon the multiplier coefficient (investment/guarantee capital): with a 5.7 multiplier, the annual amount of guarantee capital required would be between USD 75 and 177 billion annually in the case of a DGM, and only between USD 26 and 62 billion (yearly at constant 2017 prices) with a leverage of 16,3 under an MSGM.

It is useless to speculate *ex-ante* about what would be the right figures *ex-post*. Only experience and the strength of virtuous circle of confidence promoted by the GICF will determine what the actual degree of leverage will be: between 5.7 and 16.3, or whether it will be below 5.7, which would be a failure, or above 16.3, which is not impossible. Let us then consider these values as indicators, giving a reasonable range for the figures potentially involved.

TABLE 6: GUARANTEE CAPITAL REQUIRED TO BACK LOW-CARBON INVESTMENT (LCI) REQUIREMENTS

In 2017 USD billion	Lower estimate	Higher estimate
Average annual LCI to 2035	1 358	3 206
Annual LCI in developing countries (63% A)	855	2 020
of which covered by private and public firms (50% B)	428	1 010
of which funded by equity and self-financing (30% C)	128	303
Investment funded by loans (B-C)	299	707
Required guarantee capital with DGM (C/5.7)	75	177
Required guarantee capital with MSGM (C/16.3)	26	62

Pre-commitments by sovereign entities are constrained by the funding capacity of their public finances. They are also capped by the technical and organizational constraints on the scaling-up of sound projects. Ultimately, the system's ability to reach cruising speed at the required scale will depend upon the initial size of the pre-commitments and upon the parameters identified so far (level of the SVMA, low default rates, high multiplier effect). Politically, however, ***too low a level of pre-commitments, a natural reflex of the Treasuries in all countries, might undermine the GICF's capacity to be a 'game changer', while too high a level carries the risk of funding low-quality projects***.

The achievable orders of magnitude depend on the interplay between three parameters:

- The investment chronogram selected between the commitments at first period and at subsequent periods to reach the total investments for the low and high investment pathways
- The degree of optimism about the investment/paid-in capital multiplier, changes in which are related to that of the perceived default risks of the projects.
- The capitalization pathway of the MSGM and how it is impacted by changes in actual project default rates and the disbursements they imply.

Table 7 shows the inter-period interdependence of three investment chronograms that illustrate the diversity of strategies to reach the same annual averages of 544 and 989 billion 2016 USD over the period 2016-2035. Columns Exp A' and Exp B give results for exponential scaling-up of investment starting from investment over the first five years that is one-fifth of the average targeted levels up to 2035. In the 'Linear' column linear scaling up is assumed. It starts with significantly lower investment in the first five years, catches up over the two subsequent periods and requires lower investment during the last period.

TABLE 7: ANNUAL AVERAGES OF ALTERNATIVE INVESTMENT CHRONOGRAMS (IN 2017 USD BILLION)

In Billion 2017 USD	Low investment bound 428 Bn/year			High investment bound 1010 Bn/year		
Scale-up path	Exp A	Exp B	Linear	Exp A	Exp B	Linear
Average Y1 to Y5	86	141	122	333	333	289
Average Y6 to Y10	194	257	326	606	606	770
Average Y11 to Y15	439	466	530	1 101	1 101	1 250
Average Y16 to Y20	994	848	734	2 000	2 000	1 731
Total	8 560	8 560	8 560	20 200	20 200	20 200

Exp A and Exp B are trajectories reaching the same average yearly investment over twenty years but starting from an average yearly investment respectively one fifth and one third lower than the 20-year average (see Annex A).

Deriving the amounts of paid-in public capital needed to leverage 100% of the investment required in these trajectories is not straightforward. Indeed, these amounts depend on prognosis about how four parameters change: the perceived default rates, the real default rates, the multiplier effect of public funds and the rate of return of the capital in the MSGM (cash-paid in minus payments of the guarantees). Tables 7, 8 and 9 extract the relevant information from Annex B to highlight the importance of three alternative institutional designs:

- DGM: only the set aside provision applied annually to the balance sheet of each guarantor country backs the guarantees, with no residual assets to be capitalized

- MSGM1: the paid-in capital is deposited yearly so that the cash can yield 7% returns (see Section 2.5.3 above) as long as there is no default in the realization of the projects.

- MSGM2: the paid-in capital is deposited upfront every five years, which requires a greater amount to be paid-in in the first year but allows for a higher capitalization.

Annex B provides comprehensive sensitivity tests that confirm the robust hierarchy that appears between the three designs after examining the similarities and differences of results between:

- Table 8, a fixed coefficient case (FCC), in which we assume a 0.6% per year decrease in risk provision but no default rates and no change in the multipliers (corresponding to 25% of guarantees set as a provision against public finance in a DGM and 12.5% of such provision plus 12.5% in paid-in capital in an MSGM);

- Table 9, a changing coefficient case (ECC) in which we assume linearly-declining default rates over time as a function of experience[32], starting from 10% to reach 2% in 2035 (rate given by current assessments of default rates for infrastructure projects). It also assumes reducing risk perception, allowing provision for callable capital in case of default to be reduced from 25% to 10%.[33]

The most important information is that the total amount of guarantee capital (risk-provision plus paid-in capital) over the period is between 11.5% and 27.6% lower under an MSGM with yearly paid-in capital than under a DGM in the FCC case and between 35% and 39% lower in the ECC case. The main reason lies in the differences in the multiplicative factor. A second reason is that the cumulative returns of the MSGM capital allow the amount of paid-in capital in the MSGM to be decreased with a 7% rate since this cumulative return would represent 45% of requirements over the period in the annual paid-case 50.3% with upfront paid-in. These returns are lower with a 5% rate of return of the MSGM capital but still provide 31% or 34% of requirements (see details in Annex B). This mechanism explains why the total amount of guarantee capital is reduced by an additional 12.9% and 14%. Five dollars invested at a 7% interest rate yields USD 2.01 after five years (USD 0.4 per dollar), while investing one dollar a year will only yield USD 1.16 (0.40 +0.31 + 0.23 +0.15+ 0.07).

In the more realistic ECC case, with decreasing default rates, the reduction of the required guaranteed capital is around 63% in both investment pathways between the DGM and the MSGM with yearly paid-in since the risk provision and the paid-in capital would be reduced equally as the MSGMs capital revenues increase.[34] Differences in the capital revenues explains why the upfront paid-in capital in the MSGM allows for an additional 15% to 17% reduction. These figures, however sensitive they may be to the selected parameters (see Annex B), show a very robust hierarchy in the institutional designs. An important information is that the fiscal revenues of induced export needed to cancel out this gross public cost turns out to be very low in the two MSGM variants: 1,4% to 1,5% under yearly paid-in, 1,1% to 1,3% under upfront paid-in against between 3,7% to 4% under DGM. The share of total investments that has to be converted into exports of the guarantor countries is obviously country specific since it depends on the weight of tax revenues on total GDP, but it will remain far below 10%.

The charge on taxpayers during the initial period, once translated into tangible terms in public debate, would represent the equivalent of 2.12 to 6.76 cents per litre of gasoline in the Eurozone over the first five years with a DGM, 0.76 to 2.55 cents with an MSGM with yearly paid-in capital and 0.61 to 2.12 with an MSGM.

[32] Actually, this is an arbitrary rule we have adopted to avoid useless complexity at this stage. One might think indeed that the fifty/fifty rule between risk-provision and paid-in capital in the MSGM applies after deducting the capital revenues of the MSGM. This would have a positive consequence on the net public balance of the guaranteeing country.

[33] In the real world the assessment of default rates and project risk coefficients is made by stochastic methods that allow risk profiles to be assessed by type of project, sector and country and results ultimately from a learning process. However, further scrutiny of the sensitivity tests in annex B is then necessary, to help to capture the bounds of the orders of magnitude at stake.

[34] We adopted this rule for simplicity sake, although, depending upon country specific routines in public finance it may happen that the callable capital is never payed and that all the payments will be made by the MSGM. This doesn't change the results in terms of public balance.

TABLE 8: GICF OPTIONS AND THEIR COSTS, CONSTANT MULTIPLIER AND NIL DEFAULT RATE

Annual av. investment, 20 y.	[a]**428**	**428**	**1 010**	**1 010**
Investment pathway	Linear	Exp. A	Linear	Exp. A
Rate of return of MSGM	7%	7%	7%	7%
DGM				
Y1 guarantee capital	7	11	17	25
Av. Y1 to Y5 guarantee capital	21	15	51	35
Y1 to Y20 guarantee capital	**1 497**	**1 498**	**3 535**	**3 535**
Cumulative public cost	330	479	779	1 130
MSGM, yearly paid-in				
Y1 paid-in	2	4	6	9
Av. Y1 to Y5 paid-in	7	5	17	12
Y1 to Y20 paid-in	393	425	927	1 003
Cumulative public cost	73	132	173	312
MSGM, upfront paid-in				
Y1 paid-in	31	23	76	51
Av. Y1 to Y5 paid-in	6	4	14	10
Total Y1 to Y20 paid-in	344	376	812	886
Cumulative public cost	23	84	53	197

[a] **All values in Billion 2017 USD**

TABLE 9 GICF OPTIONS AND THEIR COSTS, INCREASING MULTIPLIER AND DECREASING DEFAULT RATE

Annual av. investment, 20 y.	[a] **428**	**428**	**1 010**	**1 010**
Investment pathway	Linear	Exp. A	Linear	Exp. A
Rate of return of MSGM	7%	7%	7%	7%
DGM				
Y1 guarantee capital	7	11	17	25
Av. Y1 to Y5 guarantee capital	20	14	46	33
Y1 to Y20 guarantee capital	898	828	2 121	1 954
Cumulative public cost	318	344	750	812
MSGM, yearly paid-in				
Y1 paid-in	2	4	6	9
Av. Y1 to Y5 guarantee capital	7	5	16	12
Y1 to Y20 paid-in	265	255	626	601
Cumulative public cost	119	127	281	300
MSGM, upfront paid-in				
Y1 paid-in	30	22	72	52
Av. Y1 to Y5 guarantee capital	6	4	14	10
Y1 to Y20 paid-in	231	224	545	529
Cumulative public cost	97	107	228	252

[a] **All values in Billion 2017 USD**

These results are robust to sensitivity analyses and suggest that it is ***worth paying the short-term***

transaction costs of creating an MSGM given the long-term benefits of the system. The difference between a yearly and an up-front paid-in is real but the superiority of the latter might be counterbalanced by the fact that a yearly paid-in would allow for a very small implicit tax in the first year (0.06 to 0.17 cents). However, this political economy argument might be counterbalanced by another one. With an upfront paid-in the countries taking the initiative to set up the GICF might have a significant empowerment benefit coming from the credibility provided by a high down-payment and of higher ownership rights over the system. This might incite countries to ensure that they do not miss entry into the initial group.

Obviously, not all Eurozone countries might adhere to the system while other developed country might be willing to do so (Japan, Canada, New-Zealand, UK). Some fast-emerging countries like China or India might even be willing to contribute to the paid-in capital of the MSGM under specific conditions to cover the share of the guarantees they would like to issue, based on their own SVMA.

Our rough estimates indicate, however, that an alliance that would include a significant number of middle-size advanced economies, and one or two large emerging economies could collect a significant amount of funding to make the scale of the system credible, at its cruising speed, even in the absence of the USA.

3.2. Benefits for developing countries: the Copenhagen promise and beyond

Thanks to the GICF, developing countries will undoubtedly attract new capital inflows that will help to fund their NDCs. However, part of these inflows will be in the form of loans to be repaid and cannot be counted as delivering on the 'USD 100 + billion' promise. Two types of capital inflow can be counted as means of fulfilling this promise: direct equity investments by foreign investors, and the cash grant equivalent of access to cheaper loans and the increase in the maturity of these loans (from 7 to 14 years on average for example).

3.2.1. Foreign investment inflows

Additional foreign investment inflows (FDI) will result from the positive effect of the guarantees on the risk-weighted profitability of equity investments. These investments are treated preferentially to other forms of debt and international capital inflows by virtually all developing countries. Although they are indeed in principle subject to repatriation of capital (commonly profits from their investments) their eventual costs to host countries are: **(a)** generated only when the projects are successful; **(b)** always taken in a residual repayment relative to other forms of capital (equity is the last to share in any profits after payments for all other forms of risk capital); and **(c)** limited by the small likelihood of the profits from FDI investments being systematically repatriated, unlike those of debt and portfolio capital investments.

In other words, they impose little additional cost on recipient countries, and while not equivalent to a cash grant, they are a form of risk-taking that is often beneficial to host countries (profits subject to taxes, jobs, transfers of technology, know-how and management, and 'spillovers' to other firms and sectors of the economy). Obviously, we do not know today what proportion of the 128 and 303 USD billions of equity behind our low and high scenarios will be brought by foreign or domestic investors and even within these domestic investors, what proportion will correspond to domestic reallocation of investments that would have been, for safety reasons, invested in OECD countries.

3.2.2. Cash grant equivalent of guarantees

For a given investment trajectory the cash grant equivalents of the guarantees depend on three parameters:

(a) ***the reduction in spreads*** (i.e. difference in annual interest rates) from what the market would have charged without guarantees, and what it would charge with guarantees. The magnitude of changes in risk perception will vary as a function of the countries' credit rating: the lower a country's initial credit rating, the higher the potential for spread reduction.

(b) ***the maturity increase*** effect of the average project debt profile; basically, a 15-year maturity loan might become much more accessible and contribute to an additional 250-300 basis points reduction in shadow interest rates, compared to a market-normal 5 year maturity loan without such guarantees, and this yield differential would apply to the lifetime of the loan. Extended maturities would allow for reducing of effective spreads by a longer maturity loan substituting for the alternative, if it were available, of several shorter-maturity loans being rolled over (which are transactionally costlier with shorter principal repayment periods, and high cost of refinancing every time a roll-over takes place effect, besides being more uncertain and risky for the project proposers).

(c) ***the loan repayment terms and the annual schedule of remaining loan principal to which the interest rates would apply, and access to a greater volume of capital.*** This volume effect is first due to larger volumes of project financing. In addition, guarantees will expand the pool of global financing available for low-carbon projects, especially where they may take on typical 'first-loss' provisions (pay any losses first from the guarantees, then to the lender) and/or take on more of the longer duration risks.

The basic mechanisms involved are illustrated in Figures 8 and 9 and explained more explicitly in Annex C. Thanks to the guarantee the risk perception of projects moves leftward in Figure 8, thus lowering the number of projects rated U or CCC and giving them access to loans with interest rates of projects rated at a higher grade. Ultimately the number of projects rated between AAA and B will increase. In Figure 9 the combination of lower interest costs and more than doubled average maturity of loans allows access to finance for low-carbon projects to be tripled.

FIGURE 8 Shifting Risk Perceptions Left, Before and After Global Guarantees: Illustrative Shift in Credit Ratings to Low-Carbon Across Developing Countries, With Guarantees Against Policy, Regulatory, Low-Carbon Verified and Early Start Technology and FX R

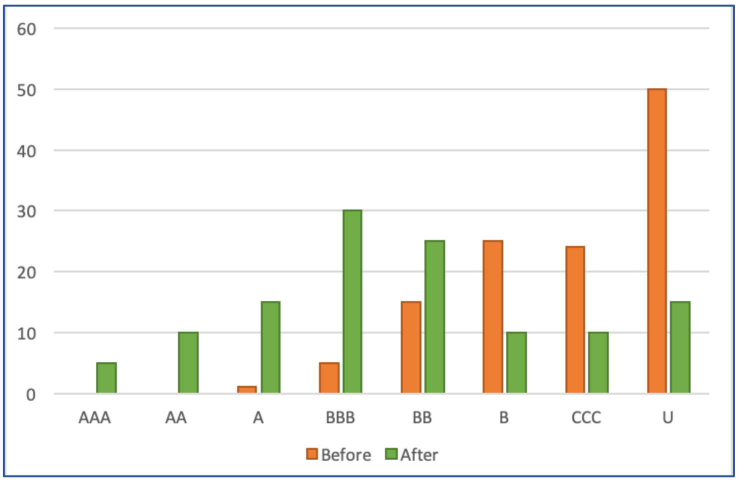
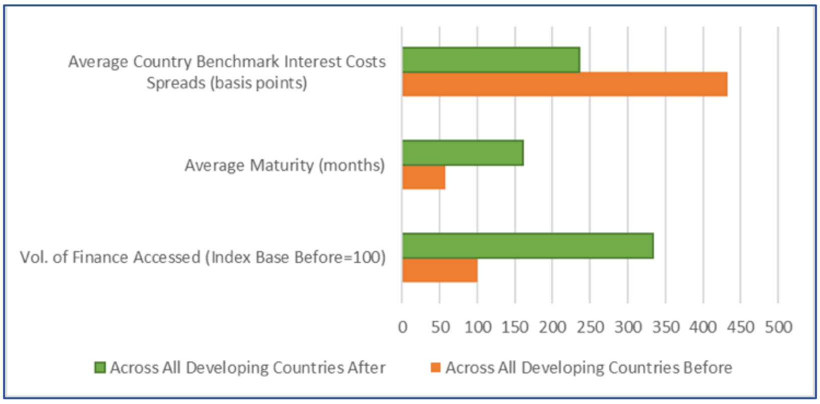


FIGURE 9 Illustrative Triple Effects of Global Sovereign Guarantees on Low-Carbon Portfolios-cum-Projects Financed Across Developing World: Lower Country Costs, Longer Maturities, Greater Access



In this paper, it is impossible to carry out an assessment of the 'grant-equivalents' of the GICF architecture that explicitly incorporates all the mechanisms shown on these graphs[35]. However, we will try and give potential orders of magnitude through a simple set of assumptions (see Annex C for primary data and more explicit justifications):

- an average of 10-year maturity loans

- pre-guarantee interest rates that add a spread function of the rating of countries by Moody's, S&P and Fitch for five classes of countries (A, BBB, BB, B, C and U) and a specific risk coefficient for projects to US treasury bond interest rates;

- post-guarantee interest rates combining a homogenous 50 bps reduction in banking fees and access for projects in a given country to the interest rates of countries rated at the next highest class (e.g. from BB to BBB)

- an upper limit to projects in A-rated emerging economies[36] with the remainder allocated in proportion to the percentage of the country's GDP or emissions in relation to those of all the countries.

Table 9 shows first that, subject to more precise investigation, the cash grant equivalent of the reduction in interest rates allowed by the GICF, between 66 and 157 annually on average, is potentially higher than the USD 50G annually promised at Copenhagen for mitigation activities. The Net Present value of these flows is between 49.8 and 91.2 USD billion assuming a 5% discount rate. Globally, the sum of the share, necessarily significant, of foreign direct investments (α.128 and α.303) and of the cash grant equivalent would quickly be able to ***fulfil the 'USD 100G and beyond commitment'*** in the Paris Agreement (para 53 Decision of the PA 1/CP.21).

[35]These trajectories do not indeed allow a distinction to be made between a) the different lifetimes of the projects and the specific interest of higher maturity loans and b) low-carbon investments that substitute for investments that would be made anyway and those that are additional to those that would be made in the absence of guarantees.

[36] A-rated emerging economies are countries like China, Singapore and OPEC countries that do not have the same type of financial constraints as most developing countries and will find the GICF facility attractive only for a minor proportion of their low-carbon investments, including the possibility of obtaining access to CRAs

TABLE 10: DISTRIBUTION OF CO2 EMISSIONS AND GDP OF G77 COUNTRIES ACROSS RATING GROUPS

Credit rating	Reduction in interest rate	Cash Grant Equivalent (CGE)		% of AA inv.*	% of Cash GE*
		299Bn AL	707 Bn AL		
A	-150	2	6	6%	4%
BBB	-202	19	45	40%	29%
BB	-287	11	27	26%	17%
B	-600	21	51	21%	32%
C and below	-750	12	28	7%	18%
Total Annual CGE		66	157		
Equity inflows		α.128	α.303		

*Excluding Cuba, Dem. Rep. of Korea, Iran, Syria, Venezuela
Source: author's computation on World Bank and Trading Economics data.

The total quantity of financial inflow is a necessary, but not sufficient, condition to create a cycle of confidence. Its distribution is important to ensure that investment in basic needs and adaptations is not crowded out in the most fragile countries. In the simulation results in Table 10, the problem is partially solved by limiting to 5% of the total low-carbon projects the share of GICF backed projects in the A-rated countries, which represent 55% of the GDP of the developing countries but 64% of the emissions. In fact, given their public finance capacity, they will be interested in the use of the GICF facility for only a fraction of their low-carbon investments.

Once excluded, because of the specifics of their geopolitical context, countries like Cuba, Democratic Rep. of Korea, Iran, Syria and Venezuela, that would be otherwise rated, allocating the remainder of the guarantees as a function of the share of the emissions level of the remaining countries (investment need are strictly proportional to the emissions level), leads to give 29% of the financial inflow to BBB countries, 17% to BB, 32% to B and 18% to C + unrated.

It is particularly noteworthy that category C receives a percentage (18%) of total cash grants higher than its percentage in annual loans (7%). This is because the spread reduction is higher for them than for the A and BBB countries that represent 46% of the loans backed by the GICF. Since the C+ unrated countries that currently have no access to formal capital markets for five- or ten-year projects, we used a 25% shadow interest rate in the baseline scenarios.

3.2.3 Conditions for maximising development co-benefits

There are two main means for the GICF to contribute directly to the satisfaction of basic needs and the improvement of adaptation capacities. The first is to ***transform those parts of projects targeted on basic needs into more 'marketable' activities*** (e.g. energy-efficient buildings, access to energy in rural areas, electrification of rickshaws, waste management) through 'bundling' small projects and experimenting with 'incubator models' for small and vulnerable countries to 'crowd-in' private investment. The second is the ***positive externality of enhancing infrastructure quantity and quality in terms of adaptation capabilities***. These co-benefits are almost impossible to quantify *ex-ante*, however, their amount will be highly dependent upon the rule we have just described to ensure that a percentage of the guarantees are targeted on basic needs and adaptation infrastructure in synergy with overseas aid mechanisms.

The second source of development co-benefits, the 'substitution effect' of guarantees, is indirect, but perhaps more powerful, more development agency funding and public cash grants becoming available for non-marketable sustainability objectives, as there is much less need for that funding and grants for mitigation investments. The ***'crowding in' of more private investment lowers the need for the direct funding of mitigation by the development agencies*** (some 80 percent of their resources currently) and allows for ***reallocation to straightforward grant-based adaptation support***, as expected from a 'pure public goods' approach. Most adaptation projects will require massively grant-aided financing, provided through funds such as the Adaptation Fund, but bilateral and multilateral agencies are preoccupied with supporting mitigation projects, which they should not normally have to do if the private sector takes over. Calculations in Annex C, table C.3 suggest that such reallocation could double the funding of adaptation, and possibly triple it for more vulnerable, low-income countries.

Finally, there may remain some scope for the GICF to devote a given amount of pre-commitments to adaptation investments. This is a matter of policy judgment in relation to three types of risk: **(a)** overloading the GICF with difficult discussions about the definition of adaptation **(b)** lowering the impact of the system on GHG emissions and c) distracting from the key challenge of reinforcing the quantitative and qualitative adequacy of overseas aid mechanisms in relation to adaptation issues.

Globally, the GICF will significantly improve the macro-economic stability and creditworthiness of the host countries. It could install additional mechanisms to reduce foreign exchange risk for private financing of long-term mitigation projects, by using some innovative mechanisms that compensate for foreign currency risks (borrowing in € or $ and providing guarantees for local currency bonds). It could also encourage savers in both developed and developing countries (sovereign wealth management funds) to re-inject their global portfolio investments into the 'safe-heavens' created by the GICF. Finally, in most cases, the macroeconomic ratings of host countries will also be improved by the greater inflow of foreign equity with no debt implications, lower borrowing costs of, longer repayment periods of debts, access to CRAs placed in the 'assets' column of their public accounts and, for fossil-fuel-importing economies, by reduction in their energy bills.

CRAs will be of particular interest to participating oil- and gas-exporting countries by giving them access to a new asset class, replacing the stranded assets that could lose about 38% of their value over the forthcoming decades (Mercure, 2018). This will help them to massively reinvest their export revenues and rents in environmentally-safe carbon-capture and storage capacities and more generally in economic diversification, thus breaking the classical 'resources curse' in which they are trapped.

3.3 Tangible benefits for developed countries, the global economy and the stability of the financial system

If the GICF is to include a significant number of OECD countries, it is critical that these countries obtain tangible benefits from it. These benefits are undeniable for the climate policies of these countries since massive reduction of emission trends in developing countries will reduce their domestic abatement efforts to meet a 2°C climate target. Without this 'where flexibility' they might resign themselves to global warming, given too short a window in which to invent acceptable negative growth development patterns that would be anyway useless given the emission trends in developing countries. One of the aims of the GICF is to avoid this outcome by clearing up the long-standing North/South misunderstandings about how to implement the principle of common but differentiated responsibility and ***fulfil the 'USD 100G and beyond commitment'*** (para 53 Decision of the PA 1/CP.21). It will create a context of confidence among stakeholders with respect to the efficacy of climate policies by hedging against the arbitrariness of such policies and against the suspicions of 'green-washing' by ODA and bond markets. It can ***also enhance the attractiveness and efficacy of explicit carbon pricing*** by increasing the amount of low-carbon investment that is economically viable for a given SVM price.

However, these arguments might not be adequate to convince climate-resigned policy makers who, under pressure from populations concerned about jobs, salary levels and safety, are prone to postpone climate action. The first argument is, paradoxically, the ***improvement in public finances*** since the gross public cost incurred by the GICF guarantee system will almost certainly be lower than the tax revenues yielded by the spill-over of successful projects into the donor's economy. Table 11 shows that if the MSGM option is chosen, an import content of between 2.83% and 3.72% of project costs would be enough to offset the public cost of guarantees, far lower than the export levels recorded for development projects. The second related argument is obviously the opening up of new markets and ***job creation*** in guarantor countries.

TABLE 11: PERCENTAGE OF IMPORTS IN LCIS TO OFFSET GUARANTOR'S PUBLIC COSTS (IN %) 428

Annual LCIs	428		1 010	
Investment pathway	Linear	Exp. A	Linear	Exp. A
DGM	9.29	10.05	9.27	10.04
MSGM yearly paid-in	3.49	3.72	3.48	3.72
MSGM up-front paid-in	2.83	3.12	2.82	3.12

More generally, the GICF is an attempt to "*regain power over money to serve the common good*" (B. Badré 2019) and to reduce ***the 'tragedy of the horizon'*** that weakens our financial systems. It provides an opportunity to demonstrate that, far from being a burden, climate policies can lead to gains in trust and reciprocity (Orstrom et al 2005) and ***reduce the gap between the propensity to save and the propensity to invest in productive assets***, which is one of the 'fault lines' of, and sources of tensions in, the global economy.

Conclusion

This Study has proposed the design of a sovereign guarantee mechanism to be established by a Group of Initiatives for Climate Finance (GICF), as early as 2020, to trigger a wave of low-carbon sustainable investments in developing countries which would help achieve development paths compatible with the global 2°C (or below) objectives and the INDCs contained in the Paris Agreement.

The cornerstone of this architecture, sketched in Figure 10, is political commitment between ***a set of developed and developing countries,*** the former agreeing ***to issue sovereign guarantees*** for low-carbon projects, the latter accepting to host these projects and to create a business environment facilitating their success (legal framework, public investment, feed-in tariffs and domestic public guarantees). We have demonstrated what key parameters are required to maximize ***the efficiency of the use of public money*** (well calibrated SVMAs, uncertainty coefficient to determine the level of guarantee, the level of default rates, the multiplier effect between risk provision and the volume of funded projects and the creation of formal ***Climate Remediation Assets***).

We have identified seven 'value-propositions', which strongly justify the establishment of a Multi-Country Sovereign Guarantee Mechanism (MSGM) as an operational arm of the GICF:

(1) Enable the constrained public finances from developed countries to have a ***much bigger impact*** than the current forms of public assistance to low-carbon investment in developing countries to meet the objectives of the Paris Agreement. The key is the ***multiplicative factor of guarantees***, the impact of one dollar of public resources on triggering private climate investment;

(2) Provide ***much greater cost advantages to low-carbon projects, de-risking them*** through the impact of guarantees on: **(a)** lower interest rates/spreads; **(b)** longer maturity; and **(c)** access to larger volumes of institutional finance (that are now deterred by a high perception of risk);

(3) Introduce scientifically-based, ***transparent project selection and a shared evaluation criteria, the social value of mitigation activities (SVMAs)***, rather than the current 'ad-hoc' and trend-following practices of picking and choosing projects; and establish a strong institutional basis for ***a new class of carbon remediation assets (CRAs)*** to improve market investment opportunities;

(4) Improve the ***performance of enabling policies by host developing countries***, by establishing incentives and mutual policy support mechanisms that encourage them to perform better;

(5) Generate ***benefits to partner developed countries***, in terms of bigger 'export' opportunities with respect to these projects, and in lower costs to public finances in delivering their climate finance commitments (in 'grant equivalent terms') that might otherwise be unattainable,

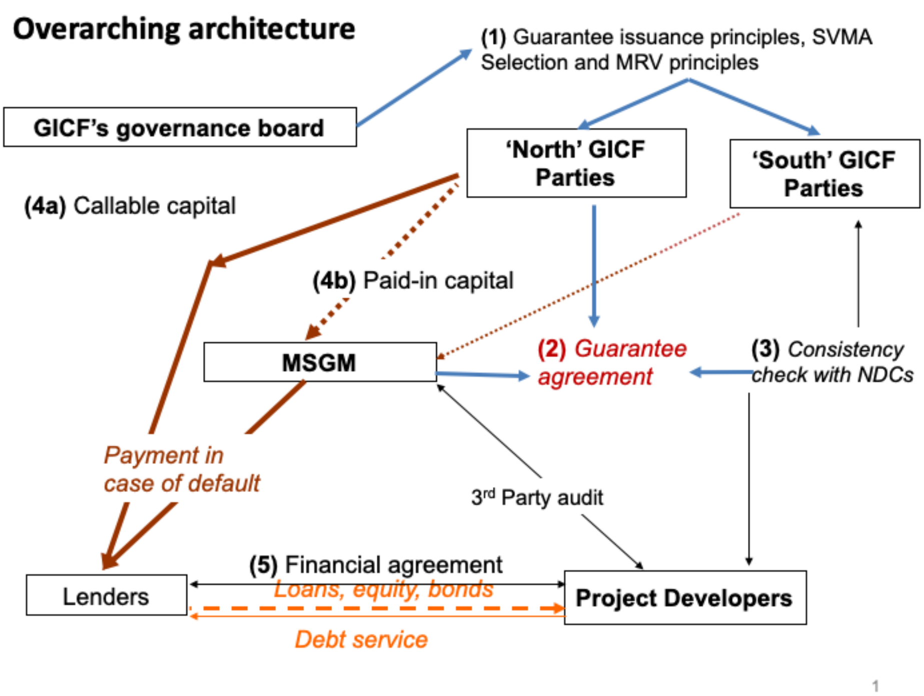
(6) Release, through greater flows of ***grant-based public climate funding for adaptation investments*** (and loss and damages) projects that are 'pure' public goods, especially in the most vulnerable, poor and economically-fragile countries;

(7) *Manage the risks involved in sovereign guarantee mechanisms*, by choosing the right institutional structures, preferable a Multi Sovereign Guarantee Mechanism (MSGM) with clear risk-management practices, that draw on real-world experience of successfully operating guarantees.

We have demonstrated the capacity of the system to massively reallocate global savings to low-carbon infrastructure and to support ***a new form of 'where flexibility' that would turn the heterogeneity of the real world into an opportunity*** whereas that very heterogeneity has proved to be a major obstacle to the universal carbon price expected from a Kyoto-type framework. AAA rated guarantees would indeed create safe havens for emissions abatements that are cheaper than the prices set by developed countries (the world SVMA) and too costly for the host countries.

To achieve this 'where flexibility', it is the responsibility of the GICF governance board to adopt ***key management rules*** of the system ((1) in Fig 10) concerning the volume of guarantees, the provisions for default risks, the paid-in capital in an MSGM, a third-party selection process and MRV, a pathway for the world social values of mitigation per avoided ton of carbon emissions to calculate the world SVMAs, domestic pathways for these values to calculate the national SVMAs possibly used by developing countries and a minimal percentage of guarantees dedicated to basic needs.

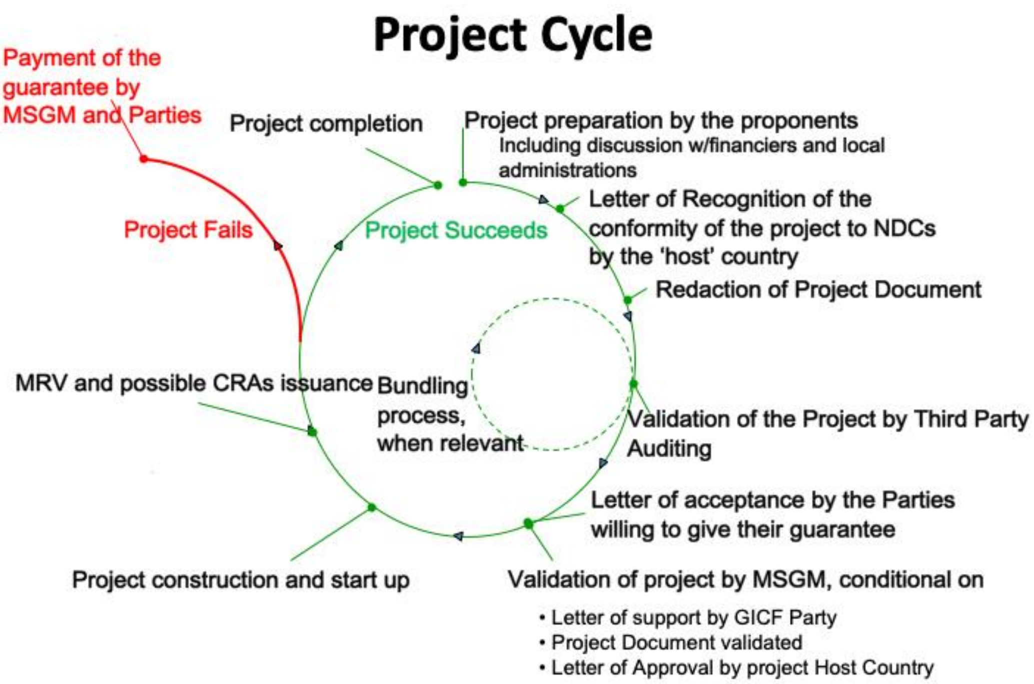
FIGURE 10



The next step in Figure 10 is a guarantee agreement (2) that includes **(a)** recognition by the host country that the ***project conforms to its NDCs*** (3) and **(b)** the commitment by guarantor countries to a paid-in capital to the MSGM (4b) and to ***an amount of callable capital*** in case of project failure (4a). The last step is financial agreements (5) that give project developers access to capital markets at low interest rates and involve new investors attracted by a project with public guarantees.

The condition for success is, within strategic guidelines adopted by the GICF, to ***protect the project cycle from political and economic lobbying interference thanks to a high level of professionalism and to systematic recourse to Third Party auditing***. Figure 10 shows the sequence of interventions by the main stakeholders in the project: the proponents, recognition by the host country government, assessment by the Third-Party auditing body, validation by the MSGM, acceptance by the guarantor country and the issuance of climate remediation assets (CRAs). One key intermediate step is the possibility of bundling small scale projects through project platforms recognized by the MSGM.

FIGURE 11



The urgency of launching a Sovereign Guarantee Design Lab (SGDL)

This type of architecture cannot be launched without precise definition of some of its key parameters and intellectual adhesion to its institutional design by key stakeholders. On challenge is to understand better the operational conditions to be meet for delivering a real fulcrum for innovative designs such as the integrated approach proposed by the Solar Risk Mitigation Initiative (SRMI) to overcome barriers to solar energy in low income countries.[37] This normally requires a long maturation time but time is against us if the Paris Agreement objectives are to be met. However, this maturation time could be reduced by launching a **Sovereign Guarantee Design Lab (SGDL)** to test the implementation issues associated with the proposed architecture using 8-10 full-scale case studies. These studies should be selected from proposals made by potential partners in the GICF and from existing initiatives such as the Solar Alliance (ISA) and the Africa Renewable Energy Initiative (AREI). It should The SGDL's mission should be to ***provide operational guidance*** to the GICF in order to:

(a) ***maximise the 'multiplicative factor'*** (volume of projects in relation to the size of the guarantee provisions) with respect to traditional forms of public support. This encompasses the interplays between **a)** the efficiency of de-risking **b)** the capacity to attract at-scale private sector financing in various sectors and countries (category A, B and C and unrated economies) and **c)** the dynamics of capital accumulation in an MSGM;

(b) ***reduce project transaction costs and maximise their expected additionality*** through standardised rules for the selection and MRV processes, bundling small and medium-sized projects and systematic Third-Party Auditing backed by available peer-reviewed forward-looking modelling exercises and specialized scientific expertise;

(c) ***reduce financing costs*** for low-carbon projects (spreads and interest rates of at least 250 basis points lower, longer maturity of at least 10 years, and access to greater volumes of financing, compared to alternative market financing mechanisms) and dialogue with the key financial intermediaries (banks, insurance companies, asset managers, rating agencies);

(d) ***link the size of sovereign guarantees to social values of mitigation actions (SVMAs)*** agreed between host countries and partner countries to cover between 40 and 70 percent of the total financing cost on the basis of the percentage of funds obtained from bank borrowing and the percentage obtained from equity financing (project sponsors and new shareholders);

(e) ***provide assessment and application to projects that form part of global and domestic SVMA pathways*** based on existing scientific literature and complementary analysis by independent economic analysts. These SVMAs encompass avoided costs of carbon per ton and the value of associated social gains to the recipient country in terms of SDG parameters, based on available scientific guidance from other similar projects in similar settings and sectors;

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[37] https://www.afd.fr/fr/la-banque-mondiale-et-lagence-francaise-de-developpement-sengagent-pour-reduire-les-risques-lies-au-deploiement-mondial-de-lenergie-solaire. Obviously, we cannot quote here all the ongoing initiatives taken in this direction, for example, in collaboration with the Climate Policy Initiative (CPI). https://climatepolicyinitiative.org/climate-finance/

(f) ***Issue Carbon Remediation Assets*** with real tradeable values after adequate measurement of the carbon reduction benefits and the introduction of an *ex-post* verification scheme showing that results meet expectations. One related question is how this new class of assets, recognized by capital markets, influences the re-direction of savings, the creditworthiness of the host and guarantor countries and the capacity of regions and countries to diversify their economies, currently based on the exploitation of fossil fuels;

(g) ***help host countries to implement policies, introduced at project inception and design stages, that maximize the chances of projects succeeding*** and development benefits being achieved for the country, with specific attention being paid to arrangements to be put into place to meet the basic needs of fragile regions and countries;

(h) ***assess the potential gains in terms of growth, employment, social, fiscal and balance of payments impacts*** for both the host developing countries and the supporting partner countries, through the consideration of induced general equilibrium effects;

(i) ***demonstrate,*** for all projects, ***the overall carbon mitigation technology, innovation, risk-sharing, social and feasibility impacts in the presence of sovereign guarantees***, compared to the impacts that would be achieved without those guarantees, thus justifying their use.

This programme should be conducted over a two-year period, with initial results available after one year, in order to support the launch of the first pilot GICF in 2020, with two years of scientific support to assess the deployment of the initiatives. It should provide support for discussions between experts from GICF country representatives and key stakeholders from the financial system (MDBs, DB, EIB, rating agencies) about the governance and institutional arrangements likely to ensure that the GICF really will be a fulcrum for existing organisations to work synergistically and scale up their capacity to contribute to sustainable low-carbon development.

Annexes

with the cooperation of

Frédéric GHERSI researcher CNRS at CIRED

ANNEX A. From modelling results to investment trajectories

The investment paths retained in this study are derived from assessments coming from three main sources after harmonizing their metrics: an ensemble of scenarios provided by four integrated assessment models (AIM, MESSAGE, POLES and REMIND) carried out the EU project CD-Links, scenarios from the International Energy Agency (IEA, 2016) and from the OECD (2016). Table A.1 synthesizes the primary results we used for the 2°C target. This table gives the assessments of the mean value of each group of study for the baselines, NDCs (Nationally Determined Contributions) scenarios and 1°5C target scenarios before giving the values retained in this report and that are reproduced in the table 1 pf chapter 1. It gives also the consolidated values retained in this report.

TABLE A.1 AVERAGE ANNUALISED MITIGATION INVESTMENTS OVER 2015–2035 IN TRILLION USD AT MARKET EXCHANGE RATES 2017)

	Energy investments	Of which demand side	Transport	Total	Ratio to MER GDP
IAM Baseline (mean)	1.96	0.24		1.96	1.8%
IAM NDC (mean)	2.04	0.28		2.04	1.9%
IAM 2°C (mean)	2.19	0.38		2.19	2.1%
IAM 1.5°C (mean)	2.32	0.45		2.32	2.2%
IEA NDC	*2.40*	*0.72*	*0.35*	*2.40*	2.3%
IEA 1.5°C	*2.76*	*1.13*	*0.55*	*2.76*	2.7%
Mean IAM-IEA, 1.5°C	**2.38**	**0.54**		**2.38**	**2.53%**
Min IAM-IEA, 1.5°C	1.38	0.38		1.38	1.6%
Max IAM-IEA, 1.5°C	3.25	1.13		3.25	4.0%
OECD Baseline	*1.91*	*0.36*	*2.46*	*5.74*	1,36%
OECD 2°C	*2.13*	*0.40*	*2.73*	*6.38*	4.7%
Consolidated value (mean)	<2.45		*2.78*	<5.24	<4.4%
Consolidated value (min)	2.0		*2.78*	4.79	3.6%
Consolidated value (max)	<3.10		*2.78*	<5.89	<5.1%
Incremental inv (mean)	<0.42		*0.28*	<0.70	<0.6%
Incremental inv (min)	0.17		*0.28*	0.45	0.3%
Incremental inv (max)	<0.79		*0.28*	<1.07	<0.9%

To derive the global financial challenge raised by these figures, table A2 gives the needed investments from private funds and compare them to the financial capacities of the total current private finance capital stock and its yearly revenues. The major uncertainty concerns the share of these investments that should be covered by private funds. In the main text of this study we give the reasons why we retained a fifty/fifty rule between the public and private funds in the core exercise. In this annex, we give the results for this mean value and for a 30% lower bound of investments from the public sector and a 60% higher bound which leads to 70% and 40% for the high and low bounds of the private investments. The annual of capital income has been calculated assuming that it grows as the GDP and for two hypothesis on returns: 3,4% per year that corresponds to the observed actual returns post 2008 financial crisis and the 5% that correspond to the long term observed trend.

TABLE A.2

Ratio of world LCIs to world capital income				
Rate of return	3,40%		5%	
	Low LCIs	High LCIs	Low LCIs	High LCIs
Low bound	3,20%	7,70%	2,20%	5,20%
Mean value	4%	9,40%	2,70%	6,40%
High value	5,70%	13,40%	3,90%	9,10%

The economic and political acceptability of the launching phase of the GICF is the amount of guarantees over the first years during which the efficiency of the system has to be demonstrated to make the scaling up attractive for both developed and developing countries. Given their concern about the implications of the system for their public budgets, or simply for internal political constraints, the guarantor countries might choose to start with low commitments and to scale-up them later, as cost of a lower international credibility effect. This is a matter of policy judgments and figure A1 translates, for the low and high investment paths, the average annual investment in developing countries (63% of the world total) into three annual investment trajectories achieving over two decades, the same amount of LCIs:

- a linear trajectory that considers a constant increase of the volume of LCIs every year from I_1 at year 1 (Y1) to I_{20} at year 20 (Y20). The value of I_1 is calculated such that, $I_t = I_1 + (t-1)(I_a/10)$ with I_a standing for the average investment over the period.
- Two exponential trajectories with investments growing at constant growth rates starting from two arbitrary values of I_1. In 'Exp A' the average investment during the first period (Y1 to Y5) is set at 20% of the average investment from Y1 to Y20; it leads to growth rate of investment of 17.76% (numerically solved). In 'Exp. B', the same ratio is set at 33%, and the growth rate of investments is 12.69%.

In the main text of the report, we selected, for simplicity sake, the linear path that implies the lowest first period commitments and the Exp A paths that implies the highest one

FIGURE A.1 ALTERNATIVE SCALING UP PATHS: LOW BOUNDS OF LCIS

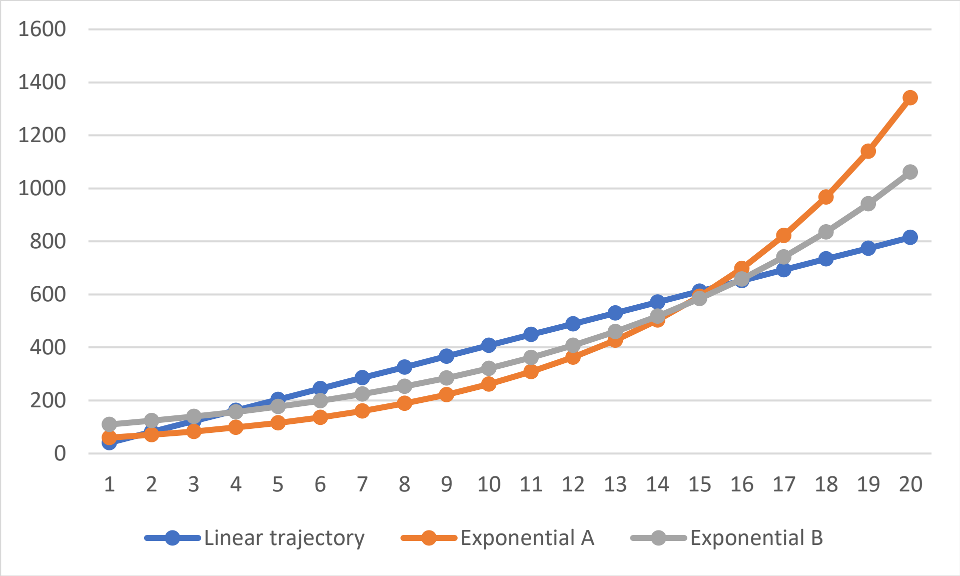
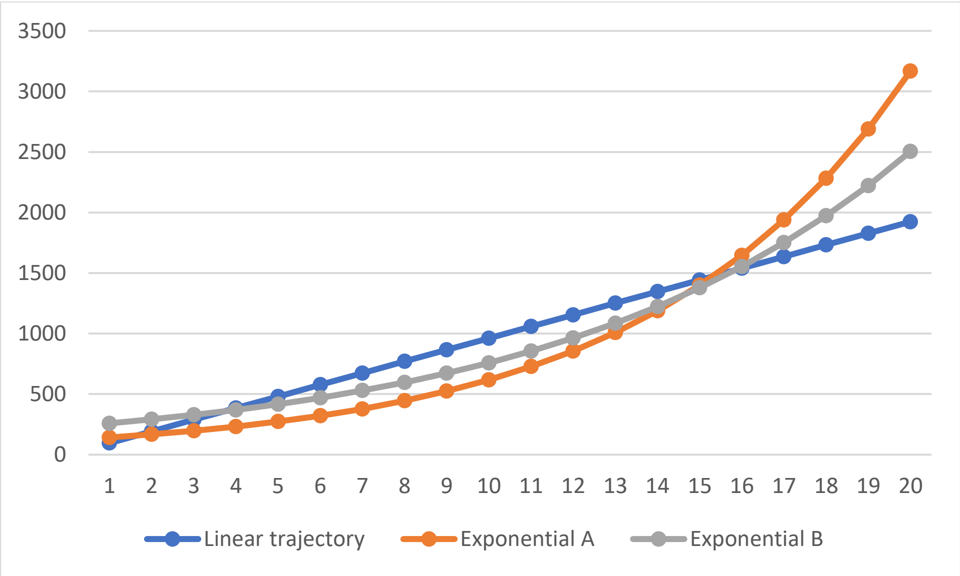


FIGURE A.2 ALTERNATIVE SCALING UP PATHS: HIGH BOUNDS OF LCIS



ANNEX B. From investment trajectories to public guarantees

This annex explains how we translated the investment trajectories into guarantee amounts and the resulting public costs. To facilitate exposition, we take the only example of linearly growing pre-commitment pathways for the low and high bounds of investment needs. Results for the two exponential investment chronograms and sensitivity tests can be consulted in this link.

We successively examine:

- A benchmark fixed coefficient case (FCC) with no default rates but a) constant risk perception leading to a 1/4 ratio of Net Guarantee Capital to GICF Guarantee throughout our 20-year horizon and b) constant effective multipliers of 5.7 in the DGM case and 16.3 in the two MSGM cases (see Table 5, section 2.3.4). This case is obviously unrealistic (constant risk perception with no default rates) but is a benchmark that helps, compared to the realistic cases, to disentangle the differences coming from the pure definition of the institutional setting of the GICF from those coming various assumptions about the investment chronograms, the default rates and the risk perception.
- An evolving coefficient case (ECC) with linearly decreasing expected default rates (from 10% to 2%) and risk perceptions (leading to decrease the ratio of Net Guarantee Capital to GICF Guarantee from 1/4 to 1/10)

In both cases the risk provision for one amount of guarantee is lowered in t+1 by 60% of its value in t to account for quickly diminishing risk perception of the projects as they follow correctly their anticipated schedule during the first years of their launching.

The benchmark FCC cases

In this FCC cases, the results for the DGM mechanisms are easy to understand: the total increase of Guarantee Capital is equal to the division of each year's investment by the multiplier (line B) and since there is no payment for defaults a) the cumulated guarantee capital in t+n is the sum of these amounts from t0 to t+n (line C) and is equal the net-of-default Guarantee Capital b) the cumulated public cost (line D) in strictly equal to the outstanding risk provisions that correspond to the gross guarantee capital trajectory.

In a MSGM mechanism, the calculation of the public cost is less straightforward. First, the total mobilized guarantee capital at a given year is the sum of the annual revenues of MSGM capital with a 7% return (line F), of a paid-in equity in the MSGM (line B) and a callable capital (line H) that appears of the book of the guarantor. Second a guarantee charge is levied, set at 0.5% of the guarantees under the assumption that the guarantees are 70% of the loans that themselves are 70% of the projects (line D). The total new guarantee capital to be provided at 't' is thus the same as in the DGM minus the revenues of the capital of the MSGM at "t" and is equally divided by in a paid-in and a callable capital. The capital of the MSGM is the sum of its capital at "t-1" plus the paid-in at "t" plus its capital revenues minus the guarantee charge. The cumulated provision of callable capital is the sum of the yearly amounts of callable capital with an annual depreciation at a constant 60% rate, which shrinks any provision to 7% its initial value after 5 years (line K). In the absence of default, the gross cumulated public cost (line M) for the guarantor is equal to this cumulated provision.

There are two options in the MSGM, a yearly paid-in and an up-front paid-in, the later leading to more cumulated interest rates that increase more quickly the capital of the MSGM and decrease the need for total guarantee capital. But there is no reason why the callable share of this capital would be given upfront (it represents a charge for public budgets and yields no returns). For simplicity sake we assumed that it follows the same trajectory as in the yearly paid-in variant minus 50% of the yearly interest rate of the MSGM capital.

The ECC variants

The main difference between the benchmark and the EEC variants is the introduction of defaults rates that decrease over time and of decreasing risk-perceptions. Compared to the benchmark, the first parameter will increase the need of total guarantee capital, especially over the short term, to fund projects in replacement of the failed ones in order to achieve the same climawhile the second will decrease this need in function the increase of the multiplier coefficient.

In the DGM case table B2, these modifications lead to introduce a line B for the default rates and E for the multiplier coefficient. The calculation of the total needs of guarantee capital in line E then applies the multiplier to the sum of the called guarantees and the guaranteed needed to back the project investments of the year. This obviously changes the results in lines F, G, and H that report results for the cumulated capital and the cumulated public liability.

In the MSGM cases table B3, 50% of amount of investments in default (line X) is added to the paid-in capital (line B) and 50% to the called capital (line J). This changes the amount of guarantee charge, the cumulated MSGM capital, the cumulated public provision and the cumulated public cost, i.e. the cumulated liability on the books of the guarantor

TABLE B.1 PUBLIC COST OF GUARANTEE UNDER DGM FOR A LINEARLY GROWING INVESTMENT AVERAGING USD 428 B, NO DEFAULT, CONSTANT MULTIPLIER A=5,7

Annual DGM chronogram	Y1	Y2	Y3	Y4	Y5	Y10	Y15	Y20
A. Total project investment	40,8	81,5	122,3	163,0	203,8	407,6	611,4	815,2
B. Guarantee capital	7,1	14,3	21,4	28,5	35,7	71,3	107,0	142,7
C. Guarantee capital net of default	7,1	14,3	21,4	28,5	35,7	71,3	107,0	142,7
D. Outstanding risk provision (= 60% Dt-1 + Bt)	7,1	18,5	32,5	48,1	64,5	151,7	240,8	329,9
E. Cumulated public cost	7,1	18,5	32,5	48,1	64,5	151,7	240,8	329,9

[a] The chronogram described here backs investment of column 1 in Table 8, DGM case

TABLE B.2 PUBLIC COST OF GUARANTEE UNDER MSGM WITH ANNUAL PAID-IN FOR A LINEARLY GROWING INVESTMENT AVERAGING USD 544 B, NO DEFAULT, CONSTANT MULTIPLIER [A]

Annual MSGM chronogram	Y1	Y2	Y3	Y4	Y5	Y10	Y 15	Y20
A. Total project investment	40,8	81,5	122,3	163,0	203,8	407,6	611,4	815,2
B. Paid-in Equity Capital (= At / 16.3 + 50% Ft-1)	2,5	4,9	7,2	9,5	11,6	20,8	27,2	30,1
C. Called paid-in (no default)	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
D. Guarantee charge (= 0.5% 70% 70% A)	0,1	0,2	0,3	0,4	0,5	1,0	1,5	2,0
E. Paid-in Equity Capital net of default and guarantee charge (= B - C - D)	2,4	4,7	6,9	9,1	11,1	19,8	25,7	28,1
F. Annual interest (= 7% (Et + Gt-1))	0,2	0,5	1,0	1,7	2,6	10,3	23,8	44,4
G. Cumulated MSGM capital (= Gt-1 + Et + Ft)	2,6	7,8	15,7	26,6	40,3	157,0	364,2	679,2
H. Callable Capital (= B)	2,5	4,9	7,2	9,5	11,6	20,8	27,2	30,1
I. Cumulated provision on Callable Capital (= 60% It-1 + Ht)	2,5	6,4	11,1	16,1	21,3	45,4	63,4	73,3
J. Called Capital (no default)	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
K. Cumulated public provision (= 60% Kt-1 + Ht - Jt)	2,5	6,4	11,1	16,1	21,3	45,4	63,4	73,3
L. Cumulated called Capital (= Lt-1 + Jt)	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
M. Cumulated public cost (= Kt + Lt)	2,5	6,4	11,1	16,1	21,3	45,4	63,4	73,3

[a] [a] The chronogram described here backs investment of column 1 in Table 8, MSGM with yearly paid-in case.

The Gross Paid-in Equity Capital therefore increases at a slower pace than the ratio of investment to the **Multiplier.** By contrast, the Callable Equity Capital remains strictly equal to the ratio of investment and the MSGM Multiplier over the entire time horizon. The consequence of accounting is thus that the Callable Capital need increasingly less Paid-in Capital from public funds. In the absence of default, the Called Paid-in is nil and the Net Paid equals the Gross Paid-in as well.

The cumulated MSGM capital grows with the successive Paid-ins and compounded interests. The critical point is that, a few years after the launch of a project, its risk coefficient decreases quickly because it turns out to be considered as 'safe'. This is why the cumulated provision on Callable Capital sums up the yearly Callable Capital guarantees with an annual depreciation at a constant 60% rate. It is, in this zero default assumption equal to the Cumulated public provision.

The MSGM with upfront option anticipates paid-ins by five-year periods, every 5 years from Y1 on (Table B.3). This allows increasing the share of the MSGM guarantee accruing from returns on the Cumulated MSGM Capital. We numerically calibrate upfront payments by assuming that the Cumulated MSGM Capital reaches identical levels at the end of each 5-year period, under either the upfront or the annual paid-in option. We also assume that the Callable Capital share of the guarantee follows the same path as it does under annual paid-in.

TABLE B.3 PUBLIC COST OF GUARANTEE UNDER MSGM FOR A LINEARLY GROWING INVESTMENT AVERAGING USD 428 B, NO DEFAULT, CONSTANT MULTIPLIER A=16.3[A]

Annual chronogram of MSGM with upfront paid-in	Y1	Y2	Y3	Y4	Y5	Y 10	Y15	Y 20
A. Total project investment	40,8	81,5	122,3	163,0	203,8	407,6	611,4	815,2
B. MSGM capital increase	32,7							
C. Called MSGM payments	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
D. Guarantee charge (= 0.5% 70% 70% A)	0,1	0,2	0,3	0,4	0,5	1,0	1,5	2,0
E. Paid-in Equity Capital net of default and guarantee charge (= B - C - D)	30,6	-0,2	-0,3	-0,4	-0,5	-1,0	-1,5	-2,0
F. Annual interest (= 7% (Et + Gt-1))	2,1	2,3	2,4	2,6	2,7	10,7	24,4	45,1
G. Cumulated MSGM capital (= Gt-1 + Et + Ft)	32,7	34,8	36,9	39,1	41,3	163,8	373,6	689,8
H. Callable Capital (= B)	1,4	3,8	6,0	8,2	10,3	15,5	14,9	7,5
I. Cumulated provision on Callable Capital (= 60% It-1 + Ht)	1,4	4,6	8,8	13,5	18,3	33,6	36,1	22,5
J. Called guarantors payments	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
K. Outstanding risk provision (= 60% Kt-1 + Ht - Jt)	1,4	4,6	8,8	13,5	18,3	33,6	36,1	22,5
L. Cumulated guarantors payment (= Lt-1 + Jt)	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
M. Cumulated public cost (= Kt + Lt)	1,4	4,6	8,8	13,5	18,3	33,6	36,1	22,5

[a]The chronogram is that backing column 1 of Table 8, MSGM with upfront paid-in case.

[b]The Cumulated MSGM Capital at the end of year 5 is set at its level under the MSGM with annual paid-in

TABLE B.4 PUBLIC COST OF GUARANTEE UNDER DGM FOR A LINEARLY GROWING INVESTMENT AVERAGING USD 544 B, linearly decreasing default and Multiplier [a]

Annual DGM chronogram	Y1	Y2	Y3	Y4	Y5	Y 10	Y15	Y 20
A. Total project investment	40,8	81,5	122,3	163,0	203,8	407,6	611,4	815,2
B. Investment in default (=d * A)	4,1	7,8	11,2	14,2	16,9	25,3	25,1	16,3
C. Called guarantee (=0.7*0.7 B)	2,0	3,8	5,5	7,0	8,3	12,4	12,3	8,0
D. Cumulated called guarantee (= D_{t-1} + C_t)	2,0	5,8	11,3	18,3	26,6	82,1	145,5	195,7
E. Guarantee capital (= (A_t+B_t-1)/m)	7,1	14,5	21,3	27,6	33,3	54,1	62,2	58,4
F. Guarantee capital net of default (= E - C)	5,1	10,7	15,8	20,6	25,0	41,7	49,9	50,4
G. Outstanding risk provision (=0.6 * G_t-1+ F_t)	5,1	13,8	24,1	35,1	46,1	92,6	122,1	126,2
H. Cumulated public cost (= D + G)	7,1	19,6	35,4	53,4	72,7	174,7	279,4	321,9

[a]The chronogram is that backing column 1 of Table 9, DGM case.

TABLE B.5 PUBLIC COST OF GUARANTEE UNDER MSGM FOR A LINEARLY GROWING INVESTMENT AVERAGING USD 428 B

Annual DGM chronogram	Y1	Y2	Y3	Y4	Y5	Y 10	Y15	Y 20
A. Total project investment	40,8	81,5	122,3	163,0	203,8	407,6	611,4	815,2
B. Investment in default (= d * A)	4,1	7,8	11,2	14,2	16,9	25,3	25,1	16,3
C. Called guarantee (=0.7*0.7 * B)	2,0	3,8	5,5	7,0	8,3	12,4	12,3	8,0
D. Cumulative guarantee needs (= D_{t-1} + 0.7*0.7 (A+B))	2,0	5,8	11,3	18,3	26,6	82,1	145,5	195,7
E. Paid-in (= (A_t+B_t-1) / m -0.5* F_t-1)	2,5	5,0	7,3	9,3	11,1	16,6	16,6	11,6
F. Called MSGM payments (= °0.5 *Y)	1,0	1,9	2,7	3,5	4,2	6,2	6,1	4,0
G. Guarantee charge (= 0.5*0.7*0.7* (A_t+B_t-1))	0,1	0,2	0,3	0,4	0,5	1,1	1,6	2,0
H. MSGM Capital increase (= E - F - G)	1,4	2,9	4,2	5,4	6,5	9,4	8,9	5,6
I. Annual interest (= 0.07 * (G_t + J_{t-1}))	0,1	0,3	0,6	1,1	1,6	5,6	11,6	19,2
J. MSGM capital (= J_{t-1} + H_t + I_t)	1,5	4,7	9,6	16,1	24,1	85,6	177,7	293,8
K. Callable Capital (= B)	2,5	5,0	7,3	9,3	11,1	16,6	16,6	11,6
L. Called guarantors payments (= 0.5 * C)	1,0	1,9	2,7	3,5	4,2	6,2	6,1	4,0
M. Outstanding risk provision (= 0.6 * M_t-1 + K_t - L_t)	1,5	4,0	7,0	10,0	13,0	23,8	26,4	21,4
N. Cumulative public cost (= M_t *somme(L_0 ; L_t)	2,5	6,9	12,6	19,2	26,3	64,8	99,1	119,3

TABLE B.6 PUBLIC COST OF GUARANTEE UNDER MSGM WITH ANNUAL PAID-IN FOR A LINEARLY GROWING INVESTMENT AVERAGING USD 428 B, LINEARLY DECREASING DEFAULT AND MULTIPLIER[A]

Annual DGM chronogram	Y1	Y2	Y3	Y4	Y5	Y 10	Y15	Y 20
A. Total project investment	40,8	81,5	122,3	163,0	203,8	407,6	611,4	815,2
B. Investment in default (= d * A)	4,1	7,8	11,2	14,2	16,9	25,3	25,1	16,3
C. Called guarantee (=0.7*0.7*B)	2,0	3,8	5,5	7,0	8,3	12,4	12,3	8,0
D. Cumulative guarantee needs (= D_{t-1} + 0.7*0.7 * (A+B))	2,0	5,8	11,3	18,3	26,6	82,1	145,5	195,7
E. Paid-in (= (A_t+B_t-1) / m – 0.5* F_t-1)	30,4	0,000	0,000	0,000	0,000	0,000	0,000	0,000
F. Called MSGM payments (= 0.5* Y)	1,0	1,9	2,7	3,5	4,2	6,2	6,1	4,0
G. Guarantee charge (= 0.5*0.7*0.7* (A_t+B_t-1))	0,1	0,2	0,3	0,4	0,5	1,1	1,6	2,0
H. MSGM Capital increase (= E - F - G)	29,3	-2,1	-3,1	-3,9	-4,7	-7,3	-7,7	-6,0
I. Annual interest (=0.07 * (G_t + J_{t-1}))	2,1	2,0	2,0	1,8	1,6	6,0	12,0	19,5
J. MSGM capital (= J_{t-1} + H_t + I_t)	31,4	31,3	30,2	28,1	25,1	91,3	183,8	298,4
K. Callable Capital (= B)	1,5	4,0	6,3	8,4	10,3	13,6	10,6	1,9
L. Called guarantors payments (= 0.5 * C)	1,0	1,9	2,7	3,5	4,2	6,2	6,1	4,0
M. Outstanding risk provision (= 0.6 * M_t-1 + K_t - L_t)	0,5	2,4	5,0	7,9	10,9	16,7	12,3	-1,2
N. Cumulative public cost (= M_t * somme(L_0 ; L_t)	1,5	5,3	10,7	17,1	24,2	57,7	85,1	96,7

[a] The chronogram is that backing column 1 of Table 9, MSGM with upfront paid-in case.

[b] The Cumulated MSGM Capital at the end of year 5 is set at its level under the MSGM with annual paid-in, see

ANNEX C. Computing the cash-grant equivalent of guarantees

The cash-grant equivalent of sovereign guaranties results first from a leftward oriented move within figure 12 of the rating of the low carbon projects with a very sharp reduction of low rated projects.

Tables C.1 and C.2 illustrate numerical the first move within countries and cross-borders through a very simple example and sums up their combined effect in terms of distribution of ratings with and without guarantees. In table C1, amongst the 40 unrated projects before the guarantees, only five remain unrated and, amongst 74 projects below a B rating, hence without financial access (Fin Access), only 17 remain in this situation. The financial access is easier for AAA projects (5 units per projects) but the improvement of the rating decreases in function of the rating grade: 2 units for A projects and only 0,25 for BB projects. The number of projects having access of finances passing from 26 to 83 projects this allows to increase the volume of finance from 34 to 126,75. The same reasoning applies for maturity. We adopted 20 years for AAA projects, 15 years for AA projects and 3 only for BB projects. Assumptions about the spreads of interest rates (200 bp, 250 bp, 300 bp and 500 bp for AAA, AA, BBB and BB projects respectively) then allows for calculating the reduction of the volume of spreads of interest rates allowed for by the guarantees. The same reasoning applies in table C.2 for the cross-border LCIs. These moves combine with a better access to higher maturity loans to deliver the reduction of the credit costs within-countries and across countries given in table C.3. and C.4., together with a higher access to finance.

Passing from the hereabove numerical illustrations to the order of magnitude of the cash grant equivalent of guarantees backing the LCIs scenarios analyzed in this report demands some simplification, primarily because we cannot make a reasonable approximation of the within countries and cross-borders rating moves.

We then used the current spread differences with the US treasury yield curve for loans of five, ten and fifteen years depending upon the rating of the countries as they appear in existing data. We then aggregated countries in five credit rating groups following the Standard & Poors' notations reported by Trading Economics on October 8th, 2018. The five groups simply merge the plus, central and minus nuances of A, B, BB and BBB notations, and consider all other countries, rated or not, as "C and below". Then, on the basis of data of table C.4 on the lending charges per type of country and of loan maturity to calibrate the spread reduction to retain for the calculation of the grant equivalents.

We did so through a very simple rule: for all countries, the fees reduction is 250 bps for BBB, BB and B categories the spread reduction has calculated on the basis of the access, for a 10 years loan, to rolling five years loans at an interest rate of the superior category (for example from BB to BBB. For A countries, the spread reduction has been arbitrarily set at 100 bps. For C countries we retained the difference between the shadow interest rates (20%) for five years loans that are inexistent currently on the formal markets and the interest rate of the BBB category.

FIGURE 12: LOWERING RISK ILLUSTRATIVE EFFECTS OF SOVEREIGN GUARANTEES ON CREDIT RATINGS OF LOW-CARBON PROJECTS

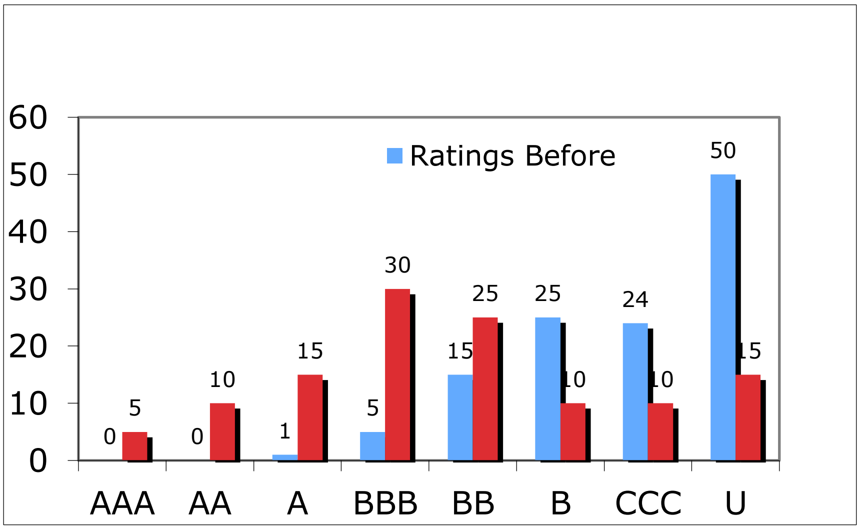


TABLE C.1 ILLUSTRATIVE PROPORTION OF LCIs FINANCED WITHIN COUNTRIES

No.Projects	AAA	AA	A	BBB	BB	B	CCC	U	Sum
Before	2	4	5	7	8	10	24	40	100
After	8	15	20	25	15	8	4	5	100
Fin.Access	AAA	AA	A	BBB	BB	B	CCC	U	Volume
Before	10	8	7	7	2	0	0	0	34
After	40	30	28	25	3,75	0	0	0	126,75
Maturity	AAA	AA	A	BBB	BB	B	CCC	U	Avg.Mat
Before	40	60	35	28	24	0	0	0	7,19
After	160	270	300	300	150	0	0	0	14,22
Spreads	AAA	AA	A	BBB	BB	B	CCC	U	Avg.Spread
Before	1166,667	800	1250	2100	4000	0	0	0	358,33
After	2682,353	2250	4000	7500	5250	0	0	0	261,23

TABLE C.2 ILLUSTRATIVE COUNTRY DISTRIBUTIONS OF LCIs FINANCED CROSS-BORDER

No. Portfolio	AAA	AA	A	BBB	BB	B	CCC	U	Sum
Ratings Before	0	0	1	5	15	25	24	50	120
Ratings After	5	10	15	30	25	10	10	15	120
Fin.Access	AAA	AA	A	BBB	BB	B	CCC	U	Volume
Before	0	0	20	100	300	0	0	0	420
After	50	200	300	600	250	0	0	0	1400
Maturity	AAA	AA	A	BBB	BB	B	CCC	U	Avg.Mat
Before	0	0	300	500	1200	0	0	0	4,76
After	1000	3600	4500	7200	2500	0	0	0	13,43
Spreads	AAA	AA	A	BBB	BB	B	CCC	U	
Before	0	0	350	2000	6750	0	0	0	433,33
After	500	1500	3000	7500	7500	0	0	0	235,29

TABLE C.3 TRIPLE EFFECT OF GICF GUARANTEES: LOWER SPREAD, LONGER MATURITIES, GREATER ACCESS

	Within-Country	
	Before	After
Vol. of Finance Accessed (Index Base Before=100)	100	373
Average Maturity (months)	86	171
Average In-Country Project Credit Costs/Spreads Above Country Benchmark (basis points)	358	261
	Across All DCs	
	Before	After
Vol. of Finance Accessed (Index Base Before=100)	100	333
Average Maturity (months)	57	161
Average Country Benchmark Interest Costs Spreads (basis points)	433	235

We then allocated, to get results reported in table C.5, the LCIs backed by the GICF in proportion of the carbon emissions data for 2013 (latest available year)[38] . However, this basic rule was applied modulo two exceptions:

- we limited the weight of the Group A countries, that include countries like China, Saoudi Arabia or Singapour to only 5% of their carbon emissions. They do not have indeed the same interest for the GICF guarantees as the other developing countries because they have a far higher domestic financial capacity; they could be part of the system for political reasons and to have access to CRAs.
- We excluded Cuba, Korean Democratic Republic, Iran and Syria for the C and unrated category because this rating results directly from the current geopolitical state of affairs and, this would have distorted (primarily because of the importance of Iran) the insights to be derived from table C.5 about the C and unrated countries current USD at market exchange rate.[39]

[38] Indicator code EN.ATM.CO2E.KT, extracted on October 8th, 2018.
[39] Indicator code NY.GDP.MKTP.CD, extracted on October 8th, 2018.

TABLE C.4 REDUCTION OF SPREADS AND OF INTEREST RATES FOR TEN YEARS LOANS (IN BPS)

Rating	Maturity	Spread to US	Lending charges	Fees	interest rate	Spread reduction
A	3 years	80	385		635	
	5 years	115	420	250	670	
	10 years	175	497	250	747	100
	15 years	235	568	250	818	
				250		
BBB	5 years	130	435	250	685	
	10 years	250	572	250	822	152
	15 years	370	703	250	953	
				250		
BB	5 years	200	505	250	755	
	10 years	350	672	250	922	237
	15 years	500	833	250	1083	
				250		
B	5 years	600	905	250	1155	
	10 years	900	1222	250	1472	717
				250		
C	2 years	1700	1988	250	2238	
	5 years		2405	250	2655	1500

TABLE C.5 CASH GRANT EQUIVALENT AND CAPITAL INFLOWS NET OF DEBT SERVICES

Credit rating	Reduction in interest rate	Cash Grant Equivalent (CGE)		% of AA inv.*	% of Cash GE*	% of total GDP*
		299Bn AL	707 Bn AL			
A	-150	2	6	6%	4%	64%
BBB	-202	19	45	40%	29%	19%
BB	-287	11	27	26%	17%	8%
B	-600	21	51	21%	32%	6%
C and below	-750	12	28	7%	18%	3%
Total Annual CGE		66	157			
Equity inflows		α.128	α.303			

*Calculations that exclude Cuba, Dem. Rep. of Korea, Iran, Syria, Venezuela
Note: 'AL' stands for Annual Loans, 'AA' for average annual, 'GE' for grant equivalent
α. is the share of equity funds provided by foreign investors.

Rating group	2013 CO2 emissions (kt)	Share*	2017 GDP (Bn current USD)	Share
A	11 696 395	64%	14 525	55%
BBB	3 391 942	19%	5 152	19%
BB	1 406 478	8%	3 262	12%
B	1 167 510	6%	2 666	10%
C and below	505 760	3%	954	4%
Total	18 168 085	100%	26 558	100%

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Acronyms

AA: Average Annual

ADB: Asian Development Bank

AfDB: African Development Bank

AL: Annual Loans

AREI: Africa Renewable Energy Initiative

CBDR: Common But Differentiated Responsibilities

CCS: Carbon Capture And Storage

CDM: Clean Development Mechanism

CER: Certified Emission Reduction

CRA: Climate Remediation Assets

DB: Deutsche Bank

DDPP: Deep Decarbonization Pathways Project

DFI: Development Financial Institutions

DGFM: Distributed Guarantee Funding Mechanism

ECC: Evolving Coefficient Case

EIB: European Investment Bank

ESM: European Stabilization Mechanism

FCC: Fixed Coefficient Case

FDI: Foreign Investment Inflows

GCF: Green Climate Fund

GDP: Gross Domestic Product

GE: Grant Equivalent

GHG: Greenhouse Gas

GICF: Groupe of Initiatives for Climate Finance

IAM: International Assessment Modeling

IBRD: International Bank for Reconstruction Development

IDA: International Development Association

IEA: International Energy Agency

IFC: International Finance Corporation

IMF: International Monetary Fund

IPCC: Intergovernmental Panel on Climate Change

ISA: International Solar Alliance

LCI: Low-Carbon Investment

MDB: Multilateral Development Bank

MFD: Maximizing Finance for Development

MIGA: Multilateral Investment Guarantee Agency

MSGM: Multi-Sovereign Guarantee Mechanism

NDC: Nationally Determined Contributions

ODA: Official Development Assistance

OECD: Organization for Economic Co-operation and Development

OPEC: Organization of the Petroleum Exporting Countries

PA: Paris Agreement

PRSM: Project Rating Standardized Methodologies

S&P: Standard & Poor's

SDG: Sustainable Development Goals

SGDL: Sovereign Guarantee Design Lab

SME: Small And Medium-Sized Enterprises

SRMI: Solar Risk Mitigation Initiative

SVM: Social Value of Mitigation

SVMA: Social Value of Mitigation Actions

TCFD: Taskforce on Climate-related Financial Disclosure

UNEP: United Nations Environment Program

UNFCCC: United Nations Framework Convention on Climate Change

USAID: United States Agency for International Development

WACC: Weighted Average Capital Cost

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