Transformative Carbon Asset Facility (TCAF)

Supporting Decarbonization through the Financial Sector in Developing Countries using Results-Based Payments for Verified Emission Reductions

January, 2021

Table of Contents

1. The rationale for carbon crediting of financial sector activities 4
2. Prioritizing financial sector activities for carbon crediting 8
   Crediting Potential 9
   Instrument Rationale (Cost-effectiveness) 11
3. Blueprinting carbon crediting for financial sector activities 12
   3.1. Blueprint A: Greening the operations of a National Development Bank 12
   3.2. Blueprint B: Portfolio Rewards to Commercial Banks 14
   3.3. Blueprint C: A sectoral soft loan program for green buildings 17
   3.4. Blueprint D: Price and Credit Guarantees: de-risking commercial green investments 20
   3.5. Blueprint E: Innovative financial engineering for accelerating the retirement of coal power plants 22
4. Summary 25

Supporting Decarbonization through the Financial Sector in Developing Countries using Results-Based Payments for Verified Emission Reductions

The Transformative Carbon Asset Facility (TCAF)[1] supports large-scale and transformative programs for reducing greenhouse gas emissions in developing countries through results-based payments (RBP) for verified emission reductions (VERs), i.e., carbon crediting.[2] Such carbon crediting can be done as climate finance operations where the VERs remain in the host country and can be used against the host country's mitigation target. In alternative the VERs can be processed further to compliance assets under carbon market mechanisms of the Paris Agreement and transferred out of the host country which therefore cannot use these assets anymore against its mitigation target. TCAF is a hybrid fund, i.e., about half of the RBPs are done as climate finance operation and half as carbon market operation. Financial sector activities that lead to climate change mitigation in the real economy can qualify for TCAF support.

This technical paper identifies financial sector activities with emissions mitigation potential suitable for TCAF support. It blueprints potential TCAF financial sector crediting approaches to inform TCAF program development and implementation.

The intended audience includes:

- Stakeholders from developing country governments;
- Financial institutions and other agencies interested in accessing TCAF funding;
- The TCAF contributor community; and
- World Bank task teams interested in preparing TCAF operations.

The paper may also be of interest to the broader practitioner and expert communities around climate finance, greening the financial sector, and new-generation carbon market mechanisms.

The paper is structured as follows:

- Section 1 discusses the rationale for carbon crediting of financial sector activities, assessing market barriers and imperfections, and the viability of using RBP to support those.
- Section 2 considers the prioritization of these financial sector activities by efficacy and efficient use of funds.
- Section 3 blueprints specific financial sector activities;
- Section 4 provides a summary of key findings.

[1] See: https://tcaf.worldbank.org/

[2] TCAF is capitalized by public funds from developed countries' governments. TCAF RBP therefore represents disbursement of international public money.

1. The rationale for carbon crediting of financial sector activities

In this section, we assess the rationale of carbon crediting of financial sector activities. Greenhouse gas emissions are generated in the real economy through the production and consumption of goods and services.[3] Most of these economic activities could not happen without the services provided by the financial sector. In particular, the financial industry has a crucial role in enabling capital investment. The carbon intensity of this investment has a critical long-term impact on emissions trajectories.

To assess the potential role of RBP to support financial sector activities with mitigation impact, we pose the following questions:

- What is the impact of the financial sector on greenhouse gas emissions in the real economy?
- Can the financial sector function as a driver of decarbonization?

These questions are, however, difficult to answer in the abstract without defining specific financial sector activities. What should those activities be? How could such activities be justified? We answer these questions by considering the motivations of green financial reform.

Governments, central banks, and public finance providers can use the financial sector to support clean investments in the real economy or address real-economy barriers and imperfections that impede the greening of the financial system.[4] In practice, both motivations overlap and often lead to activities of quite similar types.

Therefore, in the rest of this section, we ask:

- **What are the market imperfections and barriers** to green investment seen in the financial sector?
- **What options** are there for dealing with these imperfections and barriers to green investment?
- **Can RBP support the greening[5] of the financial sector** effectively and efficiently?

[3] The financial sector itself generates greenhouse gas emissions, e.g. through energy consumption in office buildings and induced commuter traffic. These emissions are not further discussed in this paper.

[4] Within the discussion on correction of imperfections we can distinguish between a 'first-best' type intervention that addresses defects in the financial sector and a 'second-best' type intervention that compensates for other problems elsewhere -- e.g., a lack of pricing of externalities.

[5] In this paper we use the terms "green" or synonymously "clean" for activities that lead to reduction or avoidance of greenhouse gas emissions relative to a baseline. "High-carbon" are activities that do not. See below on the TCAF methodological framework for baseline determination.

Market Imperfections and Barriers in the Financial Sector

Financial sector barriers and imperfections impeding clean investments and favoring high-carbon investments include:

- **Lending limits** of public or commercial banks;
- **Corporates and jurisdictions hitting limits** in their access to capital markets;[6]
- **Operational constraints** due to lack of institutional capacity and financial infrastructure in specific sectors concerned;
- **Distorted pricing of financial products** due to incomplete or erroneous risk assessments, i.e., underestimating risks of high-carbon investments or overestimating risks of clean investments, resulting in too-low interest rates for high-carbon investments and too-high rates for green investments, or causing credit-rationing for green investments;
- **Lack of green financial innovation** due to lack of awareness of green business opportunities;
- **Lack of capacity to originate and structure green financing transactions** due to lack of understanding of clean technologies and related economics and financials.

Barriers and imperfections in the real economy and related government policy include:

- **Absence of externality pricing**, i.e., climate disruption is not priced into the production and consumption of goods and services;
- **Lack of bankable green projects,** due to limited knowledge and capacity of project entities to develop such projects;
- **Gaps in green infrastructure**, e.g., an insufficient network of charging stations for electric vehicles.

Interventions in the Financial Sector

Policy and other public sector interventions can address barriers and imperfections in the financial sector, the broader policy framework, and the real economy. Such interventions include:

- **Institutional support** for greening National Development Banks (NDBs); or set-up of specialized green banks or bank business lines, with instruments such as state guarantees, public capitalization, and rewarding of green lending targets;
- **Public investments in green financial infrastructure**, such as the establishment of microfinance institutions;
- **Financial sector regulation** such as mandatory climate risk stress tests and supervisory guidance and expectations;
- **Creating green asset classes**, such as green bonds;
- **Blended finance,** where public money is used to crowd in private sector capital, e.g., through lowering interest rates or reducing risks;
- **Knowledge transfer and technical assistance,** including the provision of climate risk assessment tools, training of loan officers on the financials of green investments, or support for pipeline development and project preparation.

Most of these types of public sector interventions are quite common, with green bonds being an area of rapid growth and visibility in recent years. In particular, blended finance and institutional support are common in most countries; these include the decade-long practice of soft loan programs for clean investments.

[6] Such constraints are relevant, because clean technologies often come with higher upfront costs than high-carbon alternatives, increasing overall investment finance needs in the short run.

There is currently some momentum to expand regulatory expectations and guidance to assess bank and insurance portfolios' climate-related risks, principally through stress testing.[7] Also, there is some discussion around reflecting climate considerations in capital requirements and central bank policies. However, this is highly controversial and not representative of mainstream regulatory and central banking views.[8] The European experience of preferential capital requirements for loans to small and medium-sized enterprises did not significantly affect credit supply and financial terms.[9] Further analytical work would be required to assess if there could be potential impacts on green lending from such policies.

Can Results-Based Payments be an Efficient and Effective Instrument for Such Interventions?

Accepting that climate risk creates a case for public interventions in the financial sector leads to whether Results-Based Payments for Verified Emissions Reductions (VERs) can be an effective and efficient instrument for such interventions. This paper argues that this can be the case if two criteria are met:

- **(i) Crediting potential**, i.e., quantitative effectiveness: The supported intervention must be expected to result in a sufficiently large volume of emission reductions in the real economy. Qualifying for a TCAF program requires achieving emission reductions on the order of magnitude of at least 1 million tCO_{2e} per year.
- **(ii) Instrument rationale**, i.e., efficiency: Providing the RBP to a financial sector actor is the best use of funds under existing country-specific circumstances.

The criterion "crediting potential" does not merely aim to capture the respective financial sector activity's mitigation/avoidance potential. This criterion also assesses the likelihood that this potential will materialize in the near term (at least within the next 5-7 year time-frame relevant for TCAF RBP support). There would need to be a way to quantify it with sufficient accuracy and certainty to enable carbon crediting. Ideally, the volume of emission reductions achieved through a financial sector intervention should be directly quantified, and monitored, reported and verified. Such quantification is possible, for example, for a soft loan program with an identified investment portfolio and a plan for MRV

---

[7] The European Central Bank recently formulated regulatory expectations for financial institutions in the Eurozone on climate risk management and disclosure. See: ECB (2020), Guide on climate-related and environmental risks, https://www.bankingsupervision.europa.eu/legalframework/publiccons/pdf/climate-related_risks/ssm.202005_draft_guide_on_climate-related_and_environmental_risks.en.pdf. However, this guide remains below the level of mandatory regulatory policy. Similar guidance documents have been issued by New York State Department for Financial Services, https://www.dfs.ny.gov/industry_guidance/industry_letters/il20201029_climate_change_financial_risks; Bundesanstalt fuer Finanzdienstleistungsaufsicht, Germany, https://www.bafin.de/SharedDocs/Downloads/EN/Merkblatt/dl_mb_Nachhaltigkeitsrisiken_en.pdf?__blob=publicationFile&v=5; and Bank of England, https://www.bankofengland.co.uk/-/media/boe/files/prudential-regulation/supervisory-statement/2019/ss319. See also European Banking Authority, https://eba.europa.eu/sites/default/documents/files/document_library/Publications/Discussions/2021/Discussion%20Paper%20on%20management%20and%20supervision%20of%20ESG%20risks%20for%20credit%20institutions%20and%20investment%20firms/935496/2020-11-02%20%20ESG%20Discussion%20Paper.pdf. So far only France has introduced mandatory climate risk assessments and disclosures for financial institutions, back in 2015. See: Balton, P. et al (2020), The green swan - Central banking and financial stability in the age of climate change, Banque de France, https://www.bis.org/publ/othp31.pdf.

[8] Most central banks do not consider climate change in the conduct of their monetary policy, but developments in that space have accelerated. See: NGFS (20192019), First Comprehensive Report, https://www.mainstreamingclimate.org/publication/5044/. For a more detailed discussion: Campiglio, E., et al (2018), Climate change challenges for central banks and financial regulators, Nature Climate Change, www.nature.com/natureclimatechange.

[9] See: https://eba.europa.eu/eba-publishes-the-report-on-smes-and-the-sme-supporting-factor.

of investment project performance (project-level MRV/programmatic crediting). Similarly, when regulation changes financial products' pricing and this can be observed to have a tangible advantage on the projects that are economic (modeling and policy MRV/policy crediting).

However, even an intervention for which an expected mitigation impact can only be qualitatively explained and roughly estimated might qualify for RBP if the predicted mitigation impact is large enough to lead to a measurable decline in emissions in critical sectors of the real economy. Such interventions would be indirectly quantifiable (**sectoral MRV/sectoral crediting**).

In any case, a robust theory of change, explaining how the intervention leads to emission reductions in the real economy is required. Such a theory of change is vital to justify that the transaction is contributing to the NDC. Besides, if bank capital is at risk, there should be a business case that increasing green lending would not add risk to asset allocation.

The second criterion, i.e., best use of funds, acknowledges that emissions reductions in the real economy result from the interplay of a range of different actors, such as financiers, investors, regulators, energy service providers, and consumers. While it is futile to determine who causes the emission reductions, it is meaningful to ask the best recipient of the available money for optimal efficacy. In this context, the degree to which the financial sector can leverage the RBP and reduce transaction costs is critical.

For example, RBP for emission reductions achieved through residential building refits can be achieved when a commercial bank uses RBP funds to lower interest rates within a dedicated credit line (this is an example of a financial sector programmatic crediting approach). This is likely to be more efficient as a recipient of funds than direct payments to individual households. To take a different example: In a wind farm development project, RBP might best be paid directly to the project investor, thereby improving the project's bankability (this is an example of a real economy project-based crediting approach outside the scope of this paper).

Against this background, we define carbon crediting of financial sector activities as *results-based payments provided to a financial sector actor, such as a bank, for sizeable emission reductions achieved in the real economy*.

We require a theory of change for such operations – a theory that explains and quantifies the achieved mitigation effect in the real economy and provides a rationale for providing RBP to the financial sector actor.

2. Prioritizing financial sector activities for carbon crediting

This section uses the two criteria developed above to prioritize different types of financial sector activities for carbon crediting. We apply the two criteria set in the previous section, namely (1) crediting potential and (2) instrument rationale (cost-efficiency).

In relation to crediting potential, it is useful to distinguish the following primary impact channels through which financial sector activities can reduce or avoid emissions in the real economy:

- Increases in green lending capacities, leading to increases in actual green lending volumes (not just at an individual institution level, but across the whole economy);[10]
- Decreases in high-carbon lending capacities, leading to declines in actual high-carbon lending volumes (across the whole economy);
- Increases in financing costs of high-carbon investments;
- Decreases in financing costs of clean investments;
- Indirect effects: acceleration of green finance innovation, increase in knowledge, motivational effects due to adoption of green lending targets, etc.

It seems fair to assume that the complexity of developing a theory of change for the respective mitigation/avoidance impacts increases as one goes down this list. Lending capacities can be measured. Financing costs can be estimated as well – however, their impact on demand for finance and investment volumes is more complex to determine, particularly in cases where changes in financial regulations affect a broad range of investment types. Indirect effects through innovation and an increase in knowledge or motivation are more challenging to measure. Some specific innovative financial engineering solutions can, however, have impacts that are relatively straightforward to measure. Applying these two criteria to the types of financial sector activities identified in section 1 leads to the following summary table:

Table 1: Basic prioritization of green financial sector activities for carbon crediting: summary

Activity type	Crediting Potential	Impact channels					Instrument Rationale
		+LC gr	-LC hc	-FC gr	+FC hc	indir	
Institution - public capitalization/guaranteeing	high	x	(x)	x	(x)		strong
Institution - new financial infrastructure	medium	x	(x)	x	(x)		medium
Institution - portfolio rewards	medium			x	(x)		strong
Regulation - climate risks	low				x		medium
Blended finance – concessional finance	high	x		x			strong
Blended finance – risk guarantees	high	x		x			medium
Blended finance – TA funds and other grants	medium					x	medium
Innovation – green bonds	low					x	medium
Innovation - financial engineering	high					x	medium
Climate Intelligence	low					x	low

+LCgr: increase green lending potential; -LChc: decrease high-carbon lending potential; -FCgr: decrease green financial cost; +FChc: increase high-carbon financial cost; indir: indirect effects. Indications in brackets acknowledge possible variations of the respective activities that could activate other impact channels. For example, an increase in green banks' public capitalization could complement a simultaneous decrease in institutions' capitalization that finances carbon-intensive projects.

[10] Here and in the following, lending capacity is defined as the amount of lending a financial institution can provide. Bank lending capacity is limited by bank capitalization.

Crediting Potential

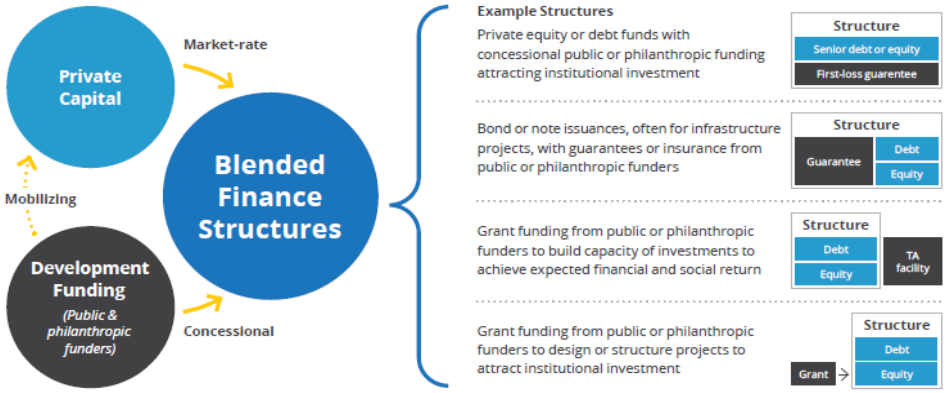
We now take a closer look at the crediting potential of the activities listed in Table 1.

Institutional support measures have, we estimate, a relatively high crediting potential, insofar as they increase clean lending capacity or decrease high-carbon lending capacity and alter relative financial costs of green vs. high-carbon projects. On-lending capabilities can be impacted by directly increasing public capitalization, by guaranteeing green banks, by developing other green lending facilities, or otherwise by improving the financial infrastructure. Providing rewards to financial institutions to achieve green lending targets (or penalties if high-carbon lending exceeds defined thresholds) primarily alters relative financial costs.[11]

Climate Stress tests are at an early stage, with some European countries mandating them. The results of these stress tests are expected to feed into prudential risk capital requirements for European banks eventually.[12] Furthermore, increased capital requirements would feed into higher lending rates. But it is not clear whether stress testing itself would, on its own, change lending rates.

Blended finance has a high and proven crediting potential – whether by softening interest rates or providing partial risk guarantees. Impact channels are (respectively) decreasing green projects' financial cost or increasing green lending capacity. Typical blended finance transactions and proportions are shown in the two figures below.[13]

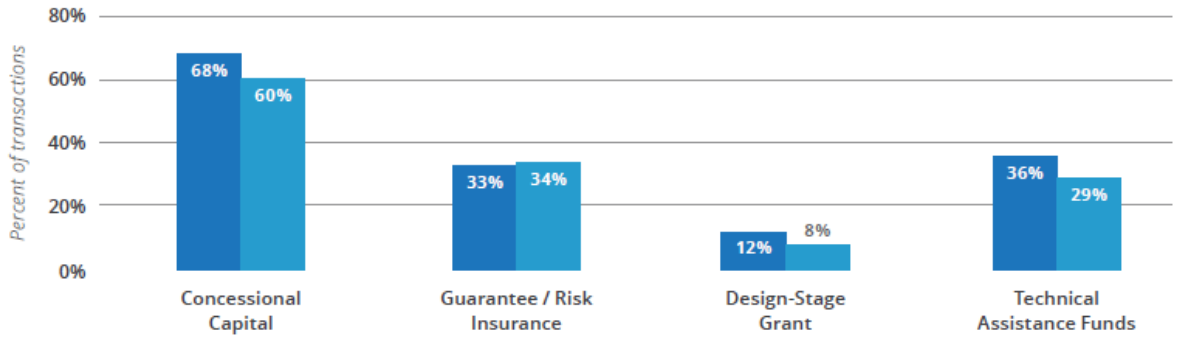
Figure 1: Typical Blended finance structure types (above) and proportions of blended finance across blending types (below). (Key for below: all-time dark blue; 2017-19 light blue)



[11] Rewarding (penalizing) achievement (underachievement) of clean lending targets or portfolio benchmarks are discussed in more detail in Stanfield, A. (2020), The rise of green loans and sustainability linked lending: where are we now?, Linklaters, https://lpscdn.linklaters.com/-/media/files/thoughtleadership/green-finance/linklaters_the-rise-of-green-loans-and-sustainability-linked-lending-where-are-we-now_may-2020.ashx?rev=0ab8a16b-eb65-4dc9-8252-f704a29f0bc2&extension=pdf&hash=5F5F53A60A140E74EC6A7550704EC927.

[12] See Fitch (2020), 'Climate Stress Tests Will Eventually Influence Bank Capital', https://www.fitchratings.com/research/banks/climate-stress-tests-will-eventually-influence-bank-capital-10-09-2020 and Deloitte (2020) The Predictive Power of Stress Tests to Tackle Climate Change https://www2.deloitte.com/content/dam/Deloitte/fr/Documents/sustainability-services/deloitte_climate-risk-assessment.pdf

[13] From Convergence (2020), 'The State of Blended Finance' https://www.convergence.finance/blended-finance/2020



The graph above shows the proportions of blended transactions globally (all time dark blue; 2017-19 light blue) that include a component of these different finance structures. The percentages do not sum to 100% due to the possibility of a transaction including multiple types of structure.

Green bonds likely have a rather low crediting potential if they do not benefit from some direct or indirect payments or subsidies for their "greenness" what is not assumed in this paper.[14] This does not mean that green bonds cannot over time leverage large volumes of green financing, resulting ultimately in sizeable mitigation impacts. However, these effects will typically be too uncertain and long-term to make a case for carbon crediting.

Green bonds basically bundle real economy green investments for funding purposes, offering (institutional) financial investors a green alternative to standard bonds. This activity per se does not alter the mix of green and high-carbon investments in the economy. In the long run, however, it is conceivable that the demand for green bonds might rise to a level that can no longer be satisfied through pure portfolio composition. From that point onward, green bonds could command a premium over standard bonds, thus lowering financial costs for green infrastructure projects. Such premiums could also emerge if green portfolios proved to have lower default risks than high-carbon portfolios. In the case of sovereign bonds, political economy factors might come into play as well, such as crowding out fiscal space for high-carbon investments through the issuance of green bonds.

Innovative financial engineering is in this paper defined as an activity that does not include any subsidy provision, as in the case of blended finance. We can design financial engineering solutions for specific purposes, such as accelerated retirement of high-carbon real assets that became uncompetitive. For example, existing coal-fired electricity generating plants will lose financial viability against the backdrop of decreasing renewable energy costs. Such innovations can unlock concrete avoidance/mitigation activities in the real economy, such as closing coal power plants and replacing them with investments in new renewable power generation assets.[15] The effects on greenhouse gas emissions can be sizeable. Innovative financial engineering, therefore, can have high crediting potential.

Climate intelligence has relatively low crediting potential. Climate intelligence, such as climate training of loan officers or climate risk assessment tools, is more upstream and uncertain in its impact on real

[14] See a similar conclusion in a recent research paper of the Bank for International Settlements, Ehlers, T., et al: Green bonds and carbon emissions: exploring the case for a rating system at the firm level, BIS Quarterly Review, September 2020, https://www.bis.org/publ/qtrpdf/r_qt2009c.htm.

[15] Bodnar, P., et al (2020), How to retire early – making accelerated coal phase out feasible and just, https://rmi.org/insight/how-to-retire-early, e.g., shows how innovative financial engineering can overcome barriers to retire existing uncompetitive coal plants.

economy emissions. This does not mean that climate intelligence provision cannot have significant mitigation impacts in the long run. Still, it means that carbon crediting might not be the preferred instrument to support such activities.

Instrument Rationale (Cost-effectiveness)

Moving to the second criterion (cost-efficiency), i.e., the rationale for providing RBP to the respective financial sector actor, the ranking looks similar overall, with some nuances. Providing RBP for activities that lower financing costs for clean activities or increase clean lending capacity seem to be most straightforward. For activities primarily disadvantaging high-carbon investments, the rationale for RBP is weaker, but RBP can still be relevant to reward relevant regulatory action or portfolio shifts of lenders.

Measures of institutional support and blended finance rank high on instrument rationale. RBP can directly flow in increasing capitalization or guaranteeing of public banks, or in portfolio rewards, or in lowering lending rates.

For financial sector innovation and climate intelligence, the rationale for RBP is highly case-specific. RBF's relevance seems relatively low for activities that are already in an early stage of market introduction, such as green bonds (unless RBF is used to soften financial terms under blended finance solutions). However, RBF can incentivize entirely new financial engineering solutions to concrete real economy investment challenges, such as financing an early retirement of high-carbon assets. For the provision of climate intelligence, direct support of intelligence providers seems preferable, compared to supporting financial sector actors.

Two more caveats can be added to this assessment. First, this assessment and the ratings provided in table 1 are based on expert judgment only. They do not consider country-specific circumstances that might lead to a different prioritization for individual countries. Second, the ratings are made from the perspective of carbon crediting potential only; they do not recommend specific financial sector activities. In the following section, we'll conceptualize (blueprint) potential carbon crediting approaches for the financial sector activities with high ratings in table 1.

3. Blueprinting carbon crediting for financial sector activities

This section will blueprint possible TCAF carbon crediting programs for the priority areas identified in section 2. Following the TCAF technical requirements defined in the TCAF core operational parameters[16] for each of the blueprints criteria and approaches for achieving transformative change, baseline-setting, and additionality, MRV, and pricing will be discussed. The blueprints represent hypothetical cases, but they are informed by real-world examples where possible.

One crucial aspect of instrument design is *additionality*. This can be defined as ensuring that a particular choice actually reduces greenhouse gas emissions, as opposed to for example simply moving financial activity from one institution or jurisdiction to another. Financial sector activities receiving RBP must be robust to *arbitrage*, meaning they should avoid mere financial shifting.

The following blueprints will be presented: A. Greening the operations of a National Development Bank; B: Portfolio Rewards to Commercial Banks; C: A sectoral soft loan program for green buildings; D: Price and Credit Guarantees: de-risking commercial green investments; and E: Innovative financial engineering for accelerating the retirement of coal power plants.

3.1. Blueprint A: Greening the operations of a National Development Bank

In this blueprint, we discuss the greening of a National Development Bank (NDB). (This falls under 'institutional support – public capitalization/guaranteeing' in Table 1.). We assume working with an already existing domestic public development bank (in particular an NDB) in a developing country. The objective is to scale-up clean lending of this institution and to improve green lending selection criteria and results-frameworks. The instrument at hand is TCAF results-based payments for verified emission reductions.

NDBs can occasionally have specific environmental mandates, but more usually, they support the nation-state's strategic objectives, including green commitments. NDBs can finance new infrastructure, provide early-stage blended finance enabling new green markets, and facilitate capital market development, for example, through issuing green bonds.

Transformative change

National Development Banks can substantially shape the economic development and sectoral dynamics of a country. Traditionally, these institutions focus on infrastructure investments, and most often, they benefit from international donor support, domestic guarantees, and public capitalization. Greening these institutions can significantly shift infrastructure investments from high-carbon to green and in locking-in sustainable green development trends in critical sectors. For example, green infrastructure needs, such as grids and electric car charging networks, are crucial to enabling the green transition.

For *transformative* change to happen, greening needs to reach critical mass. Adding green credit lines to an essentially high-carbon portfolio and business model would not be enough. Transformative greening requires mainstreaming mitigation and avoidance of greenhouse gases in all lending activities, including loan appraisal criteria and results frameworks. Following the practice of multilateral development organizations, this will typically include portfolio-level green lending targets, negative lists on carbon-

[16] See: *Core Parameters for TCAF Operations*, https://tcaf.worldbank.org/sites/tcaf/files/TCAF_Core%20parameters_July%202018.pdf

intensive investments, carbon footprinting of lending operations, and application of carbon shadow-pricing, *in addition* to more granular and sector-specific credit programs.

Furthermore, one would expect that transformative greening of a domestic development bank would generate a standard-setting effect in the country's entire financial sector, impacting the lending behavior of commercial banks. As a result of all these transformative effects taken together, green lending volumes in a country would increase. Moreover, as markets develop, green lending may become cheaper than high-carbon lending. TCAF-specific indicators for such transformative greening of a domestic development bank would need to be developed along these lines, specific to the concrete case.

Providing results-based payments to increase capitalization over time or underpin a domestic development bank's transformation to a green bank by delivering relevant financial guarantees has a robust operational rationale. It enables an overall increase in green lending volume, with RBP proportional to the bank's portfolio-greening improvement. This leveraging effect makes it an attractive target for RBP funds.[17]

Baseline setting and additionality

The most conservative approach to baseline-setting for the transformative greening of a domestic development bank is to limit the program boundary, *for the sake of determining achieved emission reductions,* to new dedicated green credit lines, ignoring the overall portfolio effects and ignoring potential impacts on the broader financial sector. It is then possible to follow well-established practices under programmatic carbon crediting.

However, the following measures are needed to reflect the country's own NDC target and TCAF technical requirements: First, the baseline must be set well-below BAU, taking into account the unconditional NDC target. Second, emissions reductions must be discounted by the contributions that concessional international climate finance or other funding sources might have made to the respective credit lines, using the TCAF attribution methodology.

Monitoring, reporting, and verification (MRV)

If the program boundary is limited to dedicated credit lines, the MRV of achieved emission reductions is straightforward and can rely on the MRV of the financed projects. In the case of sizeable individual investment projects (renewable energy plants, landfill gas projects, wastewater treatment facilities, etc.), such MRV would need to go down to each project's level. For credit lines targeting many small investments, such as energy-efficient renovation of residential buildings, standardized and sample-based approaches would be used.

A similar approach applies to the MRV of sustainable development benefits. Besides, MRV of transformational change indicators are needed to enable assessments beyond the program boundary for the MRV of emissions reductions.

Pricing of verified emission reductions

For results-based payments, pricing can be derived from the dedicated credit lines' financials using an incremental cost approach. If, for example, an interest rate reduction of 50 basis points is needed to shift

[17] Using a capital requirement of 8%, each dollar of additional capitalization could lead to an incremental lending of 12.5 dollars, i.e., a $50 million TCAF program could translate into an additional green lending volume of $750 million. This is an order of magnitude that can reach critical mass to change sector dynamics in smaller countries.

high-carbon building renovation to green building renovation, thus causing a decrease of an estimated x ton of emissions for each loan of amount y, the implicit carbon price can be derived (taking into account potential international concessional climate finance already provided (see above)). Also, costs for institution-wide measures such as carbon footprinting and shadow pricing can be factored in. In cases where the emission reductions are transferred under market mechanisms, pricing should reflect the opportunity cost of domestic NDC achievement following the general TCAF guidance on opportunity cost pricing.[18]

3.2. Blueprint B: Portfolio Rewards to Commercial Banks

This blueprint assumes using TCAF payments to incentivize commercial banks to shift their lending portfolios over time toward clean investments.

Transformative change

The basic idea of portfolio rewards for commercial lenders is to *provide a results-based payment* to achieve *a portfolio-level green lending target*. For example, a commercial bank commits to increasing the share of loans for green projects in its overall lending portfolio from currently 10% to 25% over the next five years. If the target of 25% is achieved, TCAF could pay the bank a monetary reward. Alternatively, TCAF could pay a certain amount for each percentage point the green lending exceeds 25%. In principle, such schemes could be combined with penalties for underachieving the portfolio target, but that would require additional policy action.[19]

Such portfolio reward (or penalty) schemes are different from subsidizing individual loans (or loan programs) for specific green investment projects. First, the payment is against a portfolio achievement, which can only be reached by increasing green lending *relative* to high-carbon lending. Second, the receiving bank is entirely free to use the payment for whatever purpose it prefers. It is not earmarked for any further climate action or any other defined purpose.

Some commercial banks have started to use portfolio rewards in their lending policies. With so-called Sustainability Linked Loans (SLLs), these banks have agreed with their corporate borrowers on green portfolio targets for the latter. If these targets are reached, the loan rates will be lowered by an agreed discount. An example could be a corporation's target to reduce its carbon footprint from 10 million tCO_2e to 6 million tCO_2e. Once the target is reached, the interest on all loans the bank provides to this corporation will be reduced by ten basis points. Such voluntary action by commercial Banks is at an early stage but nevertheless already reached some visible size. The overall volume of SLLs reached $122 billion in 2019.[20]

---

[18] Opportunity cost pricing is discussed in World Bank (2020), TCAF crediting blueprints synthesis report.

[19] Rewarding (penalizing) achievement (underachievement) of clean lending targets or portfolio benchmarks are discussed in more detail in Stanfield, A. (2020), The rise of green loans and sustainability linked lending: where are we now?, Linklaters, https://lpscdn.linklaters.com/-/media/files/thoughtleadership/green-finance/linklaters_the-rise-of-green-loans-and-sustainability-linked-lending-where-are-we-now_may-2020.ashx?rev=0ab8a16b-eb65-4dc9-8252-f704a29f0bc2&extension=pdf&hash=5F5F53A60A140E74EC6A7550704EC927

[20] For more detail see: *Mobilizing Private Finance for Nature*, World Bank 2020, http://pubdocs.worldbank.org/en/916781601304630850/Finance-for-Nature-28-Sep-web-version.pdf and Sustainability linked loan principles, Loan Market Association 2019,

As TCAF exclusively uses verified emission reductions as the disbursement indicator, green lending targets would need to be determined by lowering the carbon footprint of the overall lending portfolio of a commercial or public bank. The following example illustrates the case:

The overall lending portfolio of commercial Bank A has a carbon footprint in 2020 of 100Mt CO_2e. Under business-as-usual, the carbon emissions from its portfolio would increase over time. Bank A adopts a target to bring down these emissions and defines a target trajectory in table 1 below. Assuming that emissions are dropping below the target trajectory from a specific date onwards, TCAF could pay for each unit of overachievement, i.e., for 1 million tons of CO2e emissions avoidance above the initially agreed target from 2022 on over the agreed crediting period in this example.

Table 1: Portfolio target Bank A and TCAF results-based payments

	2020	2021	2022	2023	2024	2025	2026	2027	…
BAU	100	102	104	106	108	110	112	114	…
Target	100	99	98	97	96	95	93	92	…
Actual	100	99	97	96	95	94	92	91	…
Overachieved	0	0	1	1	1	1	1	1	…

While the determination of the carbon footprint of a portfolio of investment projects is a standard exercise in greenhouse gas accounting,[21] it is much more challenging to assess whether or not the (over)achievement of Bank A's portfolio target did indeed result in an economy-wide emission reduction. Bank A could have achieved its target by, for example, merely trading loans with a Bank B that does *not* have a lending portfolio target. Further criteria are needed to determine the extent to which a real emission reduction occurred.

Alternatively, the TCAF operation could be done on a financial sector-wide basis that encompasses all commercial banks operating in the country.[22] In such a case of financial sector crediting, a target trajectory would be defined for the sector as a whole, e.g., through adding-up individual targets. Payments would then be provided for overachieving the sectoral target pro-rata to the contributions of participating banks.

In a sector-wide approach, TCAF would try to catalyze lending practice changes by improving sectoral knowledge and capacity. In the former example, in which TCAF incentives are negotiated with each bank individually, TCAF payments could reach a level that might change borrower incentives (lending rates) sufficiently to generate a more immediate impact in that specific bank's portfolio. Still, such an approach would face the above-mentioned methodological challenge of determining overall impact in the real economy, and it is less transformative due to limited scale. The following elaborations assume a sectoral approach that has higher transformative potential.

https://www.icmagroup.org/assets/documents/Regulatory/Green-Bonds/LMASustainabilityLinkedLoanPrinciples-270919.pdf

[21] This builds on a broad set of proven greenhouse gas accounting methodologies. About 300 such methodologies were developed under UNFCCC alone (for carbon market mechanisms) and are publicly available. In addition, International Financial Institutions (IFIs) have started an initiative to harmonize their GHG accounting. For more detail: https://unfccc.int/climate-action/sectoral-engagement/ifis-harmonization-of-standards-for-ghg-accounting.

[22] In addition, measures to avoid international leakage might be required.

Baseline setting and additionality

A sectoral portfolio reward crediting approach rewards the greening of commercial banks' aggregate portfolios over time. The baseline must reflect the counterfactual development of portfolio composition. The right metric to use is the total carbon footprint of the lending portfolio. Shares of specific technologies in the aggregated lending portfolio would not work. Each project has its own particular emissions profile, and deeper emissions reductions from clean investments projects could be offset by a parallel increase of emissions from high-carbon investment projects.

Extrapolation of historical trends in portfolio emissions cannot be used to derive a baseline. Such trends might change during carbon crediting periods if policies and technology costs in the real economy are changing. These changes are likely to happen, because countries need to implement mitigation policies to reach their NDC targets. Many clean technologies are becoming cheaper over time, e.g., renewable power generation and electric vehicles. Furthermore, the time-series of portfolio emissions of financial institutions are not available. Carbon-footprinting of portfolios within the financial sector is a recent development and not yet widespread practice.

This means that the baseline for an aggregated financial sector loan portfolio's carbon footprint can only be established through an ex-post modeling approach, taking into account the observed dynamic in policy implementation *and* changes in technology costs. Such estimation is highly complex and might not be possible in some countries. Perhaps the best and easiest way to do it is to measure the carbon intensity performance of a group of similar countries, or rather of the same sectors in different countries, sector by sector, and reward only those that achieve the highest outperformance compared to the mean, over the TCAF time horizon (five to seven years).

Demonstration of additionality has several dimensions and while some are straightforward in the case of portfolio rewards others are challenging. Reflecting unconditional NDC targets in sectoral baselines is straightforward and application of the TCAF attribution approach to exempt emission reductions enabled by international climate finance from carbon crediting can be easier on an aggregated level as compared to a set of individual activities. Challenging is however avoidance of double counting if owners of individual emission projects seek carbon crediting opportunities themselves.

The only practical approach to exclude such double-counting is to systematically deduct any volumes of carbon credits issued outside the TCAF financial sector portfolio reward program from TCAF carbon crediting on an ex-post basis.

Monitoring, reporting, and verification

MRV of program emissions for financial sector portfolio reward programs is straightforward. It can be based on applying standard greenhouse gas accounting methodologies for individual investment projects financed by the financial sector (see above). By contrast, establishing baseline emissions relying on ex-post modeling can be highly complex, as already discussed. Further indicators for transformative change that could be monitored might include indicators for green lending capacity and intelligence in the financial sector, such as the number of specialized loan officers for green lending and the number and quality of market research products on green lending.

Pricing of verified emission reductions

The rationale for rewarding financial sector green lending portfolio targets through results-based payments is *not* to pay for a potential cost differential between high-carbon and green lending. Instead,

the purpose is to *incentivize a change process in institutional practice* that can be expected to be *self-financing.* The intention is to help financial institutions learn to take better advantage of green lending opportunities and better understand climate-related risks of high-carbon lending. What is being paid for by a program like TCAF is better awareness, knowledge, and capacity related to the climate-impacts dimension of banking.

Experiences with such approaches have shown that change processes can be incentivized with relatively low incentive payments that flow directly into the administrative budgets of financial institutions, without any earmarking for particular usages or purposes. This suggests a reverse approach to verified emissions reduction pricing. Instead of aiming to determine a viability gap as a basis for VER pricing, an overall payment envelope can be provided to reward the achieved emission reductions of the *whole financial sector.* This single payment amount can be allocated *pro-rata* to the respective mitigation contribution of each individual institution participating in the program. The VER price thereby becomes a dependent variable only known ex-post, and it will change over time. For emissions reductions transferred to TCAF as ITMOs (Internationally Transferred Mitigation Outcomes) under Article 6 of the Paris Agreement, the standard TCAF opportunity-cost pricing principles apply.

3.3. Blueprint C: A sectoral soft loan program for green buildings

This blueprint speaks to the identified financial sector activity known as "blended finance" – i.e., lowering interest rates or guaranteeing risks. It uses the examples of soft loans for energy-efficient building renovation (renovations to upgrade the energy efficiency of buildings).

Blending results-based payments into financial products is not a new idea. In the past, some efforts were made by financial institutions to use carbon revenues from the Kyoto Protocol's carbon market mechanisms to transform results-based payments into upfront investment financing through loans or grants. In other cases, specialized investment funds attempted to provide equity finance for projects in exchange for the rights to future carbon revenue streams. With very few exceptions, such approaches have failed or been abandoned.[23]

One example of a successful financial transformation of results-based payments is the Plantar project of the World Bank Prototype Carbon Fund (PCF). The company, Plantar, generated emission reductions in Brazil by substituting coal with charcoal in the pig-iron industry. Those emission reductions were sold to the PCF. A commercial lender, Rabobank Brazil, provided an investment loan to Plantar to be repaid directly by PCF against delivery of emission reductions contracted from Plantar. As a result, Rabobank monetized the results-based payments, i.e., *transformed them into upfront project lending* by taking a part of the delivery risk of the emission reductions. The regulatory aspect of that risk was absorbed by PCF - but Plantar's credit risk wasn't.[24]

[23] In programmatic carbon crediting there have been cases of redistribution of carbon revenues in payments to sub-projects, e.g., within benefit sharing schemes. Such programs have been typically managed by governmental agencies or other non-commercial coordinators. Examples include forestry programs where a program management unit receives carbon revenues and then distributes those to individual landowners. For more details see FCPF REDD+ benefit sharing approaches, https://www.forestcarbonpartnership.org/redd-benefit-sharing and similar approaches under BioCF, https://openknowledge.worldbank.org/handle/10986/34499. Such cases of pure redistribution of already received results-based payments are not considered in this paper.

[24] See: State and Trends of the Carbon Market 2010, World Bank, https://openknowledge.worldbank.org/bitstream/handle/10986/13401/55419.pdf?sequence=1&isAllowed=y

Frontloading of results-based payments involves risk-taking by the financial institution providing the upfront financing. Such risk-taking was challenging under the Kyoto market mechanisms due to high regulatory risk and often weak financials of mitigation projects relying on carbon revenues.[25] In contrast, TCAF operations will not be exposed to regulatory risk – at least, not for payments provided as climate finance – and will not build on individual marginal investment projects.[26] For these reasons, financial institutions might find TCAF payment streams easier to transform into upfront financing, but that has not been tested yet.

In addition to transforming results-based payments into upfront financing, financial institutions can merge such payments into better loan terms once the RBPs are reliably received. An example of such an approach is the Caixa program of the World Bank Carbon Partnership Facility (CPF). Caixa bank provided loans to landfill gas projects in Brazil and used carbon revenues from CPF to lower interest rates charged to the project developers.[27] A part of the rate haircut was done upfront, before receiving the carbon payments, and another was linked to the financed landfill projects' performance. In the latter case, the transformation of payments into interest-rate subsidies happened only after carbon payments were received, and the subsidies were, therefore, risk-free for the financial institution. Even such risk-free transformation of results-based payments can be impactful, as they lower transaction costs for participating landfill operators who benefit from CPF payments.[28]

In the following, we consider a hypothetical TCAF program that provides results-based payments to all banks in a country, or at least the major commercial banks, to reward soft lending to households for energy-efficient building renovation, following the examples of the Caixa program as outlined above.

Transformative change

A soft loan program for energy-efficient building renovation is a proven approach to generate large-scale emission reductions and transform a significant sector of the economy. An example is the German KfW energy-efficient building refurbishment program, which has been in existence for almost 20 years. KfW, a state-owned German domestic development bank, provides below-market refinancing and public subsidies to commercial banks for standardized green building loans to private households in Germany. This on-lending scheme has reached millions of homes and achieved substantial contributions to

[25] For a more comprehensive overview of barriers to monetize carbon revenues see: Integrating Carbon Finance in Traditional Financing - Key Barriers and Existing Experiences, World Bank 2015, https://ci-dev.org/knowledge-center/integrating-carbon-finance-traditional-financing-key-barriers-and-existing.

[26] As explained above TCAF is a hybrid fund: About half of the funds are climate finance. ERs paid for with these funds (RBCF) remain in the host country. The other half is carbon market money. ERs paid with this money are transferred to TCAF and cannot be used against the host country NDC.

[27] For more detail: Lessons Learned from Carbon Partnership Facility Programme of Activities – A Summary Note, forthcoming.

[28] In programmatic carbon crediting, there have been other cases of simple redistribution of carbon revenues in payments to sub-projects, e.g. within benefit-sharing schemes. Such programs have typically been managed by governmental agencies or other non-commercial coordinators. Examples include forestry programs where a program management unit receives carbon revenues, and then distributes these to individual landowners. For more details, see FCPF REDD+ benefit-sharing approaches, https://www.forestcarbonpartnership.org/redd-benefit-sharing and similar approaches under BioCF, https://openknowledge.worldbank.org/handle/10986/34499. Such schemes that do not involve financial transformation of results-based payments are not further considered in this paper.

Germany's greenhouse gas mitigation goals. Achieved emission reductions are estimated using a modeling approach based on individual project data collected from the borrowing households.[29]

Beyond their impact in the housing sector, such programs have transformational potential in the financial industry by building awareness, understanding, and capacity for green building projects at all participating commercial banks. Typically, interest rate subsidies can remain relatively low since payback periods of green building projects are short due to energy savings, and the projects fit into regular renovation cycles. In a developing country context, TCAF results-based payments for verified emission reductions can be deployed to fund the required loan-softening.

Baseline setting and additionality

Baseline setting for energy-efficient building renovation programs can build on established practice under programmatic carbon crediting (see also 3.1 above). Building owners who borrow money for energy efficiency renovations will be required to submit critical building data with their loan application. Based on that data, baseline energy consumption and greenhouse gas emissions can be estimated using an appropriate model. Such estimation models already exist; they are used in several countries. The main challenge is the availability of data for calibrating the models according to the country-specific building stock. Unlike past programmatic crediting approaches, baselines will be lowered to reflect NDC targets. A minimum size of the overall program will be required that enables transformative change in the whole sector.[30]

A similar typology-based approach can estimate energy consumption and greenhouse gas emissions of renovated buildings, based on the borrower's information on the type of renovation activity planned. This might encompass improved insulation of walls and roofs, window replacement, new efficient heating or cooling systems, solar water heating, etc. Using sampling methods, both baseline and project data can be verified, and the findings used to determine discount factors for uncertainty. Determination of emission reductions then follows the well-established practice of a "deemed savings" approach.[31]

Additionality is safeguarded by setting baselines below BAU and by exempting emissions reductions enabled by international climate finance from crediting as per the TCAF attribution approach. Double-counting risks are low since individual building owners cannot reach mitigation volumes large enough for project-based crediting. In the unlikely case that such project-based crediting has occurred, respective emission reductions would be deducted from TCAF crediting volumes.

[29] For more detail see: https://www.kfw.de/inlandsfoerderung/Privatpersonen/Bestandsimmobilie/ and https://www.kfw.de/Download-Center/Konzernthemen/Research/PDF-Dokumente-alle-Evaluationen/Effekte-CO2-Gebaeudesanierung-2007.pdf.

[30] Strictly speaking, a sectoral crediting approach would require an aggregate sectoral threshold to be reached before crediting could start. This is not practical in incentive programs with commercial counterparties that need certainty on results-based payments in order to implement the program. For this reason, the sectoral threshold requirement must be replaced by a proxy indicator, e.g. an ex-ante threshold relating to the total market share in residential loans of all participating commercial lenders (for example a requirement that 20% of the loans are green for the program to become operational).

[31] Under a deemed saving approach certain energy savings are conservatively assumed from a well-defined project activity based on a normal-usage assumption (e.g., one can assume that on average replacing incandescent light bulbs with LED lights reduces annual energy consumption by x kwh per LED).

Monitoring, reporting, and verification

As outlined above, MRV for building programs must be done on a sample basis by applying well-established energy auditing protocols and project-level greenhouse gas accounting tools. Also, modeling results must be verified to ensure robustness and conservativeness of the "deemed savings" approach.

Indicators for transformative change that should be monitored will include size indicators, such as market share of green loans and green renovations; indicators on the sustainability of the achieved transformation, such as improvements in technical capacity related to green lending by commercial banks; indicators of potential spill-over effects in lending for other activities; and indicators of potential impacts on domestic policy-making, e.g., related to energy efficiency standards in building codes.

Pricing of verified emission reductions

Typically, energy-saving building renovation investments come with short payback periods due to substantial energy bill savings. Greenhouse gas mitigation costs are negative (i.e., taking everything together, accounting for the initial upfront investments and subsequent savings from using less energy, the energy efficiency investments more than pay for themselves) – ignoring costs for overcoming barriers – and therefore RBP pricing cannot be based on cost gaps to be closed. In some cases, building owners and the building users are often not the same people, so the energy-bill savings don't accrue to the building owners; they accrue to the renters. In this case, long-term, low-cost lending can facilitate relatively minor increases in rents or service charges.

Green building renovation soft loan programs typically target building owners who have already decided to undertake building renovations and need financing but are not aware of green renovation's advantages (in energy savings and improved comfort levels). Against that backdrop, relatively small interest rate discounts can significantly impact shifting planned renovation activities from high-carbon to green.

Market studies and piloting programs can help to determine the needed interest rate discount. From there, the VER price to pay for the discount can be derived. This price applies to VERs that remain in the host country, which can be counted against the host country's NDC target.

If emission reductions are transferred to TCAF contributors as ITMOs, the general principles of TCAF opportunity cost pricing apply.

3.4. Blueprint D: Price and Credit Guarantees: de-risking commercial green investments

Background and Rationale

This blueprint outlines the provision of guarantees to reduce risks for investors in green projects in developing countries. There are two types of risk mitigation that could be considered. The first, more conventional type, is the reduction in risk of financial investments perceived by lenders such as banks (loans) and project developers (equity). There is a second form of risk reduction, which is the further development of capital markets and financial technology to reduce the risk of bonds and other capital market instruments that are distributed to retail investors. For example, the large development banks could issue green bonds, and those bonds could be guaranteed. We focus here on the former type of risk reduction, even though the latter is potentially very significant.

The *theory of change* argues that guarantees can reduce the cost of capital (i.e., interest rates charged on debt and the required rate of return on equity), which would need to be covered by revenues for green projects to take place. The cost of any investment project includes both the project's real costs and the financing costs. Financing costs include the (actual) interest payments made to lenders and the required rate of return on equity. In general, the higher the perceived risk of an investment, the higher interest rates lenders will charge, and the higher rates of return equity investors will demand. This general increase in the cost of capital then impacts the overall cost of the project.

Risk mitigation is intended to reduce the required rate of return (cost of capital) demanded both by debt and equity investors. Guarantees and insurance could be highly effective instruments for reducing the risk, reducing capital cost, and increasing projects' economic viability.

Risk mitigation can be a cost-effective method to reduce the overall cost of environmentally friendly options. This is in part because risk is not a zero-sum game. Financial risks can be created, not through any inherent real-world matter but through financial mismatches, the risk of time inconsistency, or the country's political risk. The risks mitigated include those created by the government in which the emissions reductions occur.

In so doing, the guarantees are expected to stimulate increased investments by reducing the cost of capital or enabling capital flows that would not otherwise occur.

There are many types of projects that might be de-risked in this way. For example, such guarantees could enable utility-scale renewable-with-storage generation projects in developing countries and renewable and storage *factories* in middle-income countries.

Let us focus on a conventional renewable generation project-- a utility-scale solar park -- for the sake of clarity. We can consider the risks of the project developer and the lender to that project.

A project developer faces the price risk that the price paid for output power varies. This is price risk, although affected by government policy. The second is the political risk; for example, the sovereign defaults or the project is nationalized without compensation.

A lender also faces the sovereign's political risk (in financial markets, the sovereign's risk is a crucial driver of borrowing costs in any jurisdiction)—finally, the project developer's direct risk on the lenders' chance of being paid back.

A standard set of guarantees already implemented in many energy contexts includes the following elements:

1. A (state-owned) utility guarantees a defined power price paid to renewables developers. A sovereign or international organization can insure these payments in the offtake agreement.
2. Credit guarantee: the developer borrows from a bank. A sovereign or international organization can guarantee the credit risk of the developer.
3. Political guarantees: an international organization can guarantee the political risk to reduce the cost of capital on the equity investor.

Transformational Change

TCAF projects are expected to fall under the conditions for size, sustainability, and leverage. Reducing capital cost in developing countries can be highly transformational because of the additionality inherent in lowering the required cost of capital. This instrument's cost-effectiveness can be relatively high.

Baseline setting and additionality

The cost of capital is a substantial part of the overall levelized cost of new renewable generation. Including the cost of taxation of profits, financing costs can be as much as half of the total levelized cost. Anything that can reduce these interest costs can inherently change the relative cost of different options so that renewables become much cheaper than alternatives. Interest rates on renewable investments are already observed and estimated in markets worldwide. Bloomberg New Energy Finance, e.g., estimates the elements of the cost of capital for different countries. In particular, it measures debt costs, and equity costs.

Baselines can be set according to already observed costs of capital in a particular country context. These costs of capital would then mean that the quantity of new green investment is sub-optimal. We measure the actual interest rate paid and then model the result of this risk reduction. We show that many more investment opportunities are available at a lower interest rate in a particular context. Thus, therefore the post hoc emission reduction has taken place.

Monitoring, reporting, and verification

The financial and real aspects of the investment would need to be tracked. The reductions in interest and other payments would need to lead to enhanced green investment.

Pricing of verified emission reductions

The risk guarantees are often very-cost effectively provided by sovereigns or international organizations due to their institutional advantages. Thus, the financial value, in terms of reduced interest payments, may be significantly higher than the cost to the sovereign or international organization (in terms of the risk of default). Pricing, therefore, would need to assess a 'cost price' for this guaranteeing activity.

3.5. Blueprint E: Innovative financial engineering for accelerating the retirement of coal power plants

This blueprint shows how TCAF payments could reward financial innovation for accelerating the retirement of coal power plants and so enabling defined emissions mitigation activities in the real economy at scale.

Transformative change

Carbon dioxide emissions from coal remain the most significant single source of greenhouse gases. In 2018, emissions from coal combustion were about 15 billion tons.[32] This represents a consistent increase over the 20 previous years, for a total increase in emissions since 1998 of greater than 70 percent. While coal is also used for industry and heating, the majority is burned in coal-fired power plants. Coal emissions are more than twice that of natural gas emissions and 30% greater than oil per unit of electricity.

[32] International Energy Agency (2019), CO_2 Emissions from Fossil Fuel Combustion, https://www.iea.org/reports/co2-emissions-from-fuel-combustion-overview

Although coal has long been viewed as the cheapest way to power the global economy, this is no longer the case. New renewable energy (RE)[33] is often less expensive than new coal plants, even before considering coal's environmental and health impacts. In some cases, the cost of renewables has fallen to the point that in many cases it is less expensive to build new renewable energy capacity, including battery storage, than to continue to operate existing coal capacity. In other words, the existing coal plants' operating costs are higher than the combined capital and operating costs of new renewable energy systems. An analysis from June 2020 concluded that 39 percent of the world's existing coal capacity is currently uncompetitive compared to new renewables with storage. This figure will rise to 60 % in 2022 and 73 % in 2025. This trend is driven primarily by performance improvement and cost reduction in RE and storage technology.[34]

Several factors inhibit the retirement of uncompetitive coal plants and their replacement with new RE capacity plus storage. One primary barrier is the upfront capital cost involved in coal plant retirement. This includes: (i) outstanding contractual obligations and (ii) costs to decommission the plant. Even if the coal plant is uncompetitive, there are still usually investment costs to be recovered, normally by the power utility. Abandoning the coal-fired power plant and replacing it with a new RE plant does not address the return on, or amortization of, the initial capital investment. Also, the costs to decommission the plant with sufficient remediation to render the site suitable for other uses can be substantial. Many regions are economically reliant on those activities, and their closure can be economically devastating and at odds with the principle of a just climate transition.

The figures cited above demonstrate coal's paramount importance in overall global greenhouse emissions. While the barriers to this process noted above are manageable, there are few cases where they have been successfully addressed, and as such, models for doing so are few and have little or no track record.

Use of Results-Based Climate Finance (RBCF) to facilitate coal plant closure

This blueprint will only address the financial dimension of coal plant closure, not the social aspect of jobs and economic impact on communities.[35] To support coal mine closure, sufficient funding is needed to compensate the asset owner for the remaining unrecovered capital cost initially invested. Given the large, often massive, investment costs for coal plants, a substantial amount of finance would be needed in most cases. Also, decommissioning and site remediation expenses will also be significant.

The structure of a deal for coal plant closure may or may not be intrinsically tied with its replacement by a commensurate amount of new power plant capacity in the form of renewable energy (e.g., wind or solar) plus energy storage systems.[36] In some cases, the coal plant may not be needed in the overall supply and demand balance of the grid or can be indirectly compensated by the overall growth of the total generating fleet. For purposes of this analysis, we will assume that the replacement of the retired coal

[33] Primarily wind and solar power, which will be the proxy RE technologies for purposes of this analysis.
[34] Paul Bodnar, Matthew Gray, Tamara Grbusic, Steve Herz, Amanda Lonsdale, Sam Mardell, Caroline Ott, Sriya Sundaresan, and Uday Varadarajan, How to Retire Early: Making Accelerated Coal Phaseout Feasible and Just, Rocky Mountain Institute, 2020, https://rmi.org/how-to-retire-early-making-accelerated-coal-phaseout-feasible-and-just/
[35] RBCF would also be a good source of financing to cover the costs associated with the coal plant closures, since the funding flow matches the costs over the years following plant retirement.
[36] Alternatively, the new renewable energy plant could opt out of on-site storage, and instead rely on grid support to handle generation intermittency; but such costs would have to be factored in.

plant with commensurate quantity of new build *will* be part of the transaction. This adds additional capital costs, but it also adds new revenue streams (from the sale of RE-generated electricity).

One model for securing this needed financing is for a third party to raise the necessary funds described above (i.e., decommissioning, site remediation, and new build). This third party could be a commercial financial institution or a development financial institution (DFI); it could raise funds through any combination of bond issuances, commercial debt, balance-sheet financing, or other means. Payments linked to the electricity generated from the new renewable plant which has replaced the original coal plant provide the return on capital for this investment. Results-based payments linked to emissions reductions from replacing coal-fired power with renewable energy generation would be another revenue stream to provide for a decent return on capital The waterfall of payments would depend on the specific financial structure in each instance but in every case the RBPs would provide an incentive for innovative financial engineering that raises the upfront capital, satisfies the outstanding investments and interests of all parties and provides electricity at a cheaper rate than the existing coal plant.

Baseline setting and additionality

The first step to setting a baseline is to project the retired coal plant's continued operation within the existing utility system under business-as-usual conditions. There will be data from many years of operations that can be drawn upon. Data on capacity factors and emissions intensity can be extrapolated into the future using assumptions about the future of the coal plant's role in the overall grid system, either as part of a full grid modeling simulation or more basic projections. Either of these approaches can generate a credible forecast of emissions from the coal plant under BAU.

This projected emissions trajectory must then be adjusted for targets under the country's unconditional NDC targets. Any action included under that target that specifically relates to the coal plant in question must be taken into account in adjusting the trajectory. For example, if that coal plant's accelerated retirement is included in actions under the unconditional target, no emissions reductions (ERs) from that action could be included. Absent explicit mention of the plant in the unconditional NDC target, the projected emissions must be reduced by NDC's emission reduction target for the entire power sector. Absent such power-sector explicit targets, the trajectory would need to be reduced by pro-rated emission reduction for the whole unconditional NDC target.

In cases where the coal electricity is replaced entirely by renewable generation, the entirety of the emissions projected from the retired coal plant could be counted as ERs. If the RE generation is less than the projected coal plant generation, the ER total would have to be reduced accordingly. If there is no replacement RE plant put in place as part of the coal plant retirement, the emissions factor of the relative utility grid system would be used to net out the total ERs from this activity.

Monitoring, reporting, and verification

The actual generation from the replacement renewable energy plus storage plant would be the key data for MRV. This data could be easily obtained from the system operator or the plant itself. Then, per the above, this generation would be used to calculate the ERs from the coal plant retirement.

Pricing of verified emission reductions

When the operating cost of the coal plant is already less than the combined capital and operating costs of the replacement power, the ER can be priced to incentivize the third-party investor to undertake the necessary innovative financial engineering to make the transaction possible. The novelty and lack of track record of the proposed plant retirement structure will deter qualified firms from pursuing the

opportunities and necessitate substantial upfront work to develop the proper legal structuring of the special purpose vehicle, contracts, and fundraising efforts.

4. Summary

Most of the greenhouse gas mitigation required in the real economy to achieve the international climate goals depend on financing provided by the financial sector. While growing numbers of investors are seeking climate-smart investment opportunities, imperfections and barriers in the financial sector disadvantaging clean investments relative to high-carbon investments provide a rationale for public interventions through policies and incentives. In addition, the financial sector can be an effective and efficient channel to allocate public subsidies or carbon market revenues to the real economy.

In both contexts results-based payments for verified emission reductions, i.e., carbon crediting can become an important and relevant instrument.

This paper identified greening of national development banks, rewarding portfolio shifts of commercial banks, de-risking commercial lending, softening lending rates for clean technology, and rewarding innovative financial engineering as activity types of particular interest for carbon crediting due to high crediting potential and strong instrument rationale.

For all these activity types robust baselines, monitoring reporting and verification, and additionality is key to justify usage of public funds and safeguard environmental integrity. To achieve transformative impact further criteria need to be followed. Finally, pricing of verified emission reductions or compliance carbon market assets need to be informed by pricing methodologies specific to these activity types.

This paper outlined how technically sound carbon crediting programs in the financial sector could look like following the methodological requirements of the Transformative Carbon Asset Facility (TCAF).

These blueprints are not exhaustive and other approaches are possible. They are meant to inspire carbon crediting program development in the financial sector of developing countries. Concrete programs always will be and need to be specific to the respective country circumstances.