POLICY RESEARCH WORKING PAPER

Pure Play Green Sovereign Bond: Innovative Finance Proof of Concept

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Abstract

Sovereign “use-of-proceeds” green bonds and “sustainability-linked” bonds based on key performance indicators (KPIs) have emerged as key novel debt instruments with the potential to facilitate a just climate transition on a global scale. In contribution to the developing sustainable sovereign debt ecosystem, this report explores the conceptual and practical viability of a first-of-its-kind pure-play green sovereign bond (PPGSB) label.

Building on the conceptual foundations of existing sustainable thematic bonds, PPGSBs are designed to recognize and support developing “green” countries through the global sovereign debt marketplace. The report articulates the proof-of-concept for PPGSBs through the following sections: (I) the rationale behind and the definition of “pure-play green sovereign bonds,” (II) the selection criteria and conditions for issuance selected to qualify prospective issuers for the “pure-play green sovereign” designation, and (III) the recommendations for relevant stakeholders to facilitate the creation of PPGSBs. In addition, a dynamic interactive data model that simulates the PPGSB certification process based on findings of this report is available upon request.

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Section I - Introduction and Conceptual Framework

1.1 Background

The adverse impacts of climate change will not fall uniformly on all countries. By 2030, unmitigated climate change could push more than 130 million people into poverty in vulnerable Emerging Markets and Developing Economies (EMDEs).[1]

Despite these headwinds, a number of "green" EMDEs across geographies have nonetheless stood out for their environmental stewardship. In Central America, Panama is a decade ahead of the global goal to conserve 30% of terrestrial and marine habitat by 2030.[2] In Asia, Bhutan legally enshrined environmental protection by writing a minimum 60% forest cover requirement in its constitution.[3] In the Pacific, island states like the Maldives and Palau are actively combating rising sea levels through infrastructure projects, legal instruments, and international activism.[4]

While EMDEs often depend on funding from multilateral development organizations, international debt markets could play a crucial role in encouraging developing countries to be part of the climate solution, particularly for countries with substantial capital needs and underdeveloped domestic debt markets. Thematic bonds, in particular, offer EMDEs an avenue to diversify their investor bases and tap into alternative funding sources by catering to international investor interest in transparency and sustainability.[5]

Structural characteristics of the existing global debt market, however, have failed to differentiate and reward the aforementioned "green" EMDEs. While interest in sustainability-aligned debt instruments has steadily increased in recent years, with cumulative issuance of sustainable bonds projected to reach $900 billion in 2024, the funding gap between developed and emerging economies has persisted.[6] High costs of capital and lending hurdles continue to prevent EMDEs from effectively accessing the financing essential to a complex range of sustainable development and climate transition needs.[7]

Namely, persistently high interest rates — an average of 7% compared to the 3% typical in developed markets — amplify debt service burdens and limit fiscal capacities, even as annual climate adaptation costs are projected to reach around 1% of GDP in about 50 EMDEs in the next 10 years at quadruple the global average.[8] This disparity is similarly accentuated by the widening gap in investments aligned with

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[1] World Bank, "Rapid, Climate-Informed Development Needed to Keep Climate Change from Pushing More Than 100 Million People into Poverty by 2030," November 2015, URL

[2] Mission Panama, "Boldly Sustainable," accessed on April 14, 2024, URL

[3] FAO, "Bhutan's Forest Conservation Act," accessed on April 14, 2024, URL; World Bank, "Investing in Bhutan's Forests for a Sustainable Future," accessed on April 14, 2024, URL

[4] UNEP, "Maldives Rests Hope on New National Adaptation Plan to Tackle Climate Change," accessed on April 14, 2024, URL; SPREP, "Developing Marine Spatial Plan Toolkit for Pacific," accessed on April 14, 2024, URL; UNDP, "Palau Marine Spatial Planning Project Document," March 24, 2021, URL

[5] UN News, "Developing countries face $4 trillion investment gap in SDGs," July 2023, URL.

[6] S&P Global, "Global Sustainable Bonds 2023: Issuance to Exceed $900 Billion," accessed on April 14, 2024, URL

[7] World Bank, "Unlocking market finance for developing countries," November 2, 2023, URL.

[8] Despite nearly tripling renewable energy investments since the Paris Agreement's adoption in 2015, the bulk of this investment has flowed to developed countries. EMDEs require about $1.7 trillion annually for renewable energy investments but only attracted approximately $544 billion in 2022.

Sustainable Development Goals (SDGs) between developed and developing countries, which increased from $2.5 trillion in 2015 to $4 trillion in 2023.[9]

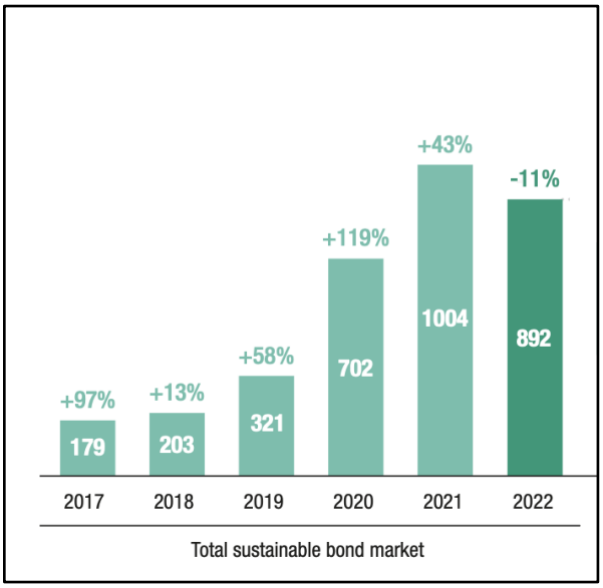
Against this backdrop, the mismatch between the surge in investor demand and the limited supply of high-quality sustainable debt instruments further aggravates financial challenges facing EMDEs. Existing green bond standards place outsized emphasis on the transparency and enforceability of financed assets, but suitable projects with demonstrably strong and replicable environmental benefits remain scarce in EMDEs.[10]

In developing markets, this mismatch is further accentuated by capital access obstacles and general state capacity constraints; EMDEs frequently find themselves unable to access green capital in the debt market due to an inability to meet stringent green bond issuance requirements. Aside from hindering effective portfolio allocation and market efficiency, this mismatch further exacerbates the climate funding gap between developed and developing countries.[11] To unlock the full potential of green bonds, especially for "green" developing countries, a new approach is needed.

1.2 Overview of Existing Bond Instruments

The global bond market comprises sovereign bonds and corporate bonds. Since 2008, both sovereign and corporate bond markets have experienced substantial growth. By the end of 2023, the combined volume of sovereign and corporate bond debt reached nearly $100 trillion, approximately equivalent to the global GDP.[12]

Figure 1: Global Sustainable Bond Issuance Trends (Source: United Nations)[13]



Sovereign bonds are debt securities issued by a sovereign government to raise capital for spending needs, such as on government programs and paying down debt. These bonds can be denominated in the issuing government's domestic currency or a foreign currency. Similar to corporate bonds, the risk associated with sovereign bonds depends on the likelihood of the issuing government defaulting. Countries with higher political and economic uncertainties may face a greater risk of default. Conversely, stable countries are generally considered to have a lower default risk.[14]

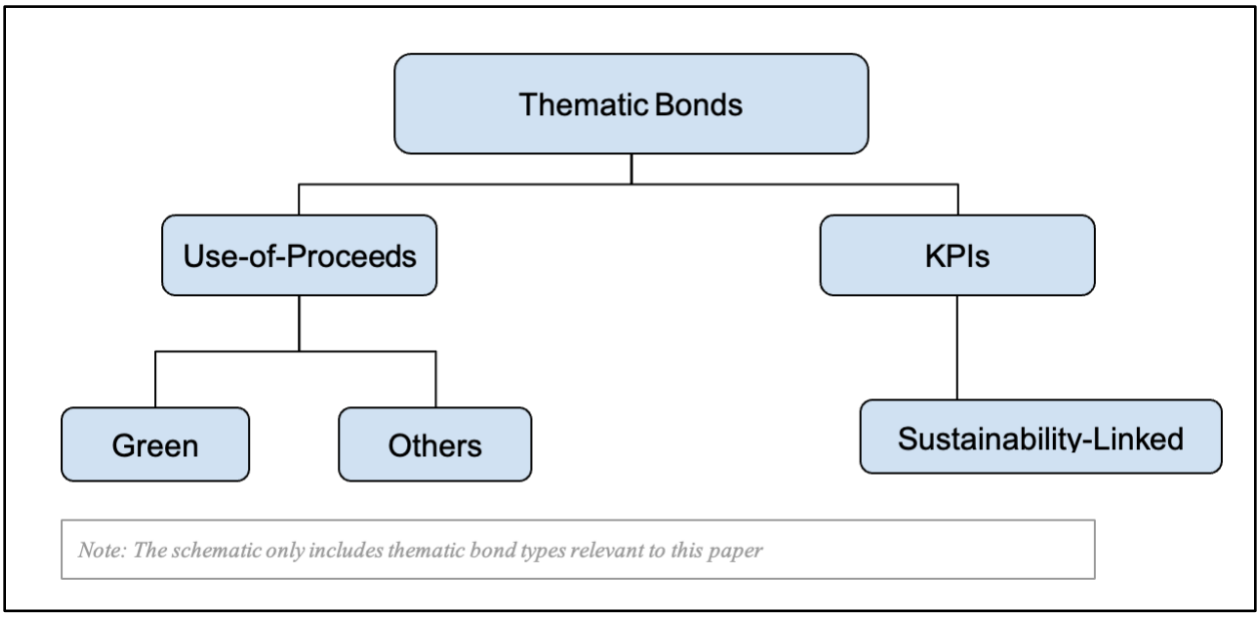
Thematic bonds, also referred to as labeled bonds, are fixed income instruments that allow investors to provide capital for thematic objectives, such as specific Sustainable Development Goals in areas

[9] UNCTAD, "Developing Countries Face $2.5 Trillion Annual Investment Gap in Key Sustainable," accessed on April 14, 2024, URL
[10] OECD, "Green and Social Sustainability Bonds: Developing Countries and Donor Coordination," accessed on April 14, 2024, URL
[11] EQ-Cap, "ESG Green Bonds Have a Chicken-and-Egg Problem," accessed on April 14, 2024, URL
[12] OECD, "Global Debt Report," accessed on April 14, 2024, URL
[13] UNCTAD, "World Investment Report 2023," accessed on April 14, 2024, URL
[14] Investopedia, "Sovereign Bond," accessed on April 14, 2024, URL

such as climate change mitigation, health, food, education, or access to financial services.[15] The total value of sustainable bonds issued by both corporate and official-sectors soared to $4.3 trillion in 2023 from $641 billion just five years earlier.[16] Despite this exponential growth, sustainable debt still only accounts for less than 5 percent of the global bond market.[17]

The two most common categories of thematic bonds are Use of Proceeds (UoP) and Key Performance Indicator (KPI). UoP bonds restrict the ways in which the issuer is allowed to use the capital raised, which is typically "earmarked" for expenditure in areas such as climate sustainability or social projects. In contrast, KPI bonds do not "ring-fence" proceeds. Rather, these bonds set forth certain KPIs, which often pertain to environmental, social, and governance (ESG) metrics, to be met over the lifespan of the securities. To reassure investors, KPI bonds often include clauses that allow for their coupon rates to be adjusted based on the issuer's performance in meeting these goals.

Figure 2: Types of Sustainable Thematic Bonds[18]



Green bonds are the most prominent type of thematic bond instruments. They require proceeds to be exclusively allocated to eligible green projects spanning areas such as climate change mitigation and adaptation, nature and biodiversity conservation, or pollution control. In contrast, sustainability-linked bonds (SLBs) are forward-looking performance-based instruments which employ a structure contingent on the issuer's achievement of predetermined sustainability performance targets (SPTs). These SPTs are mapped to select KPIs with financial and structural characteristics of the bond becoming more or less punitive based on whether targets are met.

[15] UNDP, "SDG Tools: Thematic Bonds - Green, Blue, SDG, Islamic Frameworks," accessed on April 14, 2024, URL
[16] OECD, "Global Debt Report," accessed on April 14, 2024, URL
[17] UNCTAD, "World Investment Report 2023," accessed on April 14, 2024, URL
[18] Columbia Center on Global Energy Policy, "Thematic Bonds: Financing the Net-Zero Transition in Emerging Market and Developing Economies," accessed on April 14, 2024, URL

Thematic bonds issuance has grown exponentially over the past decade, but their adoption has been uneven across markets. Cumulative issuance of green bonds in emerging and developing economies, where they have been the predominant sustainable debt instrument, remains modest at around 13% of the global green bond market excluding China.[19] Efforts to establish standardized, international procedures are currently underway, with no binding regulations in place. Instead, issuers typically adhere to the principles established by the International Capital Markets Association (ICMA).[20] These voluntary guidelines have emerged as the de facto global standards. In 2021, 98% of green bonds issued were in alignment with ICMA's Green Bond Principles.[21]

While taxonomy harmonization, local expertise and demand, and credit enhancement facilities have been highlighted as potential avenues to help unlock the full potential of thematic bonds, the existing assortment of instruments fails to adequately reward and incentivize countries, especially EMDEs, that have consistently exercised exemplary environmental stewardship.

One of the primary reasons for this mismatch is that existing thematic bonds typically have a narrow focus on specific projects or initiatives without taking the financial needs and challenges of EMDEs into account. While these bonds provide avenues for diversifying investor bases and accessing alternative funding sources, they often lack the adequate level of financial flexibility that EMDEs in weak fiscal standing need to reap the potential rewards for their environmental efforts in the global debt market. For instance, EMDEs often struggle to secure favorable interest rates or meet the stringent criteria set forth by "use-of-proceeds" bonds due to state capacity constraints, which in turn limits their ability to access capital markets in an effective and efficient manner.

As a result of this existing gap in the market, a novel bond instrument label tailored specifically to the financial and developmental realities of green EMDEs may be useful. This specialized instrument would recognize and reward EMDEs' environmental stewardship while providing them with the capital necessary for sustainable development and climate transition needs on more accommodating terms. By bridging the gap between sustainability objectives and financial accessibility, such bonds could play a crucial role in mobilizing sustainable finance for EMDEs, ensuring that their developmental and environmental objectives are both adequately supported.[22]

1.3 Introduction to the Pure Play Green Sovereign Bond (PPGSB)

1.3.1 Motivation

As escalating debt-to-GDP ratios and interest rate disparities aggravate financial challenges for EMDEs, innovative financial solutions are increasingly crucial in order to address both fiscal and climate vulnerabilities in a synergistic manner. At the same time, climate-aware investors are increasing demand for high-quality sustainable bond products, the supply of which remains limited.

Against this backdrop of structural capital access obstacles facing EMDEs in the global sovereign debt market, which includes a bias for developed countries and a prioritization of future commitments over

[19] Columbia Center on Global Energy Policy, "EM-Green Bonds CGEP Report December 2022," accessed on April 14, 2024, URL
[20] International Capital Market Association (ICMA), "The Principles, Guidelines and Handbooks," accessed on April 14, 2024, URL
[21] Dentons, "The Name is Bonds: Thematic Bonds," November 2023, URL
[22] Columbia Center on Global Energy Policy, "A Potential Path for Alleviating Currency Risk in Emerging Market Green Bonds," accessed on April 14, 2024, URL

historical performance, this report seeks to provide additional financial incentives for climate-ambitious developing nations through the establishment of a novel sovereign debt instrument.

Namely, this report explores the conceptual and practical viability of a first-of-its-kind “Pure-Play Green Sovereign Bond”(PPGSB), a novel sovereign bond label tailored to the developmental and environmental needs of “green” EMDE states. Combining elements of sovereign “use-of-proceeds" green bonds and KPI-based sustainability-linked bonds, the proposed PPGSBs are designed to recognize and support “green” EMDE states through innovative financial mechanisms.

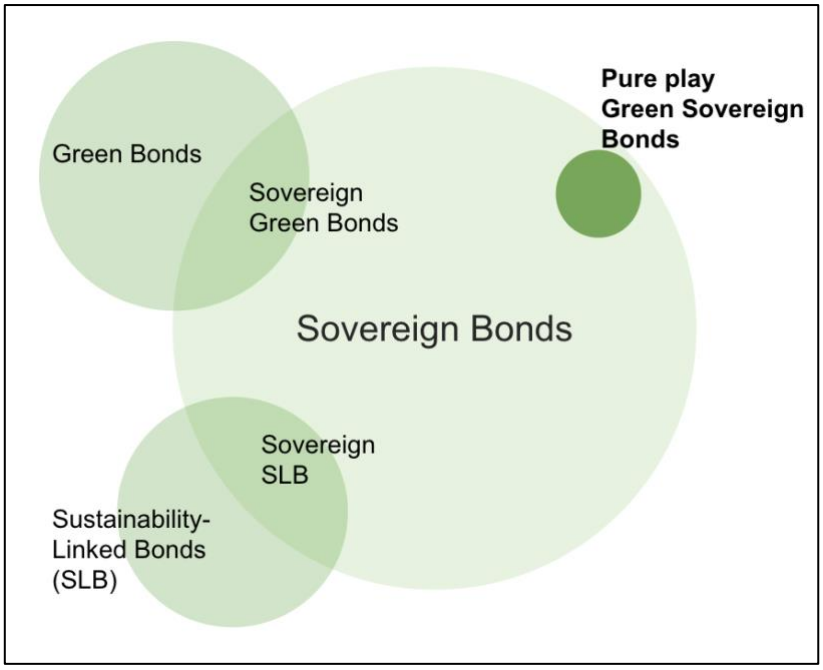
The development of PPGSBs aims to incentivize and reward developing economies that have achieved net-zero or low emissions, allowing them to benefit from their environmental achievements without disrupting their current emissions cycles. By recognizing green EMDEs for their existing efforts and encouraging them to maintain their green status quo, PPGSBs seek to provide a tangible mechanism for governments to finance their environmental policy objectives.

The PPGSB instrument does not seek to replace existing bond labels. Rather, it is an attempt at expanding the scope and coverage of the global sustainable sovereign debt market. Namely, PPGSBs aim to establish a more balanced criteria that addresses both developmental and environmental needs of EMDEs to complement existing green bond standards.

1.3.2 Definition

The PPGSB represents a novel debt instrument label aimed at catalyzing additional sustainable investment opportunities that reward green sovereign issuers. As depicted in the figure below, PPGSBs occupy a distinct space within the broader universe of sovereign bonds while adopting certain elements of established thematic bond categories such as green bonds and SLBs.

Figure 3: PPGSB Definition Diagram



As shown in the diagram, while PPGSBs share some similarities with other sustainable thematic bonds, they are a standalone sovereign bond instrument with distinct certification and enforcement mechanisms. In contrast to green bonds, which mandate proceeds to be exclusively used on selected projects (“ring-fencing”), the pure-play green designation does not hinge on predefined expenditures. Rather, PPGSBs measure a sovereign issuer's adherence to established “green” metrics that quantify existing environmental stewardship and monitor prospective sustainability commitments. This approach

aligns with sustainability-linked bond principles, but focuses on leveraging pre-existing climate attributes and policy measures to affirm the sovereign's consistent commitment to environmental stewardship.

The PPGSBs seek to facilitate a greater flow of sustainable capital to green sovereign issuers, particularly smaller countries with less developed financial markets. If successfully implemented alongside proven thematic bond models, this instrument could unlock an extensive, recurring pipeline of sovereign-issued sustainable debt securities. By simplifying complex rating systems and operational mechanics, PPGSBs are specifically tailored to the needs and constraints of EMDEs while creating opportunities for investors interested in fostering low-carbon modes of development in emerging markets with prerequisite natural reserves. However, developing clear qualification criteria, coordinating international standards, and garnering robust market support remain crucial prerequisites for the concept's operational viability.

PPGSBs v. Green Bonds

In contrast to green bonds, which could be issued by sovereigns or private entities, PPGSBs can only be issued by a “pure-play green” sovereign. A sovereign that meets certain green criteria and conditions for issuance is qualified for the “pure-play green” label, which automatically certifies all of the sovereign bonds it issues as “Pure Play Green Sovereign Bonds (PPGSBs).”

Unlike green bonds, which have “use-of-proceeds” clauses that “ring-fence” drawdown to be used only for certain predetermined projects, PPGSBs do not restrict the ways in which sovereign issuers use the capital raised. Barring the projects and practices prohibited in the exclusion criteria set forth by the PPGSB taxonomy, the issuer can exercise discretion in allocating PPGSB proceeds.

In the evolving landscape of the global sustainable finance ecosystem, PPGSBs could emerge as a key tool for EMDEs seeking to balance environmental stewardship with development needs by offering a tailored solution attuned to the “dual-vulnerability" dynamic. By lowering capital access barriers, PPGSBs could empower green EMDEs to capitalize on their environmental stewardship while pursuing developmental objectives. In addition, the PPGSB label will also enhance the green EMDE’s reputation and influence in international environmental policy discussions, diversify its investor base, and stimulate economic activity across SDG-aligned sectors. Overall, the label is intended to provide a tangible market-based mechanism through which EMDE governments can expand financing for environmental policies and broader sustainability goals.

PPGSBs could address the gap in capital access faced by EMDEs by aligning their bond offerings with the growing investor interest in sustainability. By linking favorable financial terms to overall country environmental performance, PPGSBs would recognize and motivate the sustainable efforts of green EMDEs. Conversely, PPGSBs also would provide a credible and transparent mechanism for investors looking to meaningfully contribute to sustainability goals. Support and buy-in from international entities wielding structural power, such as multilateral development banks (MDBs) and market standard-setters, will be crucial in the creation and adoption of PPGSBs. Partnerships with these institutions that leverage and facilitate functional expertise, knowledge sharing, capacity building, and legitimacy will be needed to enhance the viability, scalability, and impact of the nascent PPGSB market.

Section II - Design of the Pure Play Green Sovereign Bond (PPGSB)

2.1 Design Overview

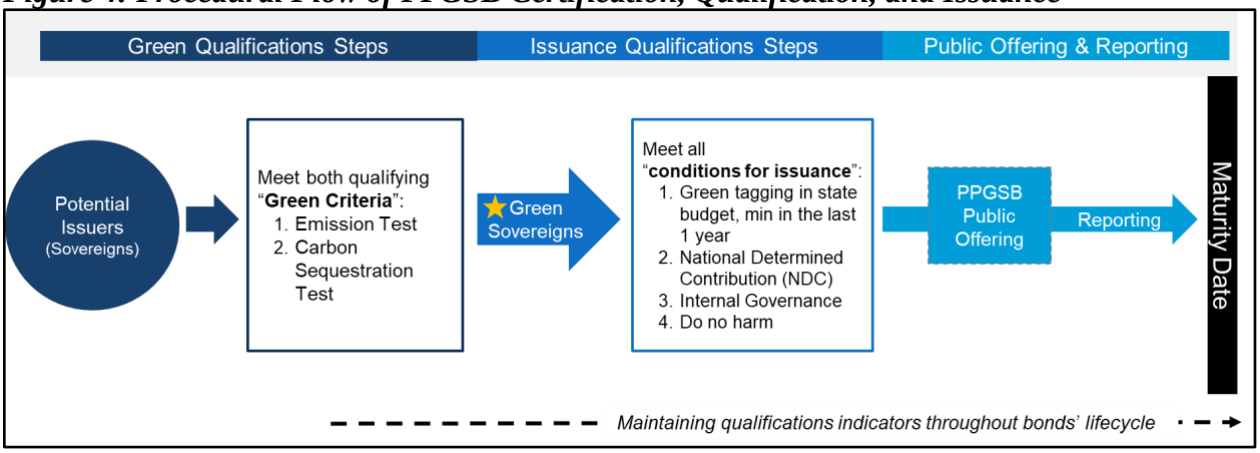
2.1.1 Certification and Issuance Framework

A dynamic certification methodology derived from quantifiable, precise, and reliable standards that determine which countries qualify as pure play green sovereign issuers is crucial to the successful rollout and uptake of PPGSBs. In order to accurately identify qualifying countries, this system needs to be able to materially assess and differentiate countries' substantive climate impacts as measured by relevant metrics.

The schematic below illustrates the necessary steps for PPGSB certification and issuance (Figure 4). First, prospective issuers must meet certain "green criteria" to be recognized as "green sovereigns." Following this certification, assessments are then administered to determine whether these green sovereigns meet additional conditions for issuance. Finally, sovereigns are cleared to proceed with the public offering of their new pure play green sovereign bonds if they manage to advance through both of the two preceding steps.

A dynamic interactive data model that simulates the PPGSB certification process is available upon request (see Appendix for details).

Figure 4: Procedural Flow of PPGSB Certification, Qualification, and Issuance



2.1.2 Leveraging Existing Standards

The standardization of "green" criteria is crucial to the development of PPGSBs, as the definition of "green" investment continues to be subject to diverging interpretations among market participants. Existing certification schemes and frameworks developed by private and public entities alike could offer insights into what is already widely recognized and accepted as "green" by the market, which in turn creates analytical leverage for the qualification process of PPGSBs. An overview of relevant existing "green" products, standards, and methodologies can be found in Table (a) & (b) in the Appendix. These existing approaches to green certification vary in scope, formulas, and weighting. For instance, some gauge greenness based on the environmental impact of the revenue generated by underlying assets, while others assess the greenness of the assets themselves. Similarly, certain products have a narrow sectoral or thematic focus while others are benchmarked to specific sustainability indicators. This report assesses and incorporates appropriate design elements from relevant existing standards in order to maintain a holistic approach aligned with market expectations; specific data selection mechanisms are discussed in-depth in requisite sections below.

2.2 Selection Criteria

2.2.1 Step I: Green Qualification

2.2.1.a Emission Test

Rationale for the Emissions Test Criteria

Carbon and GHG emissions are the primary driver of climate change; reducing emissions directly mitigates its impacts. Using emissions as a measure of a country's climate ambitions and commitments is crucial because it provides a quantifiable and standardized way to track progress toward climate goals. Data on emissions guide policymakers in assessing the effectiveness of their climate policies and allow them to adjust strategies as needed. Emissions also serve as a fungible global standard, enabling comparisons between countries and ensuring accountability under international accords such as the Paris Agreement.

Qualifying Test #1: Five-Year Time-Weighted Emissions
First, prospective issuers' cumulative GHG emissions from the past five years will be measured using a time-weighted system in accordance with PPGSB guidelines.[23] Then, this five-year time-weighted emissions figure will be compared against a PPGSB benchmark value. The initial recommended emission benchmark is 10 MT CO2e/year, based on a sensitivity analysis of historical EMDE data. Finally, prospective issuers whose five-year time-weighted emissions fall below the emission benchmark will pass this qualifying test.[24]

Selection of datasets

After a thorough evaluation of potential data sources, the Emissions Database for Global Atmospheric Research (EDGAR) was identified as the most appropriate to support the compilation of an illustrative list of countries that qualify under the emission test. The selection was based on factors such as availability of most recent data for all countries and frequency of updates.[25]

Selection of metrics: GHG emissions v. CO2 emissions

Greenhouse gas (GHG) emissions arise from various sources such as the combustion of fossil fuels (coal, oil, and natural gas), deforestation, agriculture, and industrial processes. Although CO2 is the most common greenhouse gas, others like methane, nitrous oxide, and fluorinated gasses also play a role. Methane, for example, is approximately 28 times more potent than CO2 in terms of its heat-trapping ability[26].

[23] The time-weighted system used for evaluating a country's emissions profile in the Emissions Database for Global Atmospheric Research (EDGAR) emphasizes more recent data by assigning increased weight to each successive year.
[24] Bhutan, Cayman Islands, Fiji, Grenada, Guyana, Jamaica, Maldives, Martinique, Palau, Réunion, and São Tomé and Príncipe qualify under the Five-Year Time-Weighted Emissions test.
[25] Data sources considered for emissions assessment include Climatewatch, the World Bank, the Statistical Review of World Energy, UNFCCC, PIK PRIMAP, the International Energy Agency, and the Global Carbon Project.
[26] European Commission, "Methane Emissions," accessed on April 14, 2024, URL

Considering GHG emissions account for these gasses while CO2 alone does not, measuring GHGs provides a more comprehensive approximation of the emitters' overall impact on climate change. Most credible data sources report yearly emissions by country under three metrics: total GHG/CO2 emissions, GHG/CO2 emissions per capita, and GHG/CO2 emissions per GDP. All three indicators are measured in CO2 equivalents or CO2e.[27]

Selection of Metrics: Total emissions v. emissions per capita v. emissions per unit of GDP

The total emissions metric has been prioritized over emissions per capita and emissions per unit GDP for clarity, fungibility, and equity reasons.

First, total emissions are directly aligned with the PPGSB framework's goal of rewarding low-emitting countries and offer a stable measure that is less sensitive to changes in population size or economic activity. Additionally, total emissions figures also provide a precise metric for setting and tracking emissions reduction targets at the national level and is less susceptible to misinterpretation or misrepresentation compared to per capita or per GDP metrics, which can be influenced by factors such as population size or economic output. Furthermore, total emissions better reflect the effectiveness of policies aimed at reducing emissions, as they directly measure the amount of emissions reduced, rather than just the efficiency of emissions relative to population or GDP. Importantly, total emissions provide a more equitable measure for evaluating countries' environmental performance compared to emissions per GDP, which could make small, underdeveloped countries with low GDP appear less environmentally efficient.

Timeframe for measuring total GHG emissions

Measuring a country's five-year time-weighted emissions offers a dynamic and up-to-date perspective on its environmental impact, which could support better decision-making and climate action planning. This criterion provides a comprehensive view of a country's recent environmental impact. It enables trend analysis by highlighting whether emissions are increasing, decreasing, or stabilizing over time. This trend can indicate the effectiveness of current mitigation efforts and inform future strategies. The time-weighted approach emphasizes more recent years, providing a more accurate reflection of the country's current emissions profile. This is crucial for assessing progress towards climate goals, as it focuses on the most relevant data. This method also helps evaluate the effectiveness of recent policies and initiatives aimed at reducing emissions.

Inclusion of years affected by the COVID-19 pandemic

For the purpose of this analysis, the COVID-19 period (2020-2022) has been included, as the pandemic's overall impact on emissions was observed to be minimal. Specifically, only 33 countries, representing 15.79% of the total, experienced a significant increase in GHG emissions (above 10%). In contrast, the

[27] To account for the different global warming potentials of various greenhouse gases, the concept of CO_2 equivalent (CO_2e) is utilized, converting all emissions to a common metric based on their impact relative to CO_2.

majority of nations exhibited a negligible change in emissions with an absolute variation of less than one million metric tons of CO2 equivalent. This suggests that the inclusion of the pandemic years does not substantially skew the broader observed GHG emissions trends.

2.2.1.b Carbon Sequestration Test

Rationale for the Carbon Sequestration Test

Carbon sequestration is a critical aspect of natural resource management and climate resilience, making it integral to PPGSBs' central objective of supporting EMDEs that demonstrate exceptional environmental stewardship. Countries with effective carbon sequestration practices contribute to mitigating climate change by removing CO2 from the atmosphere and storing it in natural sinks such as forests and oceans. Therefore, the ability of a nation to manage carbon sequestration is directly linked to its natural assets management and qualifies it for recognition under the PPGSB framework. As a result, the PPGSB evaluation will comprise an analysis of the degree to which these nations efficiently administer and safeguard their natural resources in accordance with carbon sequestration capacities.

Qualifying Test #2: Carbon Sequestration via Natural Resource Preservation

To pass the carbon sequestration test, a sovereign should:

1) maintain a minimum 50% forest cover by the year of issuance, and
2) maintain a maximum average annual deforestation rate of 0.30% over the 10 years preceding the issuance year

Only countries that pass the emissions tests and pass the carbon sequestration test will be eligible for the "Green Sovereign" label.

Selection of Carbon Sequestration Metrics: Terrestrial vs Water-based

Most efforts to reduce atmospheric CO2 surplus have focused on terrestrial solutions such as afforestation. At the same time, a growing body of research is considering marine habitats as a feasible domain for CO2 removal, as coastal wetlands and mangroves accumulate carbon at a rate that is ten times greater than that of fully developed tropical forests.[28]

This report will exclusively consider carbon removal on terrestrial surfaces, particularly through forests. This determination is predicated on 1) the simplicity of measurements, given that the carbon sequestered in vegetation and trees can be monitored and measured directly using a variety of methods including satellite imagery, forest inventories, and ground-based assessments, and 2) deforestation and forest degradation constitute a significant climate risk, as they alone account for approximately 15% of worldwide greenhouse gas emissions and are the second most prominent contributors to global warming.[29] Recognizing forests as a critical focus area allows for both the conservation of existing carbon stocks and the mitigation of emissions stemming from deforestation.

[28] NOAA National Ocean Service, "Coastal Blue Carbon," accessed on April 14, 2024, URL
[29] Forest Carbon Partnership, "What is REDD+?" accessed on April 14, 2024, URL

High Forest, Low Deforestation (HFLD)

High Forest, Low Deforestation (HFLD) areas are characterized by substantial forest coverage and comparatively minimal deforestation rates.[30] Although a precise threshold does not exist, widely accepted criteria include deforestation rates below the global average, estimated to range from 0.263% to 0.296% from 2000-2010 and 2009-2019, and a minimum of 50% forest cover.[31]

To align with the characteristics of HFLD regions, criteria for the carbon sequestration test includes 1) maintaining over 50% forest cover by the issuance year, and 2) limiting the average annual deforestation rate to 0.30% over the preceding decade. Anchoring to HFLD metrics allows PPGSBs to facilitate effective monitoring and benchmarking on a global scale through the establishment of a standardized and fungible metric measuring carbon sequestration across diverse geographies.[32] In addition, the timeframe for calculating the annual average deforestation rate used for the PPGSB qualifying test is set at a 10-year interval, which aligns with the timeframe used in earlier research to establish the suitable minimum deforestation rate for these countries to be labeled as HFLD.[33]

Selection of Datasets: Global Forest Watch (GFW)

Data from Global Forest Watch (GFW), developed by the World Resources Institute (WRI), will be used for the PPGSBs to further limit statistical noise due to the scope, timeliness, and accessibility of its coverage.[34] GFW includes both forest loss and forest cover metrics and does not require specialized knowledge to decode. In addition, GFW delivers timely and precise data regarding the condition of forest ecosystems across the globe by incorporating immediate notifications for areas where recent tree cover loss is suspected. GFW's crowdsourcing tools also enable users to make contributions by sharing first-person stories and data. By incorporating insights from both top-down and bottom-up perspectives, GFW ensures that the data is comprehensive and up-to-date.

[30] Environmental Defense Fund, "High Forest Low Deforestation (HFLD)," accessed on April 14, 2024, URL
[31] World Bank, "Options for Conserving Stable Forests," accessed on April 14, 2024, URL
[32] Global Forest Watch, "Global Dashboard," accessed on April 14, 2024, URL
[33] Environmental Defense Fund, "HFLD Crediting and Additionality," accessed on April 14, 2024, URL
[34] NDC Partnership, "Global Forest Watch Climate Toolbox," accessed on April 14, 2024, URL

2.2.2 Step II: Conditions for Issuance

Once prospective issuers pass both the emissions and carbon sequestration tests, they are qualified to earn the "Green Sovereign" label. This is a necessary, but not sufficient, requirement to become a PPGSB issuer. Green sovereigns must also meet a set of criteria designed to ensure that countries enforce actions that enable them to maintain environmental stewardship in the future. These criteria include a country's Nationally Determined Contributions (NDCs), adoption of green budgeting and Do No Harm criteria, and establishment of a robust internal governance mechanism. Collectively, these criteria constitute the "Conditions for Issuance," the assessment of which enables relevant stakeholders to authenticate the green sovereigns' commitment to environmental stewardship.

2.2.2.a Nationally Determined Contributions (NDCs)

Nationally Determined Contributions (NDCs), which encapsulate each country's commitment to reducing national emissions and adapting to the impacts of climate change, are a pivotal element of the Paris Agreement. The specific NDCs of potential bond-issuing countries are therefore a critical consideration for the PPGSB issuance.[35]

Prospective issuers' clearly-outlined NDC commitments serve several essential purposes including: 1) demonstrating how the use of proceeds will directly support the country's national climate action plan and contribute to the global goals of the Paris Agreement; 2) highlighting the country's ambition and commitment to emissions reductions, adaptation, and broader sustainable development, which are essential factors in evaluating the credibility and long-term viability of the PPGSBs; and 3) enabling tracking and reporting on the bond's contribution to the country's achievement of its NDC targets over time, which foster transparency and accountability.

To be considered for PPGSBs, countries will be assessed based on disclosed data on climate targets, strategies, and alignment with global climate goals. Prospective investors must be informed of the country's progress towards these NDCs, as well as any updates or revisions that reflect increased ambition. A thorough analysis of NDCs will not only provide a clearer picture of the country's climate goals but also establish the bond's potential impact on these commitments. To meet the qualifications of issuance, countries should submit prospectuses including metrics such as those delineated in the box below.

Potential NDC evaluation metrics

1) The country's current greenhouse gas emissions reduction target for 2030
2) Key strategies and actions the country has outlined to achieve these emissions reduction goals such as:
    a) Increasing renewable energy generation to specified targets
    b) Improving energy efficiency across sectors like buildings, industry, and transport
    c) Transitioning to low-emission transportation modes
    d) Implementing sustainable land use and forestry practices
3) The country's existing progress towards its NDC targets to date.
4) Planned updates or revisions to increase the ambition of the country's NDC over time, in line with the Paris Agreement's long-term temperature goal
5) Other metrics deemed relevant

[35] United Nations Framework Convention on Climate Change, "Nationally Determined Contributions (NDCs)," accessed on April 14, 2024, URL

2.2.2.b Green Budgeting

Green Budgeting refers to the systematic integration of climate and environmental considerations into the public financial management and national budgeting process to promote sustainable development. Green budgeting enables countries to align their public expenditures with environmental and climate commitments, such as those outlined in their Nationally Determined Contributions (NDCs) under the Paris Agreement. Transparency in green budgeting will help build credibility and trust with investors by demonstrating a robust framework for monitoring and evaluating the impact of financed projects.[36]

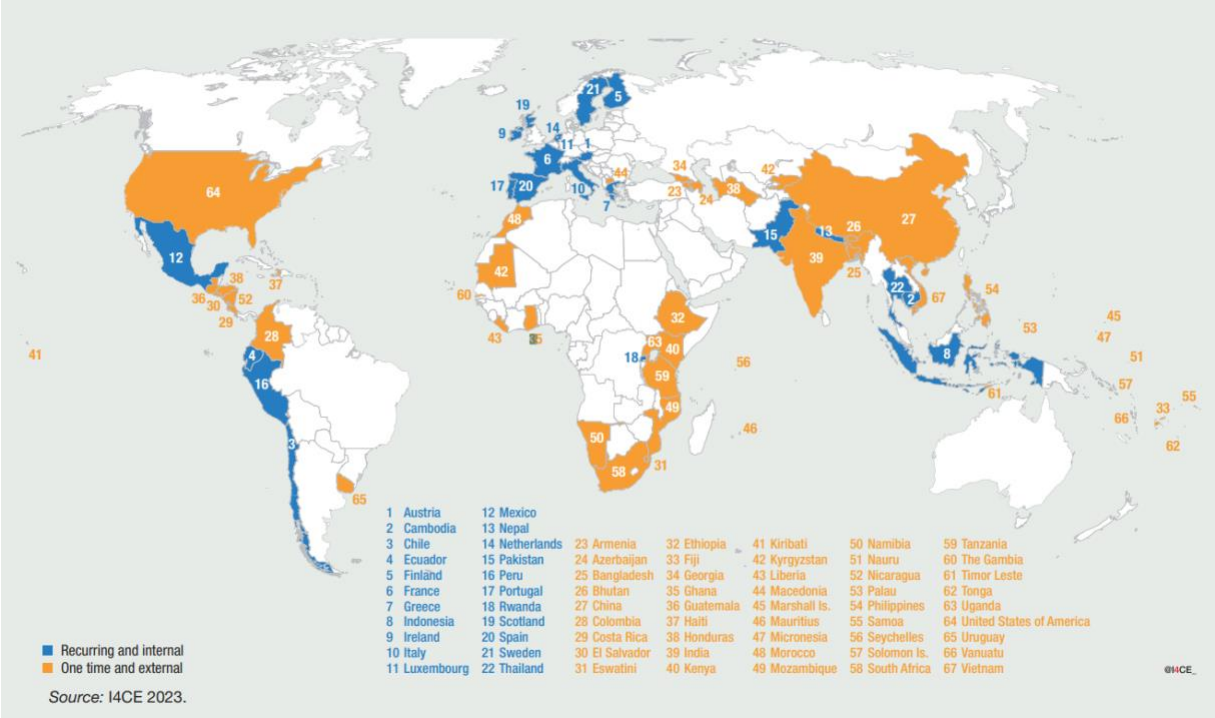
To be considered for PPGSB issuance, potential issuer prospectuses should include a retrospective analysis of green budgeting practices adopted in previous years. Demonstrating a robust green budgeting framework is crucial, as it 1) provides transparency on how the country has historically channeled public funds towards green projects and initiatives, which may signal how proceeds from the PPGSB will be used in the future, 2) highlights the country's institutional capacity, governance mechanisms, and monitoring/reporting systems for managing and accounting for sustainable public expenditure, 3) allows investors to assess the degree of alignment between the country's budgetary priorities and the intended use of proceeds from the PPGSBs, and 4) indicates the country's long-term commitment to financing its climate and environmental goals beyond the specific PPGSB issuance.

Green Budgeting in EMDEs

Implementing green budgeting can enhance the ability of developing nations to access climate-related development funds. Studies have found the adoption of green budgeting to be linked to increased flow of climate-related development finance.[37] At least 43 developing countries have adopted it once, while 22 have incorporated it more than once.[38]

Figure 5: Map of Countries that have Undertaken Green Budgeting

[36] OECD, "Government Budgeting and Public Expenditures," 2024, URL
[37] C. Pindiriri and M. Kwaramba, "Climate finance in developing countries: green budget tagging and resource mobilization," Climate Policy (2024): 1-15, URL
[38] Institute for Climate Economics, "Greener, better, stronger: Factors for the successful implementation of green budgeting in EU Member States," June 2023, URL



The green budgeting analysis should include 1) a breakdown of expenditures on environmental protection, climate adaptation, and mitigation initiatives, as well as 2) how these expenditures have been funded, including through any previous green bonds. The disclosure should also highlight the effectiveness of these investments in achieving environmental outcomes and how they align with the country's broader economic and environmental strategies.

Green Budgeting as Conditions of Issuance

To qualify for issuance, the issuing country should provide details on its green budgeting approach in its documentation including the following:

1) Green Budget Allocations
    a) The government has been implementing green budget tagging for at least one year, indicating the presence of a functioning committee overseeing its execution.
    b) A minimum of 25% state budget should be tagged as green.[39]
    c) Following minimum level 1 EU green budgeting framework.
2) Monitoring and Reporting
    a) Description of the country's internal processes for identifying, tracking, and reporting on climate-related and environmentally relevant public expenditures.
    b) Details on the methodologies used to categorize, quantify and report on the climate and environmental benefits of these green budget allocations.
    c) Information on independent third-party verification or auditing of the country's green budgeting practices and outcomes.

[39] The average proportion of Bhutan, Fiji, and Nepal's green budget is estimated at 30%, with a tolerance margin of ±5%, utilizing the lower bound for analysis.

3) Governance and Coordination
    a) Explanation of the institutional arrangements and cross-ministerial coordination mechanisms in place to inform green budget decision-making and implementation.
    b) Overview of the roles and responsibilities of various government entities (e.g. ministries of finance, environment, planning) in the green budgeting process.
    c) Disclosure of any advisory bodies, stakeholder engagement processes, or public consultation undertaken to guide the country's green budgeting approach.
4) Lessons Learned and Future Improvements
    a) Discussion of key challenges faced, best practices identified, and lessons learned from the country's green budgeting experiences to date.
    b) Outline of any planned enhancements or expansions to the country's green budgeting framework, such as the incorporation of climate risk assessments or green budget tagging systems.

2.2.2.c Internal Governance Mechanism

Internal governance and reporting mechanisms are critical to ensuring the successful implementation and oversight of the sustainable finance activities and instruments issued or utilized by PPGSBs market participants. Potential issuer prospectuses must elaborate on the governance structures in place to manage the proceeds of PPGSBs, including the roles and responsibilities of involved parties (e.g., ministries, environmental agencies).

Governance Framework

Prospective issuers should provide a detailed overview of their internal governance framework for PPGSBs, including:

1) Critical government entities (e.g., ministries of finance, environment, planning) and their respective roles and responsibilities in the PPGSB management and decision-making process.
2) The composition and terms of reference of any dedicated PPGSB committees, steering groups, or audit mechanisms responsible for overseeing the selection, evaluation, and monitoring of activities, expenditures, or instruments associated with PPGSB proceeds.
3) Established criteria and procedures for identifying, evaluating, and selecting eligible activities, expenditures, or instruments to ensure alignment with the country's PPGSB framework and broader environmental and climate objectives.

These governance mechanisms should detail the decision-making processes, criteria for project selection, and the protocols for ongoing monitoring and reporting. Additionally, prospective issuers should describe the transparency and accountability measures in place, such as independent audits and public disclosures. Effective governance mechanisms will reassure investors of the integrity and effectiveness of the bond, thereby enhancing its appeal and potentially leading to more favorable financing terms. Prevailing market-standard reporting frameworks such as GRI and IRIS+ could also be used as references.[40]

Reporting and Transparency

[40] Global Reporting Initiative, "GRI Standards," accessed on April 14, 2024, URL

In addition to the governance structure, prospective issuers should also outline the country's commitments to ongoing reporting and transparency, including:

1) The frequency and content of public reporting on the use of PPGSB proceeds, including details on the allocation and disbursement of funds raised through the bonds.
2) Indicators and methodologies used to measure and report on the outputs, outcomes, and impacts of PPGSBs, which should draw on established frameworks such as GRI, IRIS+, or other relevant standards.
3) Plans to engage independent third-party auditors or verifiers to assess and certify the country's alignment of PPGSBs with the country's environmental, social and governance (ESG) goals and commitments.
4) Channels and platforms used to publicly disclose PPGSB reports and other relevant information, which ensure accessibility for investors and stakeholders.

2.2.2.d Do-No-Harm Compliance

"Do no harm" compliance is a fundamental prerequisite for issuing PPGSBs, as these bonds are designed to promote sustainable development while mitigating potential negative environmental and social impacts. Adherence to "do no harm" principles is a critical condition that must be satisfied upfront, before the issuance of PPGSBs. In the pre-issuance stage, comprehensive assessments and robust management plans should be put in place to ensure that the proposed activities or expenditures funded by the PPGSBs do not cause unintended harm to the environment, communities, or vulnerable groups. By establishing "do no harm" compliance as a condition of issuance, countries can demonstrate their commitment to upholding the integrity of these bonds and instill confidence among socially and environmentally conscious investors.

The annual reporting of the Environmental and Social Commitment Plan (ESCP) by issuers is pivotal for upholding the integrity of these bonds and boosting investor confidence. Issuers are encouraged to follow the framework set by the World Bank Group, which outlines comprehensive guidelines and standards for managing environmental and social impacts associated with investment projects. These guidelines demand thorough environmental and social assessments, risk classification, active stakeholder engagement, and robust management plan.[41] Such practices ensure equitable distribution of benefits from projects funded by PPGSBs and protection for vulnerable groups, thereby enhancing the societal and ecological value of the investments and attracting socially and environmentally conscious investors.

[41] The World Bank, "Environmental and Social Framework," 2018, URL

2.2.3 Step III: Post-issuance Reporting Mechanisms

2.2.3.a Monitoring and Reporting

Sovereign bond issuers are increasingly adopting advanced practices in reporting and governance to enhance transparency and investor confidence. This trend is particularly significant for investments in the green bonds market, where clear, transparent, and comprehensive reporting and disclosure are crucial to the accomplishment of the instruments' stated objectives. Such practices include the thorough disclosure of bond terms, consistent reporting of both financial and non-financial data, and compliance with internationally recognized standards.[42]

The unique attributes of PPGSBs necessitate specific reporting requirements that enable green developing countries to issue sovereign debt while ensuring the instrument's long-term investment viability. To this end, it is recommended that PPGSB issuers establish robust internal governance systems to guarantee the accuracy and timeliness of reported data throughout the life cycle of PPGSBs.

Reporting Mechanisms

To maintain the integrity of the PPGSB designation, issuers must regularly publish and make accessible the following information each year until maturity:

1) Current data on GHG emissions and carbon sequestration performance.
2) An Environmental and Social Commitment Plan (ESCP) report verifying that funded projects avoid unnecessary environmental and social harm.
3) Green budgeting efforts.
4) Efforts to achieve NDCs.
5) New initiatives undertaken to maintain/enhance environmental status.

All disclosed data should be verified by an independent third-party evaluator under the ICMA Guidelines for External Reviews. Should there be delays in reporting or the unavailability of certain data, issuers must issue interim reports detailing the status of each required metric.

In addition, since these reporting metrics are designed to reflect the reality that GHG emissions in green developing countries may rise due to growth and development, flexibility for temporary fluctuations is incorporated:

1) An annual increase of up to 5% in GHG emissions is permissible.[43]
2) Countries must maintain at least 50% forest cover and restrict the deforestation rate to no more than 0.3% annually.[44]

2.2.3.b Failure to Maintain Criteria for Selection

In the event of a sovereign issuer failing to continue to meet the required GHG and Carbon Sequestration screening and issuance conditions requirements for PPGSBs, the repercussions will be governed by the

[42] International Capital Market Association, "Sustainability-Linked Bond Principles," June 2020, URL

[43] The analysis observes an average growth rate of GHG emissions between -7% and 3% over the past five years for countries with emissions under 10 MT. The methodology allows an additional 2% above the highest growth rate observed in these lower-emitting countries, promoting sustainable development while aligning with international environmental goals.

[44] Specifically mirroring the carbon sequestration test utilized in qualifying green projects or entities.

bonds' terms and conditions. Similar to green bonds, the potential results differ based on the terms of the investment mandate but may include the dissolution of funds, reputational damage that leads to an institution losing funding approval, or the necessity to sell bonds on the secondary market.[45] Given this risk, disclosing bond-associated risk factors in the prospectus document is crucial for prospective issuers, while placing reporting provisions directly into bond terms governing put events may further incentivize compliance.[46] Potential remedies may include allowing bondholders to sell the bonds back to the issuer at a predetermined price if the issuer exceeds the acceptable ranges for PPGSB reporting indicators.

[45] Lexology, "Detail on Green Bonds," accessed on April 14, 2024, URL
[46] Baker McKenzie, "Green Bonds Market Insights," September 2019, URL

Section III - Conclusion and Recommendations

3.1 Conclusion and Next Steps

As an innovative financial instrument, PPGSBs have the potential to markedly transform the sovereign debt landscape for EMDEs. Namely, PPGSBs could constitute a concrete financial mechanism that rewards a select group of EMDEs for their past and ongoing environmental efforts, while also incentivizing the maintenance and proliferation of such practices.

The key to actualizing the full potential of PPGSBs lies in the robust engagement and coordinated action of multiple stakeholders. Framework-makers must continue to refine and strengthen the standards, ensuring the system's integrity through clear, measurable criteria and comprehensive guidelines. At the same time, the involvement of Multilateral Banks (MDBs) and Development Finance Institutions (DFIs) is crucial. MDBs and DFIs can support the PPGSB concept by providing the necessary reputational endorsement, financial backing, and technical assistance to facilitate widespread adoption.

For sovereign issuers, particularly those in EMDEs, the opportunity to leverage their environmental credentials for favorable financial terms can significantly ease the cost of accessing capital. This would serve a dual purpose of supporting their immediate fiscal needs while being aligned with broader sustainable development goals. For investors, the PPGSBs represent a viable avenue to diversify portfolios and invest in a future that values environmental sustainability alongside economic returns.

In conclusion, the successful implementation of PPGSBs depends on a collective commitment from relevant stakeholders in the global debt market to facilitate a transparent, accountable, and dynamic sustainable finance environment. Aligning efforts across sectors and borders would ensure that PPGSBs serve their intended purpose of financing a greener future, thus contributing to a resilient, sustainable global economy.

3.2 Detailed Stakeholder Recommendations

3.2.1 Framework-makers

Develop Robust PPGSB Standards and Guidelines: To enhance the efficacy of the PPGSB instrument, framework-makers should take the lead in continuously establishing comprehensive standards, eligibility criteria, and operational guidelines for the PPGSB. This includes defining clear environmental performance metrics, verification processes, and disclosure requirements to ensure the integrity and credibility of the PPGSB market.

Facilitate Global Coordination and Harmonization: Framework-makers should work closely with other standard-setting bodies, multilateral institutions, and regional development banks to promote global coordination and harmonization of PPGSB standards. Relevant institutional partners may include the Climate Bonds Initiative (CBI), the Institutional Investors Group on Climate Change (IIGCCO), the International Capital Market Association (ICMA), and more.[47]

Provide Technical Assistance and Capacity Building: Framework-makers should offer technical assistance and capacity-building support to sovereign debt offices in EMDEs to help them assess their environmental performance, strengthen policy frameworks, and navigate the PPGSB issuance process.

[47] United Nations Environment Programme Finance Initiative, "UNEP FI to Support CSRD Implementation by Leveraging Principles for Responsible Banking Requirements," accessed April 14, 2024, URL

The technical assistance and capacity-building support could include offering advisory support to strengthen environmental governance frameworks, helping design and implement green public financial management systems, green budgeting, and conducting training programs for debt management office staff on sustainable finance instruments.

3.2.2 Multilateral Development Banks (MDBs), Development Finance Institutions (DFIs), etc.

Endorse and Support PPGSB Adoption: Multilateral banks and development finance institutions should lend their institutional weight and credibility to the PPGSB concept, which would help promote its adoption among sovereign issuers and investors. For example, they can issue joint statements or white papers endorsing the PPGSB as a viable sustainable finance instrument for sovereign issuers, or facilitate PPGSB pilot transactions with selected sovereign issuers to showcase the instrument's application and benefits.

Provide Financing and Credit Enhancement: These institutions should explore ways to provide financing, credit enhancement, and other forms of financial support to facilitate PPGSB issuances, particularly for smaller and riskier EMDE sovereign issuers. The measures can include guarantees, concessional lending, or first-loss capital to mobilize private investment into PPGSB markets.[48]

Collaborate on Data and Verification: MLBs and DFIs should work closely with framework-makers (including the World Bank) to develop robust data collection, monitoring, and verification frameworks for PPGSB issuances. For example, they can work together to create standardized impact reporting templates and methodologies for the PPGSB issuing process, and collaborate on designing rigorous third-party verification and assurance procedures for PPGSB issuances.[49]

3.2.3 Sovereign debt offices

Evaluate Environmental Performance: Sovereign debt offices should collaborate with relevant government departments to conduct thorough assessments of their country's environmental performance and policies to determine eligibility for issuing PPGSBs. This involves evaluating existing green projects and sustainability agendas against the PPGSB criteria.

Strengthen Environmental Policy and Governance: To qualify for PPGSB issuance, sovereign debt offices should collaborate with relevant government departments to work towards strengthening their environmental governance frameworks and policies, ensuring that they align with selection criteria and PPGSB standards.

Capitalize on Environmental Stewardship: For countries that already have a strong track record in environmental stewardship, sovereign debt offices should leverage it by electing for PPGSB label to issue PPGSBs to gain more favorable terms in the capital markets, reducing the cost of capital and enhancing access to funding.

Enhance Transparency and Reporting: Implement robust monitoring, reporting, and verification mechanisms to ensure transparency regarding the budgeting plans and the environmental impact of the PPGSB. This will build trust with investors and potentially improve the market perception and creditworthiness of the sovereign issuer.

[48] International Finance Corporation, "Blended Finance," accessed April 14, 2024, URL
[49] International Capital Market Association, "Green Bond Principles (GBP)," accessed April 14, 2024, URL

Engage with Standards and Practices: Actively participate in the development and harmonization of international standards for green bonds and PPGSBs. Sovereign debt offices should contribute to and adopt best practices, facilitating a more accessible and impactful sustainable finance market.

3.2.4 Investors

Diversify Portfolios with PPGSBs: Investors should consider diversifying their portfolios by including PPGSBs, which not only offer a financial return but also contribute to global sustainability goals. PPGSBs represent an opportunity to invest in countries demonstrating track record in and long-term commitment to environmental stewardship.

Seek Transparency and Accountability: Demand high standards of transparency and accountability from sovereign issuers regarding the environmental impacts of PPGSBs. This includes regular reporting and independent verification.

Support Sustainable Development: Investors should view PPGSBs as an instrument to support sustainable development in EMDEs. Investing in PPGSBs contributes to bridging the financing gap for climate adaptation and sustainable projects in these countries.

Advocate for Standardization and Innovation: Investors can play a critical role in advocating for the standardization of green bond criteria and the innovation of new financial instruments like PPGSBs. Engaging with issuers, standard-setters, and regulatory bodies can help shape a more efficient and impactful sustainable finance ecosystem.

3.3 Final Note and Looking Ahead

As we conclude our exploration of PPGSBs, we recognize their transformative potential in sustainable finance. By rewarding and motivating EMDEs for their environmental efforts, PPGSBs align financial strategies with sustainable development objectives. However, broader engagement of all stakeholders, including framework-makers, multilateral banks, sovereign debt offices, and investors, is crucial. For PPGSBs to truly be impactful, they must be supported by well-defined, science-based, and rigorous methodologies. Only with such robust backing will these instruments sustain their relevance and continue to drive towards a resilient and sustainable global economy.

Section IV - Appendix

4.1 Table (a): Existing Approaches

Approach	Green Exposures	Green Products
Assets - Balance Sheets	80% green	SEC Asset labelling guide for funds
	70% green	China Green Assets Backed Securities
Revenue - Income Statement	50% green	China Green Assets Backed Securities
	30% green	China Green Assets Backed Securities
	50% green	LSEG Green Economy Mark
	90% green	Pure Play Green Corporate
UoP allocation - Cash Flow Statement	70% of funds raised to sector-specific	China Green Assets Backed Securities
	Sector-specific	Green Loan Principles - Loan Market Associations
	Sector-specific	Fannie Mae Framework
Benchmark based	Promote environmental & social, measured by indicators	SFDR Article 8 - Light green funds
	1) Sustainable investment as objective (measured by indicators) 2) may or may not benchmark to an index	SFDR Article 8 - Dark green funds

	3) reduction of carbon emission objective	

4.2 Table (b): Existing Indices

Index	Provider	Green Exposures
DJ Sustainability World	Dow Jones	Top 10% in each sector, of the largest 2,500 companies in the base index
MSCI World ESG Index	MSCI	Best in class on ESG - Relative to sector peers
MSCI Global Climate	MSCI	Best in class on clean technology and efficiency , renewable energy , and future fuels
MSCI Climate Action Index	MSCI	Emission eligibility: 95th percentile & Climate risk management
S&P U.S Carbon efficient	S&P	Carbon emissions/unit revenue
S&P Global Eco	S&P	Best in class - Clean Energy, Environmental Services, Water
FTSE environmental opportunity	FTSE	Companies in FTSE Green Revenues Classification System (GRCS) - min 20% revenues are green

4.3 Dynamic Simulation Model for PPGSB Certification

The dynamic simulation model contains data and logic that automate the PPGSB certification process for an assortment of prospective issuers. It is available upon request at jc5823@columbia.edu. Screen captures of the model are included below for reference.

Instructions

The "Pure Play Green Sovereign Bond" Dynamic Simulation Model is designed and built by the Capstone Team, School of International and Public Affairs, Columbia University, working on "Exploring the Case for 'Pure Play' Sovereign Green Bonds" with the World Bank Group.

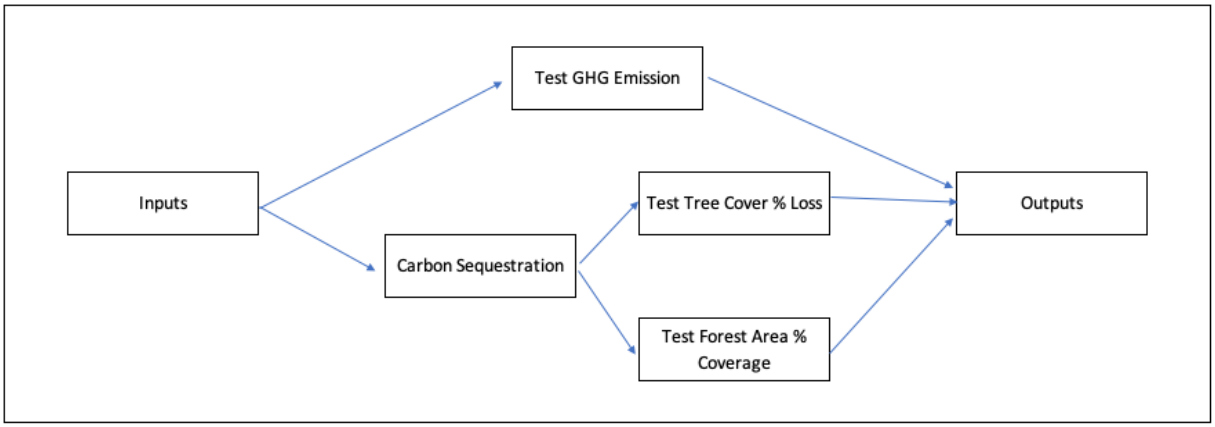
The "Flow Chart" sheet explains the flow of calculations and variables within the model.

The "Assumptions & Results" sheet takes in assumptions from users (blue numbers can be editted). As users change the assumptions, the results are automatically updated, including the summary section. Black numbers should not be changed.

The "GHG Emission" and "Forest Area" sheets are calculation sheets. The eligibility thresholds are directly linked to assumptions and are automatically udpated. The data can be updated with different sources as needed.

The "Tree Cover Loss" sheet is the final calculation sheet of the specific test. The eligibility thresholds are directly linked to assumptions and are automatically udpated. The data can be updated with different sources as needed in the "Tree Cover Loss Source" sheet.

Flow Chart



Assumptions

Scenario	3		1	2	3
Label Name		Light Green	Dark Green	Green	Light Green
1. Emission Test					
GHG emission	CO2e	20	10	15	20
2. Carbon Sequestration					
Tree cover % change	% p.a.	0.40%	0.20%	0.30%	0.40%
Forest area % coverage	%	40%	60%	50%	40%

Summary of results

#	PPGSB Label	Total Eligible Countries
Live	*Light Green*	*20*
1	Dark Green	3
2	Green	14
3	Light Green	20

Eligible Countries
Bhutan
Brunei
Cayman Islands
Costa Rica
Equatorial Guinea
Fiji
Gabon
Georgia
Grenada
Guyana
Jamaica
Maldives
Martinique
Moldova
Namibia
Palau
Papua New Guinea
Réunion
São Tomé and Príncipe
Seychelles

GHG Emission

Label Name	Light Green						
Year	Year 1	Year 2	Year 3	Year 4	Year 5	Recent year	Threshold
Weights	10%	12%	15%	18%	20%	25%	20

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Weighted GHG emissions	Test
Afghanistan	30.19	34.4702774	32.464602	30.8999541	31.2144461	31.2084954	30.5672304	31.770000	31.440000	30.320000	28.150000	28.950000	29.120000	29.63	Fail
Akrotiri and Dhekelia														NA	Fail
Åland														NA	Fail
Albania	8.14	8.54346293	8.25365032	8.51493426	9.00652878	8.84587444	8.4616234	9.280000	9.230000	8.740000	7.860000	7.900000	7.980000	8.34	Pass
Algeria	209.13	215.372078	232.089109	234.858097	249.434226	259.852052	261.586947	264.910000	274.750000	278.410000	265.210000	284.170000	284.450000	276.91	Fail
American Samoa														NA	Fail
Andorra														NA	Fail
Angola	78.13	76.6917098	78.4130328	82.9854928	85.1866452	90.110604	87.0960374	81.890000	78.220000	77.440000	71.680000	69.610000	66.480000	72.64	Fail
Anguilla	0.03	0.03108662	0.03115529	0.03317117	0.0331736	0.03331812	0.03373098	0.030000	0.030000	0.030000	0.030000	0.030000	0.030000	0.03	Pass
Antigua and Barbuda	0.34	0.28053352	0.30223053	0.34769523	0.35739247	0.35644874	0.37718121	0.340000	0.380000	0.410000	0.360000	0.350000	0.360000	0.37	Pass
Argenti	346.29	353.77344	358.823716	368.29518	366.644545	375.124916	375.901251	379.170000	378.290000	373.750000	359.030000	378.420000	382.990000	375.43	Fail
Armenia	7.10	7.72309333	8.59448859	8.60428928	8.68247586	8.61804093	8.42832828	8.620000	8.790000	9.270000	9.800000	10.000000	9.380000	9.42	Pass
Aruba	0.51	0.3371248	0.40998619	0.4638482	0.47508055	0.47646118	0.49411402	0.470000	0.500000	0.580000	0.490000	0.480000	0.500000	0.50	Pass
Australia	601.87	605.794724	608.288217	597.073659	585.442039	593.561492	594.024356	601.070000	597.770000	596.030000	572.830000	561.650000	571.380000	579.53	Fail
Austria	89.81	88.0077307	84.742703	85.4195886	81.7459266	82.724126	83.4198209	85.870000	82.850000	84.400000	78.310000	81.220000	76.740000	80.71	Fail
Azerbaijan	48.63	51.428074	54.9683347	56.4017744	58.443917	58.0320296	58.1301174	57.790000	59.190000	64.310000	63.530000	68.040000	68.880000	64.79	Fail
Bahamas	1.58	1.19212273	1.38759692	1.52178044	1.5215142	1.46141038	1.57440245	1.680000	1.950000	2.130000	1.870000	1.820000	1.880000	1.89	Pass
Bahrain	51.70	52.0644466	55.8953626	60.7226041	62.7597749	62.9367252	63.1304619	63.000000	63.310000	67.430000	67.630000	69.430000	69.980000	67.57	Fail
Bangladesh	216.44	220.954516	226.530119	231.82802	238.08191	248.088355	255.68275	268.200000	278.910000	276.850000	269.030000	276.800000	281.080000	275.87	Fail
Barbados	1.03	0.90696721	0.88632437	0.9997233	0.91113883	0.93565399	0.98176814	0.860000	0.960000	1.030000	0.920000	0.900000	0.930000	0.93	Pass
Belarus	93.21	103.241932	105.077714	105.624096	105.057193	100.527178	99.7185468	101.400000	104.720000	102.720000	100.060000	102.490000	99.870000	101.59	Fail
Belgium	142.09	131.762899	129.765271	130.870857	123.719126	127.996941	126.584552	124.190000	124.900000	124.550000	116.790000	121.880000	114.030000	120.00	Fail
Belize	0.84	0.81501426	0.79230364	0.86887016	0.81646125	0.85914422	0.88154082	0.920000	0.910000	0.940000	0.910000	0.950000	0.980000	0.94	Pass
Benin	12.38	12.5056643	12.5027072	13.3294381	13.9321152	14.5003019	16.1911154	16.600000	18.140000	18.260000	19.060000	20.100000	20.690000	19.20	Pass
Bermuda	0.33	0.18013526	0.20964236	0.2391882	0.30603502	0.25404722	0.32950153	0.300000	0.350000	0.380000	0.350000	0.340000	0.350000	0.35	Pass
Bhutan	2.22	2.42847159	2.37627057	2.48761377	2.49213641	2.66895446	2.81809096	2.980000	3.210000	3.400000	3.410000	3.060000	3.070000	3.19	Pass
Bolivia	46.26	47.4181084	49.8607819	52.3693382	53.6471834	54.5915628	56.1381363	56.610000	56.900000	57.140000	53.950000	58.290000	58.460000	57.04	Fail
Boire, Sint Eustatius and Saba														NA	Fail
Bosnia and Herzegovi	28.46	31.7483488	29.6553067	29.4738871	28.0078584	27.9624687	30.9851276	31.570000	32.000000	30.320000	30.230000	29.290000	29.320000	30.17	Fail
Botswa	10.21	10.6133419	9.67580631	11.4968156	12.3566862	12.794955	11.9291083	12.130000	13.080000	11.910000	10.590000	11.340000	12.610000	11.90	Pass
Brazil	1177.71	1212.9225	1250.57547	1288.06471	1323.6088	1307.96891	1285.08996	##########	##########	##########	##########	##########	##########	1301.25	Fail
British Virgin Islands	0.07	0.06144143	0.06530778	0.07701936	0.07928111	0.07791609	0.08268195	0.070000	0.100000	0.090000	0.080000	0.070000	0.080000	0.08	Pass
Brunei	14.10	14.6274512	14.4271771	13.9248905	13.5182494	12.6930518	12.9657968	13.650000	14.250000	13.430000	15.480000	15.340000	14.830000	14.65	Pass
Bulgaria	63.18	68.8210205	63.501179	58.1001819	60.5906017	64.9058245	62.5939788	65.320000	62.100000	60.710000	56.080000	63.360000	68.410000	62.96	Fail
Burki Faso	24.56	25.299103	26.2515457	27.2797931	27.6228262	29.4169422	30.1479345	31.300000	32.550000	33.730000	34.400000	35.580000	36.500000	34.53	Fail
Burundi	4.95	5.27469513	5.34159267	6.07015627	6.07510291	6.14036049	6.51293276	7.220000	7.520000	7.180000	7.140000	7.330000	7.480000	7.32	Pass
Cabo Verde	1.02	1.13244633	1.01661717	0.99699327	1.0530447	1.0667149	1.08497436	1.110000	1.120000	1.160000	1.180000	1.250000	1.300000	1.21	Pass
Cambodia	34.35	35.6772323	35.3738643	35.2141995	36.0337003	37.393776	40.0356739	42.490000	43.610000	47.600000	48.600000	49.690000	50.020000	47.81	Fail
Cameroon	32.97	32.6205922	33.4998152	35.7353365	37.8109338	41.0350393	42.2620152	40.730000	41.770000	42.630000	43.530000	43.670000	43.170000	42.84	Fail
Cada	726.13	742.214528	744.557705	755.625534	768.758716	764.534966	758.575666	772.900000	787.650000	775.380000	711.470000	733.080000	756.810000	752.00	Fail
Cape Verde														NA	Fail
Caribbean small states														NA	Fail
Caspian Sea														NA	Fail
Cayman Islands	0.26	0.21934088	0.21777048	0.25437956	0.2609976	0.26955966	0.27950307	0.290000	0.300000	0.400000	0.340000	0.330000	0.340000	0.34	Pass
Central African Republic	11.16	12.1109842	11.8042938	11.751462	11.6456698	12.0695883	12.8209027	12.330000	12.590000	12.580000	12.860000	13.130000	13.450000	12.93	Pass
Chad	46.76	49.1238905	52.3285748	55.2273529	58.0991191	63.0004512	66.4074149	70.230000	74.250000	78.220000	82.090000	86.020000	89.840000	82.11	Fail
Chile	107.45	117.839748	121.672494	123.432397	115.908081	121.124475	126.408024	128.450000	130.460000	136.530000	128.960000	140.660000	137.010000	134.58	Fail
Chi	11565.47	12572.8841	12928.2291	13485.4405	13650.1334	13479.8804	13447.1364	##########	##########	##########	##########	##########	##########	15003.57	Fail
Colombia	181.31	184.52838	182.355441	190.644482	191.679505	193.010352	197.134522	193.580000	201.860000	205.830000	206.090000	209.850000	215.540000	207.41	Fail
Comoros	0.61	0.60782875	0.6262475	0.66495433	0.65801278	0.68228691	0.71227103	0.780000	0.810000	0.850000	0.870000	0.910000	0.920000	0.87	Pass
Cook Islands	0.10	0.10927383	0.11414397	0.11846408	0.12566165	0.11590856	0.12141048	0.130000	0.130000	0.140000	0.110000	0.120000	0.120000	0.12	Pass
Costa Rica	14.19	14.8817281	14.5603077	14.9070115	15.223936	14.988571	15.669961	16.060000	16.590000	16.550000	15.060000	16.210000	16.860000	16.25	Pass

4.4 Research Process Log

Stage I: Project Introduction and Background Research

Following an alignment meeting with The World Bank team in December, the capstone team identified key areas for preliminary research relevant to the scope of the project. The team's research plan in the preliminary phase of the project focused on three key areas:

- **Overview of bond markets and related taxonomies** with a focus on sovereign bonds and thematic bonds including trends in issuances of green bonds and sustainability-linked bonds. Additionally, green taxonomies such as the Green Bond Principles issued by International Capital Markets Association, the European Union Green Bond Standards and The World Bank's Sustainable Development Bonds Framework were also reviewed.
- **Green definitions and terminologies** including concepts such as green budgeting, carbon accounting, carbon budgeting, greenium, net zero and net negative were also examined given their importance for promoting environmental sustainability and guiding policy development.
- **Country-Specific Research** focused on Bhutan, Costa Rica, Panama and Suriname, which were identified by The World Bank team as examples of countries who could potentially qualify for the pure play sovereign green bond label. The team analyzed these countries from multiple lenses including an overview of their environmental, social and macroeconomic indicators, financial markets and regulations, past sovereign bond issuances, and the climate impacts of their sovereign green bond issuances.

Stage II: Midterm Realignment and Deep Dive

Insights from the preliminary research enabled the team to construct an initial hypothesis framework and formulate key clarifying questions. These were subsequently discussed with The World Bank team in early February, providing the team with a better understanding of The World Bank's vision. The primary

motivation for the label was to incentivize environmentally-conscious behavior in countries with ambitious climate goals by offering a financial reward. The World Bank's objective was to introduce this label through a white paper, which could potentially be adopted and designed by other expert organizations. The focus was on designing a sovereign green bond label with stringent criteria, ensuring that eligibility would be limited to countries demonstrating exceptional commitment to climate action. The team was advised to deprioritize research on the financial rewards of investing in the label, as this would be challenging to predict at this stage and would be determined by the market eventually. The World Bank team also recommended basing this label on existing green principles and taxonomies rather than introducing completely novel concepts and definitions.

Following the recommendations, the project hypothesis was revised. Over the next few weeks, the team conducted research on pure play corporate green bonds and reviewed the taxonomies of countries that have issued green bonds. A long list of indicators and potential data sources was also developed. Additionally, the team reviewed existing green principles, frameworks, and indices to assess how they could be leveraged for the selection criteria for the new label.

In the midterm meeting, the team presented an overview of the potential approaches to narrow down the selection criteria including potential conceptual frameworks, evaluation lenses, indices and datasets. The World Bank team's recommendation included the following:

- **Simplification**. The data and criteria for labeling will be simplified to focus on quality and impact, while avoiding the creation of new criteria unless absolutely necessary
- **Absolute criteria over a ranking**. There was a consensus on moving towards an absolute criteria model for defining "pure play" green bonds, stepping away from a relative ranking approach. This shift was aimed at ensuring clarity and rigor in the label's application.
- **Emphasis on natural reserves**. Given the project's focus on developing countries, the significant role of natural reserves in these countries should be explicit within the labeling criteria.
- **Time dimension.** The framework was to prioritize countries' current environmental contributions over future promises, placing a premium on immediate and tangible outcomes.
- **Minimum safeguards**. Incorporation of social and policy factors would need to be streamlined to focus on essential safeguards that do not detract from the environmental criteria but ensure holistic evaluation.

Stage III: Framework Finalization and Model Construction

Based on the recommendations, the team worked on integrating nuances into the eligibility criteria framework while continuing research on potential indicators and datasets suitable for the label. The team also leveraged insights from private sector initiatives for green labeling. The final eligibility criteria include two key indicators to test the eligibility of countries for the PPGSB label: total greenhouse gas (GHG) emissions and carbon sequestration, which includes forest cover and tree cover loss. Apart from these tests, the team also developed a recommended set of conditions for sovereign bond issuances, including conditions on a country's Nationally Determined Contributions (NDCs), green budgeting practices, a list of "do-no-harm" criteria, as well as internal governance and reporting practices.

Upon analysis and internal discussions, the capstone team proposed to adopt the term "Pure-Play Green Sovereign Bond" instead of "Pure-Play Sovereign Green Bond." This change was considered essential since it represented the vision for the new label more accurately and avoided any potential confusion with similar instruments. The label applied to "sovereign bonds," as the term sovereign green bond would imply that the label pertains to green bonds. However, since the new label is not designed to adopt use-of-proceeds or project evaluation, it could not be classified as a green bond that is aligned with the Green Bond Principles. Lastly, given the goal of the capstone project was to identify sovereigns as "pure-play

issuers," all sovereign bonds they issue should ideally be labeled as "pure-play green". Thus, the green here represented the sovereign's environmental ambitions as opposed to a type of bond, i.e. a green bond.