# Breathe Better Bond Initiative

*LAB INSTRUMENT ANALYSIS*
*September 2019*

DESCRIPTION & GOAL —
An emerging market municipal bond that invests in urban infrastructure projects that reduce both air pollution and greenhouse gas emissions, with tied-in technical assistance and financial incentives to support city governments.

PROPONENT —
International Finance Corporation (IFC)

SECTOR —
Electricity/Power, Transportation, Urban Development, Water, Other

GEOGRAPHY —
Africa, Asia, Central/South America

PRIVATE FINANCE TARGET —
Institutional investors with emerging market bond mandates

The Lab identifies, develops, and launches sustainable finance instruments that can drive billions to a low-carbon economy. The 2019 Global Lab Cycle targets four specific sectors across mitigation and adaptation: blue carbon in marine & coastal ecosystems; sustainable agriculture for smallholders in West and Central Africa; sustainable energy access; and sustainable cities.

## AUTHORS AND ACKNOWLEDGEMENTS

# 1. CONTEXT

*The anticipated growth in urban populations in the near future will require a massive buildup in urban infrastructure, which is a key driver of both air pollution and greenhouse gas emissions.*

Cities are a major contributor to climate change. Urban $CO_2$ emissions represent around 70% of global $CO_2$ emissions (C40 & JJ, 2019). In addition, an estimated 2.5 to 3 billion people will shift from rural to urban areas by 2050 (IPCC, 2014), with over 90% of this increase in urban populations taking place in Africa and Asia (UN, 2018). The anticipated growth in urban population will require significant investment in urban infrastructure, including electricity generation, transport and waste management (IPCC, 2014).

This investment, if deployed in a business-as-usual manner, will be a massive driver of emissions across sectors, especially in cities in developing countries, as they typically have higher per capita greenhouse gas (GHG) emissions than their national averages (IPCC, 2014).

In addition, four out of every five people living in cities globally are exposed to polluted and unsafe air. This number rises disproportionately in developing countries. Air pollution is a major health risk to populations, causing an estimated 4.6 million premature deaths each year (World Health Organization, 2019). It is also an economic burden. The cost of air pollution-related welfare losses for the world economy was estimated to be approximately $5.1 trillion in 2013 (Coalition for Urban Transitions, 2017).

A growing number of city coalitions are emphasizing tackling both GHG emissions and air pollution, especially through short-lived climate pollutants (SLCPs). SLCPs are elements which remain in the atmosphere for a much shorter time than $CO_2$, but their global warming potential is far greater. Certain SLCPs are also dangerous air pollutants that have harmful effects on human health. These include methane (CH4), tropospheric ozone (O3), hydrofluorocarbons (HFC), black carbon emissions (BC) and nitrogen oxides (NOX), which together are responsible for up to 45% of global warming (CCAC, 2019a).

There is a need of between US$ 1.2 trillion and US$ 2.5 trillion per year for the growing infrastructure needs of cities in developing countries. An additional US$ 700 billion is needed to move from business as usual to "green growth" (Coalition for Urban Transitions, 2017). Unlocking financial flows to address this gap as well as to ensure new infrastructure that both simultaneously reduces GHG emissions and improves air quality is of paramount importance. Focusing on projects and measures that reduce both $CO_2$ and dangerous air pollutants, including SLCPs, can help address both issues simultaneously.

# *CONCEPT*

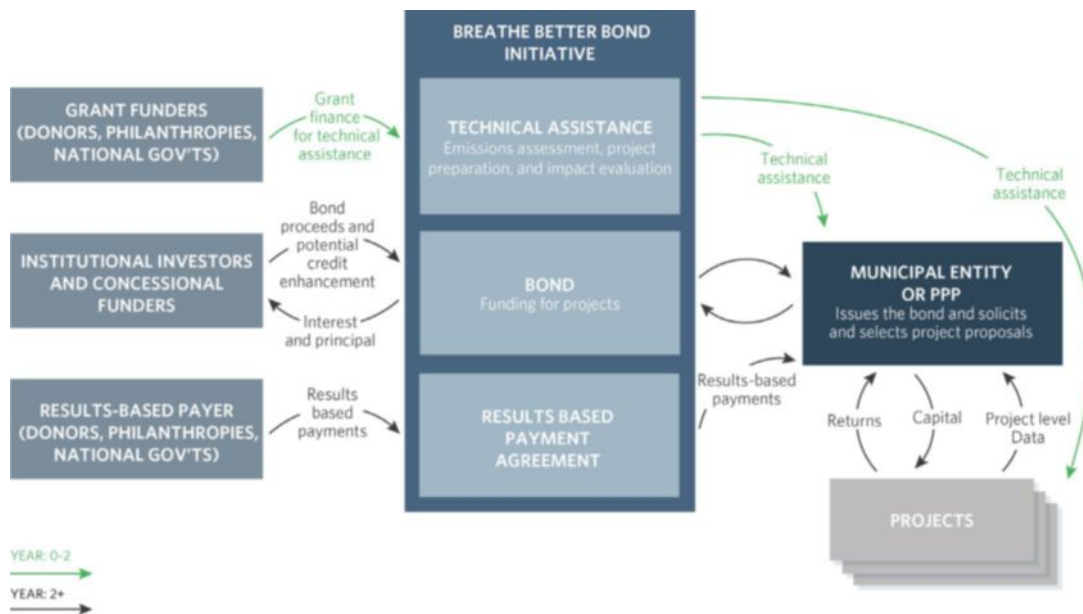## 2. INSTRUMENT MECHANICS

*The Breathe Better Bond Initiative is an innovative bond issued by local governments in developing nations, which is paired with technical assistance and uses proceeds to invest in projects that reduce both air pollution and greenhouse gas emissions.*

The Breathe Better Bond Initiative aims to accelerate climate-friendly infrastructure, by providing local governments with the necessary tools to identify emission problem areas as well as capital, through issued bonds. The proceeds from the bond will be used to fund infrastructure projects that reduce both air pollution and GHG emissions. It was proposed to the Lab by the International Finance Corporation (IFC), who would also lead its implementation.

*Figure 1: Instrument mechanics*



## 2.1    INSTRUMENT MECHANICS

**The Initiative is kicked off by grant financing from donors, philanthropies or national governments for technical assistance to identify air pollution and emissions sources in local contexts.** The grant financing will establish and/or support a local team[1] designated by the municipality or local authority with the proper tools and expertise to undertake an emission inventory that will effectively identify and assess both air pollution and GHG emissions sources.

The team will use emissions software planning tools to assess primary sources of greenhouse gases, SLCPs and other air pollutant emissions and build mitigation scenarios. This will enable the local authority to better understand how SLCP emission reductions can benefit citizens.[2]

The objective of deploying these tools will be to identify projects and measures that can most efficiently reduce SLCPs and $CO_2$. Building on this work, parallel technical assistance workstreams will be activated so that the project(s) can begin as seamlessly as possible. These additional technical assistance packages will include (1) support for related institutions

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[1] Annex 8.4 for more details

[2] Two examples of these types of software packages are the Long-range Energy Alternatives Planning Integrated Benefits Calculator "LEAP-IBC", promoted by the Stockholm Environment Institute (SEI), and the Greenhouse Gas and Air Pollution Interaction and Synergies Model "GAINS", promoted by the International Institute for Applied Systems Analysis (IIASA). Issues such as global warming, health benefits and agriculture effects can be analyzed by the models.

and stakeholders in strengthening enabling conditions, (2) a project preparation and structuring component and (3) bond structuring advisory services. More detail on these packages is provided in Section 4.

It is expected that this initial technical assistance process will take an average of six months in cases where cities have strong enabling conditions and project pipelines, and at most two years in cities which are more capacity-constrained or lack an existing pipeline of relevant projects.

**A municipal entity or private public partnership (PPP) sells bonds to private investors to fund emission reducing projects.**

Once the technical assistance phase is complete, the local authority issues a call for proposals based on the results of the TA phase, targeting developers who would build, operate and own the project or portfolio of projects. At the same time, the local authority assigns a municipal entity or PPP that will serve as the "issuing body" for the bonds.

The winning bidder would then enter into an agreement with the issuing body that sells bonds to institutional investors in order to raise capital to invest – either as equity or debt – into projects. Alternatively, the city can house the project as a 100% owner of the asset. The funds will support development and construction costs and provide the funding needed by project developers to reach financial close. The issuing body would be supported by service providers, including investment banks and law firms, throughout the issuing process.

Depending on the city context, development finance institutions and/or impact investors may invest in a tranche of the bond issue at concessional terms or provide a credit enhancement feature, which will help to reduce financing costs for the issuing body.

Technical assistance will shift to support capacity building for monitoring, reporting and verification (MRV), as well as impact evaluation activities. Once projects are operational, each project will periodically provide data for impact tracking purposes.

**A results-based payment agreement helps decrease the cost of financing and align emission impact interests**

The issuer can decrease the cost of financing by entering into a results-based payment agreement with a donor, philanthropic institution, a development finance institution (DFI), or the issuing body's national government. Results based funders can offer this incentive as a reinforcement measure to the city to ensure climate and air pollution benefits.  The results-based agreement would award the issuing body with a "bonus" payment(s) if it achieves certain pre-agreed criteria: examples of triggers[3] for this results-based payment are pre-agreed investment milestones, use of funds in measures that will reduce air pollution,  verified level of pollution reduction, or positive deemed health impacts as a result of the proposed interventions. The criteria and related "trigger" mechanism (which the payment would depend on) would be structured on a bespoke basis for each city, depending on its local context (see Section 3). If the trigger is met, payment will be made depending on a pre-agreed payment structure, for example with periodic payments over the remaining duration of the bond or as a lump sum payment. While this bonus payment would be beneficial in certain contexts, during target-market scoping, it was clear that some cities would find the

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[3] Annex 2 explores this further.

benefits clear enough to issue a Breathe Better Bond without the need for a results based payment.

## 2.2    PROJECT CRITERIA

The Breathe Better Bond would support infrastructure projects in urban environments[4] that have low technology risk and achieve the program goals of reducing both air pollution and GHG emissions. This includes:

- Solar generation projects (large-scale PV & rooftop)
- Landfill management projects
- Landfill gas generation projects
- Low-carbon & electrified public transport
- Energy efficiency projects

It will fall to each local Breathe Better Bond Initiative to establish the type of cash-generating project(s) and how to most effectively structure its investments. In this respect, the individual city's bond will have full flexibility and could set parameters based on their specific context and results from the technical assistance phase.

**The Breathe Better Bond Initiative can be more effective in cities which meet certain criteria but can be implemented in any emerging market city where the local government has an interest in expanding green infrastructure.**

Emerging market cities with current or likely future elevated health costs and lower economic activities due to air pollution and/or those that are member of climate-focused coalitions such as C40, Global Covenant of Mayors, and Local Governments for Sustainability (ICLEI), for example, will offer the best enabling conditions where the Initiative would have the highest chance of successful implementation.

However, the most important characteristics would be a local authority's credit profile and ability to attract concessional financing, as well as a strong interest in combatting both air pollution and GHG emission at the national and local level.

## 3. INNOVATION

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*The combination of tied-in technical assistance and a results-based payment will help unlock finance for climate-friendly infrastructure in cities in developing countries.*

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## 3.1    BARRIERS ADDRESSED: FINANCIAL, DATA, & CAPACITY CHALLENGES

Emerging market cities generally face financial, data and capacity challenges to develop climate related urban infrastructure. The Breathe Better Bond Initiative tackles these barriers.

**Financial barriers: Strong project pipelines, stakeholder coordination, and linking of two vital issues – climate change and air pollution – will allow cities to expand their funding options.**

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4 The CCFLA defines urban infrastructure as "projects that fall within the physical boundaries of an urban area or are designed to meet the needs of city dwellers and industry, including access to water, electricity and heat and transport of waste. Under this definition, urban infrastructure is not confined to the assets located inside a city itself" (CCFLA, 2015).

A major barrier for cities is competing demand for capital, as other priorities can crowd out borrowing for addressing global problems like climate change. It is therefore important that measures for climate change mitigation be related to local co-benefits, or even better if the investments are undertaken to address local issues like air pollution and result in global co-benefits. The Breathe Better Bond Initiative links these two crucial issues and provides technical assistance to assess a city's pollution problem and identify effective interventions as well as attractively priced financing, creating an opportunity to increase the local authority's motivation to address both pollution and climate change.

A city's ability to finance urban infrastructure is based on its budget, creditworthiness, access to capital markets and regional or national government funding streams (CCFLA, 2015). This is a challenge corroborated by a World Bank study estimating that only 5% of 500 cities studied were deemed creditworthy (Jetpissova, S./WB. 2013). The Initiative addresses these difficulties as it identifies revenue generating projects that can be ring-fenced to pay back obligations that would improve the quality of the issuance. IFC may also provide credit enhancements to issuing cities to further improve access to capital.

Lastly, a tied-in results-based payment agreement funded by donors, philanthropic institutions, or national governments will serve as an incentive to deploy the financing as intended, while achieving a lower cost of borrowing.

**Data barriers: The Initiative's technical assistance will bridge gaps in information that would otherwise impede proper planning and prioritization.**

A lack of consistent and comparable emissions data makes it difficult to formulate urban climate plans. The lack of available air quality data, sources of pollution, or knowledge of how this affects citizens' health and the economy impedes a government's efforts to take the appropriate measures to address these problems.

The Initiative's initial technical assistance component will support local teams in the assessment modelling and forecasting of emissions, to bridge these data gaps and assist the relevant teams to properly evaluate the situation and select the most efficient projects. This data can also provide correlation between air pollution and reductions in avoided deaths, respiratory diseases and healthcare costs.

**Capacity barriers: The Initiative helps drive project development, implementation, as well as monitoring and evaluation.**

Even if there are known pathways that clearly identify SLCP reducing interventions, a lack of expertise on how to structure these into bankable projects and/or how to analyze the investment/impact tradeoff could result in projects not moving forward. In addition, the lack of resources to explore financing options or technical knowledge in financial or emission related messaging and reporting issues may result in a lack of appetite from capital providers.

The project preparation and the subsequent monitoring and evaluation capacity building components within the initial technical assistance aim to address these issues.

**Legal barriers: Using proxy issuers to indirectly access green finance.**

To address the legal barriers characterized by the lack of ability to issue bonds and limited capacity to enforce regulation, municipalities enter into a Public Private Partnership (PPP) vehicle with a private sector partner to issue the bond. For example, city-affiliated or owned public agencies, utilities or project companies, national or multilateral agencies or development finance institutions, as well as private sector partners are all entities that a local authority can use to access green finance (Oliver, P./CPI, 2016).

## 3.2  INNOVATION: THREE COMBINED FEATURES MAKE THE BREATHE BETTER BOND UNIQUE

The Breathe Better Bond Initiative is innovative in several ways. First, a Breathe Better Bond would have a more focused eligible project scope than a standard green bond. In addition, a green bond is defined only by its use of proceeds whereas the Breathe Better Bond is defined by the three components that make it unique: (1) air pollution investment focus, (2) a results-based payment agreement that effectively reduces the borrowing cost for the issuing body and (3) tied-in technical assistance.

**Air pollution angle in the Breathe Better Bond's eligibility criteria**

A Breathe Better Bond will only finance projects that reduce both air pollution and GHG emissions. This includes projects that result in the reduction of $CO_2$, while also reducing $CH_4$, HFCs, $O_3$, $NO_X$ and BC. Although the Breathe Better Bond is not a traditional green bond, its ability to qualify under green bond frameworks is an advantage for portfolio composition purposes, as its eligible projects are more focused climate-related assets than would otherwise be present in some standard green bonds.[5]

**The Breathe Better Bond's is unique in that it combines a results based payment feature, as well as thorough technical assistance in its air pollution focus.**

Results-based payment mechanisms have been designed with the purpose of providing incentives to issuers. Similarly designed instruments include Social Impact Bonds (SIBs), Development Impact Bonds (DIBs), and Environmental Impact Bonds (EIBs), as well as Catastrophe bonds. The Breathe Better Bond shares the most commonalities with DIBs, although DIBs are not tradeable securities and do not feature tied-in technical assistance.

The results-based payment will be triggered by a reduction of a predefined metric that will be informed by a city's specific context. The intention is that the payment will serve to reduce the borrowing cost of the issuer, thereby making urban infrastructure investments more attainable.

Table 1 below juxtaposes the Breathe Better Bond with similar instruments and programs.[6]

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5 An illustrative example of how regular green bond eligible projects interact with Breathe Better Bond eligibility can be viewed in Annex 3.

6 Annex 4 illustrates some example structures of the results-based payment mechanism that were analyzed.

*Table 1: Comparison of existing instruments*

| | Similar Instruments | Description | Differentiation |
|---|---|---|---|
| **Results-based payment instruments** | Results-Based Climate Finance (RBCF) | Strong potential to deliver on transformational low carbon development, delivered through different design types | Not tradable securities |
| | Social Impact Bonds (SIB), Development Impact Bonds (DIB) Environmental Impact Bonds (EIB) | Investors provide upfront financing to service providers and are paid back by outcome payers when certain results are achieved | Not tradable securities |
| | Catastrophe bonds | Issuer pays Libor based coupon and parametric triggers from third-party data | No tied-in TA |
| **City -focused climate technical assistance** | C40 Cities Finance Facility (CFF) | Develop finance-ready projects to reduce emissions in developing country cities | Not tied in to a bond |
| | Financing Energy for Low-carbon Investment – Cities Advisory Facility (Felicity) | Advise cities on how to draw up and implement projects (that reduce GHG emissions in cities) that will qualify for funding | Not tied in to a bond |
| | Project preparation fund | Loan, equity (decided on case by case) for high development impact project preparation activities | Not tied in to a bond |

**While other results-based instruments exist, the Breathe Better Bond differentiates itself by providing technical assistance for all aspects of the process.**

City-focused initiatives often involve technical assistance, in part due to the importance of stakeholder engagement. Comparable initiatives include C40's Cities Finance Facility (CFF), the Financing Energy for Low-Carbon Investment – Cities Advisory Facility (Felicity), and other standard project preparation facilities.[7]

## 3.3    CHALLENGES TO INSTRUMENT SUCCESS

*Difficulties securing grant funding:* The catalyst in the instrument is the grant funding, which will support the initial technical assistance. In this pivotal step, the IFC plans to approach climate coalition partners to identify which target cities that are of particular interest to international donors, and have demonstrated a strong track record of ambition around pollution reduction, and health-improvement measures.

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[7] Important to note that in the mapping of its member organizations and initiatives, the CCFLA identified 27 project preparation facilities, of which 15 have an exclusively urban focus and 25 operate at the subnational or project level (CCFLA, 2017).

*Preferences for conventional green bonds:* It is possible that cities might prefer to issue a conventional green bond, which might allow for more flexible use of funds. However, the results-based payment feature and technical assistance provided by the Initiative is an added benefit to the issuer and should be communicated as such, as it can result in the effective cost of borrowing to be lower than other options, in addition to the clear health and societal benefits resulting from the explicit focus on pollution reduction, thereby offering a tangible value-add over traditional green bonds.

*Lack of viable project pipeline*: In order to justify issuing the bond, there needs to be a viable set of projects. A way to increase viability would be to choose pilot cities with existing project pipelines that currently have a financing gap. In a similar vein, pre-vetting cities with climate coalition partners and experts will ensure that the pilot location will be ready to issue a bond. Throughout the Lab development process, the proponents have engaged in numerous conversations with potential target city governments to evaluate project pipelines, testing the target market analysis detailed in Section 4.

# *MARKET TEST AND BEYOND*

## 4. IMPLEMENTATION PATHWAY AND REPLICATION

*The Breathe Better Bond Initiative will initially be piloted in one to three emerging market cities over the next year which have demonstrated initiative in addressing both air pollution and climate change, with an aim to replicate the model rapidly once the pilots have proven market value & impact.*

The proponents IFC will pilot the Initiative in one to three developing country cities in the next 12 months, where reducing air pollution and addressing climate change is a priority. Each Initiative is envisioned to feature a bond issue between US$ 100 million and US$ 500 million. Because the context of each will vary widely among different issuers, so will the composition of the stakeholders.[8] IFC will serve as the central hub, bringing together all actors within each Initiative, while concurrently participating directly in an investor or credit enhancement role.

Implementation can be divided into three main phases[9] which are detailed in Figure 2 below together with IFC's proposed pilot milestones.

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[8] Potential external stakeholders are listed in Annex 8.9 "Opportunities for Involvement" (don't know if this will get rearranged)

[9] See Annex 4 for more details

*Figure 2: Pilot implementation pathway*
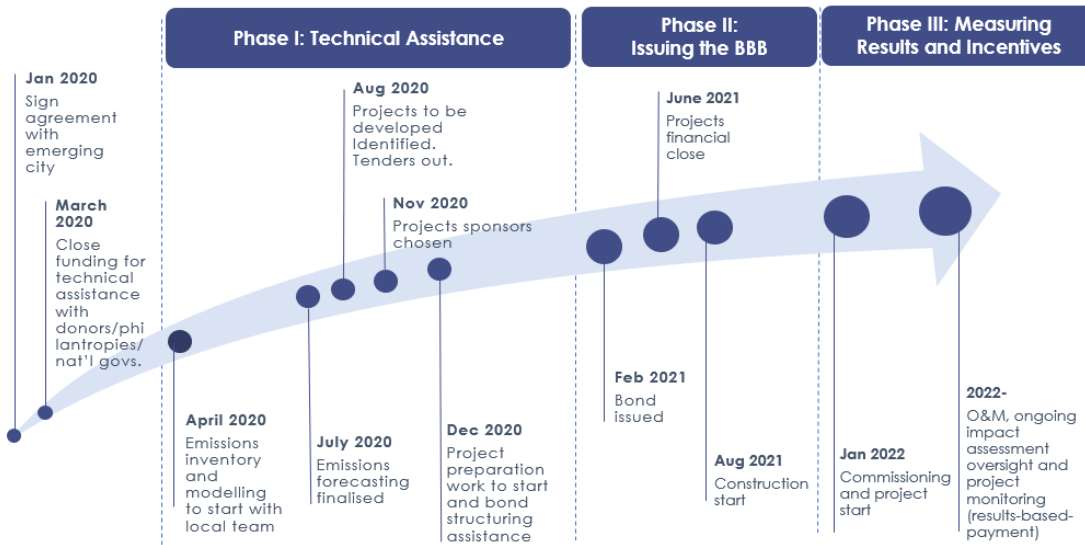


## 4.1 TARGET CITIES

Together with the proponents, the Lab Secretariat created a customized city selection tool, with input from cities climate networks including CCAC, ICLEI, GCOM, C40, BreatheLife Campaign & others. to identify priority cities to establish Breath Better Bond Initiatives, based on key feasibility criteria, including value to stakeholders, population, and significant GHG emission and air pollution abatement potential. In total, the Lab and IFC identified a list of 28 cities as potential candidates for the pilot Breathe Better Bond Initiative.[10]

The top ten cities generated by the city selection tool are shown in Figure 3, with priority cities identified across three continents.

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[10] In addition the tool included inputs from Bloomberg (Bloomberg, 2019), Air Visual (Air Visual, 2018), CAIT (WRI), and the Corruption Perception Index (Transparency International, 2018) see annex 5.

*Figure 3: City selection tool results*
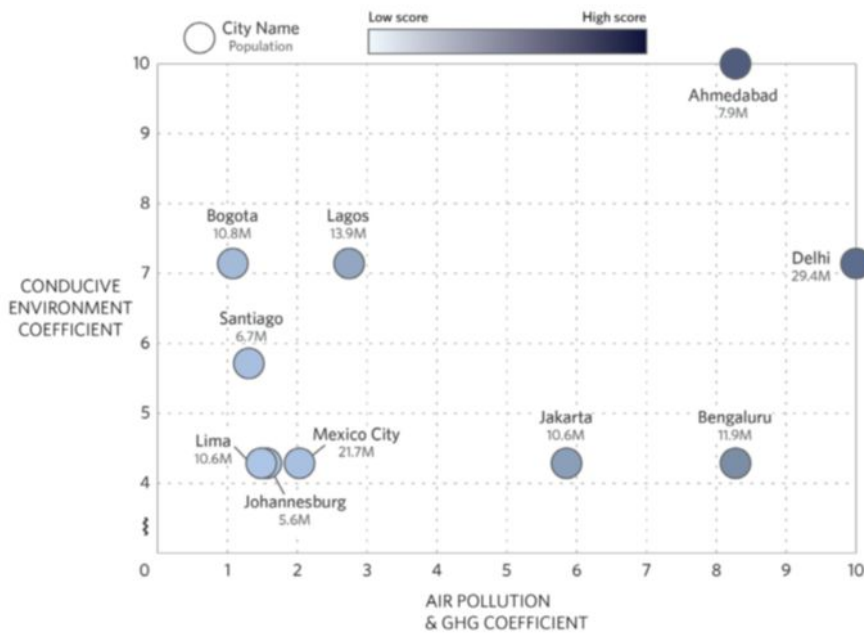


# 5. IMPACT

*The Breathe Better Bond Initiative has the potential to substantially reduce $CO_2$ and short-lived climate pollutants, which would also translate into significant health benefits, making emerging market cities more livable.*

## 5.1 PRIVATE FINANCE MOBILIZATION AND REPLICATION POTENTIAL

Given the infrastructure investment deficit and growing cities population in the future, the Breathe Better Bond Initiative is able to link global and local benefits that will catalyze the mobilization of institutional investor funding into sustainable infrastructure investment in the developing world. The IFC estimates that each city will be able to issue a bond between US$ 50 million and US$ 500 million in order to implement green infrastructure projects.

By expanding the Breathe Better Bond Initiative to the top ten cities with the most potential for impact as identified in the target market assessment, the instrument could mobilize an estimated US$ 4 billion in sustainable infrastructure investment that can reduce health impacts associated with air pollution, and mitigate greenhouse gas emissions.

Once piloted in 1-3 initial target cities during the 2020-2022 period, the initiative could potentially be replicated in all emerging market cities with the necessary conditions that are willing to participate. The Breathe Better bond is a highly flexible instrument that can support a wide array of projects, and function effectively under a range of market conditions, with clear benefits for issuing cities. Its simple structure and similarities to standard green bonds also makes it potentially attractive to institutional investors who are looking to participate in the soaring green bond market, with issuances up 42% year-on-year from 2018 to 2019 (Climate Bonds Initiative, 2019). Once a track record of Initiatives is established in cities with

stronger enabling conditions, and lessons learned from implementation, Breathe Better Bonds could be replicated in those with weaker or more challenging enabling environments.

## 5.2 QUANTITATIVE MODELLING

To understand how the Breathe Better Bond's results based payment feature could lead to wider acceptance of a bond issue in order to fund projects, The Lab Secretariat and IFC modelled how the results-based payment mechanism or concessional financing could reduce the cost of borrowing to the issuing body.

The amount and structure for the results-based financing and/or concessional financing for each bond will vary depending on city context, investor and donor appetite, and quality of projects to be financed. Nevertheless, in order to assess potential impact, we assumed all else to be equal and analyzed the effect the results-based financing and/or concession financing tranche would have on the overall reduction to cost of borrowing for the issuing body.

As illustrated in Table 5, the issuer would benefit the most from a bond structure with both features. However, on a dollar for dollar basis the RBP would be most efficient in reducing the cost of borrowing. This example assumes an issue with a 10-year tenor, 9.7% senior pricing and 6% concessional pricing.

Alongside technical assistance and institutional support, this reduction in borrowing cost would, in many target cities, be the catalyst in getting emissions and pollution-reduction projects off the ground, which would otherwise struggle to proceed.

*Table 5: Average effective issuer interest rate*

**Average Effective Issuer Interest Rate ($100mm issue, 10-year senior tenor, 9.7% senior pricing, 6% concessional pricing)**

|  |  | Concessional Tranche % of Total Issuance | | | | | | |
|---|---|---|---|---|---|---|---|---|
|  |  | 0.00% | 10.00% | 20.00% | 30.00% | 40.00% | 50.00% | 60.00% |
| **RBP % of Issue** | 0.00% | 9.70% | 9.06% | 8.61% | 8.27% | 8.02% | 7.81% | 7.65% |
|  | 2.50% | 9.25% | 8.68% | 8.28% | 7.98% | 7.76% | 7.58% | 7.43% |
|  | 5.00% | 8.81% | 8.30% | 7.95% | 7.69% | 7.50% | 7.34% | 7.22% |
|  | 7.50% | 8.36% | 7.92% | 7.62% | 7.40% | 7.24% | 7.11% | 7.00% |
|  | 10.00% | 7.91% | 7.54% | 7.29% | 7.11% | 6.98% | 6.87% | 6.78% |
|  | 12.50% | 7.47% | 7.16% | 6.96% | 6.82% | 6.72% | 6.63% | 6.57% |
|  | 15.00% | 7.02% | 6.78% | 6.63% | 6.53% | 6.46% | 6.40% | 6.35% |

## 5.3   ENVIRONMENTAL AND SOCIAL IMPACT

The Lab modelled the Breathe Better Bond Initiative's potential to reduce GHG emissions and air pollution.

Determining emissions reductions from the Breathe Better Bond Initiative requires the consideration of each city and region's unique environment.[11] The Lab and IFC used the Stockholm Environment Institute's LEAP-IBC tool[12] to model emissions reductions from a Breathe Better Bond in a simulation city, up to 2030. The simulation city has characteristics of a South Asian city to establish a baseline scenario and then three projects (listed in Table 2) were introduced into the model in order to assess their impact.

*Table 2: Simulation projects*

| Project | Starting Year | Debt (US$ mn) | Equity (US$ mn) | Total (US$ mn) |
|---|---|---|---|---|
| **Electricity Generation**- Project to install a 200MW Solar Plant. | 2021 | 101 | 34 | 135 |
| **Transport-** Project to retire 200 diesel buses and replacing with 240 electric trolleys. | 2021 | 155 | 52 | 207 |
| **Waste -** Project to handle 420,000 tons of Municipal Solid Waste. | 2021 | 131 | 44 | 175 |
| | Total | 387 | 130 | 517 |

## Greenhouse gas emissions

The three combined projects in the simulation city would abate a total of **3.4 million tonnes of $CO_2$** during the total period from 2022 to 2030, which is the equivalent of removing more than 700,000 cars from roads for a year. This does not consider the warming abated by black carbon reduction.

Annualizing the emissions abated and investment amount, this means $CO_2$ will have been abated at an efficiency of US$ 45.23/ tonnes of $CO_2$. The table below details the $CO_2$ and SLCPs abated during the simulation period.

*Table 3: Greenhouse gas and SLCP emissions abatement*

| Combined scenario | | | | |
|---|---|---|---|---|
| | Average annual emission reductions from 2022-30 | Estimated total emissions reductions in the years 2022-30 | $CO_2$ conversion rate | Estimated $CO_2$ Equivalent |
| **$CO_2$ (Metric Tonnes)** | 200,000 | 1,800,000 | 1 | 1,800,000 |
| **$CH_4$ (Metric Tonnes)** | 7,240 | 65,160 | 25 | 1,629,000 |
| Total | | | | 3,429,000 |

## Air Pollution

In terms of air pollution, PM2.5 concentration, which is the most important pollutant affecting human health,[13] black carbon, and nitrogen oxides (NOx) were also forecasted.

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11 This includes electricity generation mix and the unit's proximity to the city, transport fuel use makeup, waste management characteristics, and other aspects such as current industrial structure, emissions from agriculture and other sources originating from outside and carried into the city from long distance transport.

12 Long-range Energy Alternatives Planning System linked with the Integrated Benefits Calculator (LEAP-IBC). The tool uses demographic, energy, non-energy sources, and economic data to estimate current emission levels in terms of CO2, methane, HFCs, black carbon, and other emissions that contribute to PM2.5 concentrations, and other relevant pollutants, especially those that are precursors to ground-level ozone formation.

13 Primary PM2.5 is formed by particles emitted as Black Carbon, Organic Carbon and mineral dust (like ash from industry). The gases NOx, $SO_2$ and NH3 give rise to secondary $PM_{2.5}$ in the atmosphere and non methane volatile organic compound emissions also give rise to secondary organic aerosols that also contribute to $PM_{2.5}$ concentrations.

The table below shows the impact the three infrastructure projects would have on these emissions. It is important to mention that black carbon forms part of the PM2.5 total but is shown separately, as this has an important warming effect but was not quantified or considered in GHG estimation in the previous section.

Nitrogen oxides ($NO_X$) emissions form part of secondary PM2.5 concentrations and also $NO_2$ concentrations close to emission sources, which also has health impacts. The model did not estimate secondary PM2.5 and therefore this emission was shown separately.

*Table 4: Air Pollution emissions abatement*

| Combined scenario | | |
|---|---|---|
| | Average emissions reductions from 2022-30 | Estimated Total Emission reduction from 2022-30 |
| Primary PM2.5 (metric tonnes) | 220,000 | 1,980,000 |
| Black Carbon (metric tonnes) | 7,240 | 65,160 |
| $NO_X$ (metric tonnes) | 1,530 | 13,770 |

The figures in table 4 show the reduction of harmful air pollution particles brought about by implementing the three infrastructure projects in the simulation city. In summary, emissions of PM2.5 particles from the transport sector would reduce by 5% and from the energy sector by 30%. In addition, methane emissions from the waste sector would decrease by 10%.

Taking into account figures from a recent study14, the associated reduction in Total PM2.5 reduction of 220,000 tons per year, equivalent to 748,000 years of life lost per year (~31,500 premature deaths year year)

If deployed in ten cities the Breathe Better Bond Initiative has a potential to reduce GHG emissions by an estimated 35 million tons of $CO_2$. In addition, reduction in particulate matter concentrations can lead to health benefits for the city's population and reduce the burden of welfare losses in the city.

# 6. KEY LAB TAKEAWAYS

## 6.1 2019 LAB FOCUS SECTOR: SUSTAINABLE CITIES

The goal of the Lab's 2019 sustainable cities stream is to accelerate innovative financial instruments to address market barriers and support the deployment of climate solutions in cities in developing countries.

The Breathe Better Bond Initiative directly addresses many of the barriers that cities face to accessing financing for climate mitigation. It can attract much-needed sustainable infrastructure finance in order to create more livable, climate-friendly cities in emerging markets around the world. By partnering with institutions such as project preparation facilities and climate coalition partners may allow for the instrument's quicker replication.

The instrument has the potential and ambition to help achieve the following Sustainable Development Goals:

- 3. Good health and well being

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[14] Regionalized life cycle impact assessment of air pollution on the global scale: damage to human health and vegetation

- 7. Affordable and clean energy
- 9. Industry, innovation and infrastructure
- 11. Sustainable cities and communities
- 13. Climate action

## 6.2 LAB ENDORSEMENT CRITERIA

The Breathe Better Bond Initiative meets the four criteria for Lab endorsement in the following ways:

**Innovative:** By pairing tied-in technical assistance and a results-based payment, the initiative can attract much needed finance for climate-friendly and pollution-reducing infrastructure in emerging market cities.

**Financially sustainable:** While the initial bond issuance would require grant funding and concessional finance, bond issuances would mobilize additional capital from private investors, and supported projects are revenue-generating and of low technology risk.

**Catalytic:** The Initiative can transform how local governments view GHG emissions mitigation and pollution-reducing projects, linking two crucial issues – climate change and air pollution. Once proven, as a simple and flexible innovation on the successful green bond model, the Breathe Better Bond has strong potential to meet investor needs, and achieve replication and scale.

**Actionable:** The IFC has vast experience in emerging economies and the Initiative's co-benefit angle has strong potential for local buy in.

# 7. REFERENCES

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# 8. ANNEX

## 8.1 THE IMPORTANCE OF SHORT-LIVED CLIMATE POLLUTANTS (SLCPS) – INFO FROM CCAC
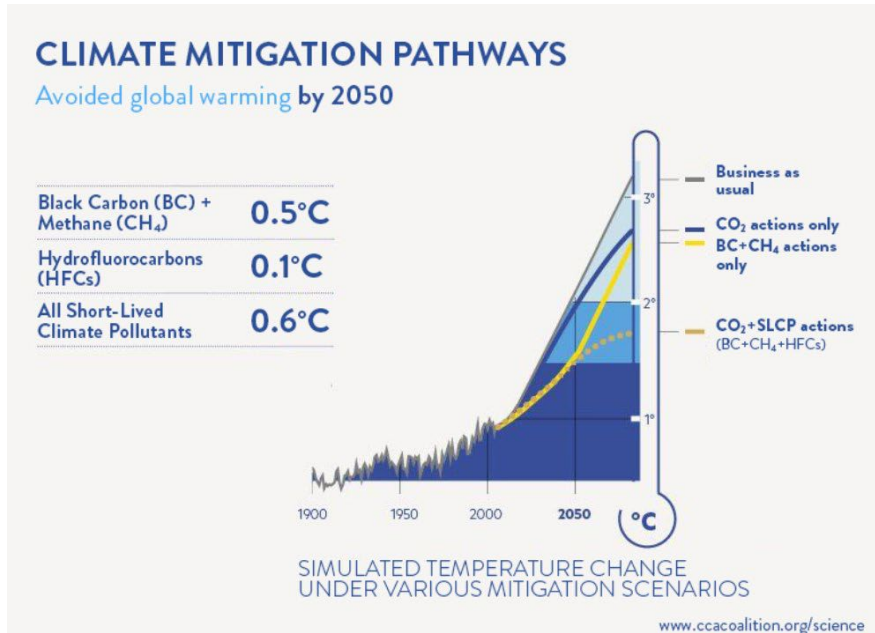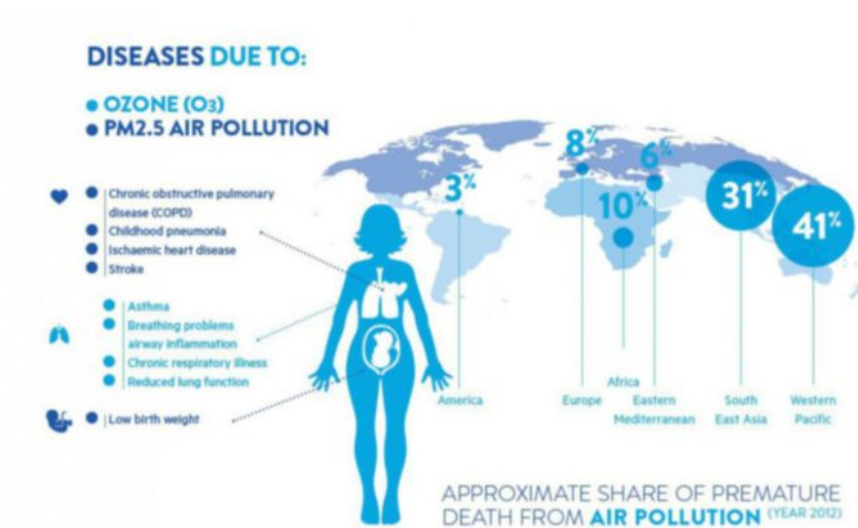


Chart: Paris temperature target of 1.5 degrees Celsius can only be achieved by reducing both near term and long term climate forcers. Doing both now will also prevent millions of premature deaths from air pollution and help achieve SDGs.

## 8.2    RESULTS-BASED PAYMENT AGREEMENT CONSIDERATIONS

An important decision when structuring a results-based payment agreement is the choice of which phase of the project's development the trigger will be set.  As an example, the image below shows an electric bus fleet project's progress. As seen in the diagram, negotiating the trigger can be based on a result centered on either output, outcome or impact and in some cases on activities.

Example: Electric Bus Fleet Project

| Inputs | Activities | Results* |
|---|---|---|

**Results\***

| Outputs | Outcomes | Impacts |
|---|---|---|

| Inputs | Activities | Outputs | Outcomes | Impacts |
|---|---|---|---|---|
| • Legal framework<br>• Funding<br>• Expertise | • Bus procurement<br>• Bus replacing<br>• Infrastructure construction or installation | # of electric buses in use | Avoided CO2 and NOx gas emissions | Climate change and pollution indicators |
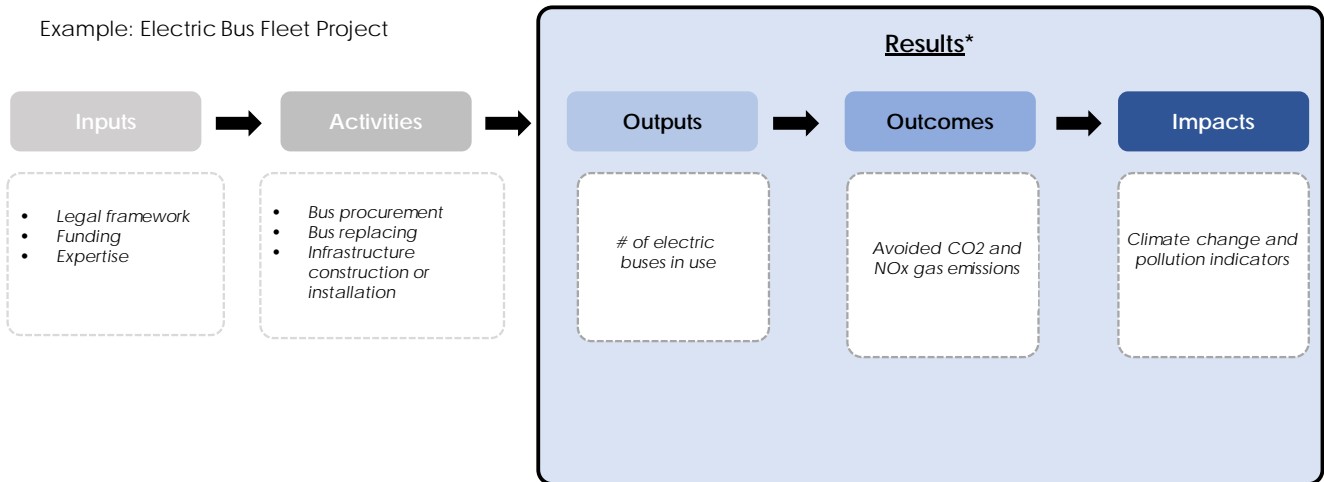
## 8.3    ILLUSTRATION OF RESULTS-BASED PAYMENT STRUCTURES EXAMPLES

### Comparable Instruments - RBP
### Results Based Payment Instruments  (The RBP feature)

**Traditional Output Based Aid**

Donor

Output met: Payment
Output Not met: No Payment

Service Provider (Gov)

**Sustainable Land Bonds**

Investor

Success: Interest
Failure : No Payment

Results based Payer

Success: Principal
Failure : Principal +Interest

Issuer

**Get – Fit**

Donor

Success: Feed In Tariff Top up.  50% of 20 yrs commitment in first 5 yrs

Failure: No Top Up

Project

**Cameroun Cataract Bond: DIB**

Investor

Success Principal + Interest
Failure % of  Principal + Interest

Results based Payer

Failure  % of Principal +Interest

Issuer

**DC Water: EIB**

Investor

Success

Results based Payment

Principal + Interest

Failure

Issuer

**Cat Bond**

Investor

If  Natural Disaster: %  of Principal Not Paid

Issuer

## 8.4 IMPLEMENTATION PATHWAY PER PHASE

### 8.4.1 PHASE 1 – TECHNICAL ASSISTANCE

The city first needs to designate a local team to serve as the operational counterpart to the initiative. Depending on the local context and the city's existing organizational structure, this local team could sit within an entity assigned by the local government, function as a new standalone taskforce in a sub-division within the local authority or form part of an existing local or national environmental agency within the country.

The goal in Phase 1 is to identify the city's pollution priorities and associated SLCP-reducing projects to be developed. The table below is an example timeline for technical assistance activities. Timeframes would vary in each location, with durations estimated to be a minimum of 6 months, and two years on the upper end.

*Table 2: Technical assistance timeline and activities*

| Technical Assistance Period Activities | Year 1 Q1 | Q2 | Q3 | Q4 | Year 2 Q1 | Q2 | Q3 | Q4 | Ongoing |
|---|---|---|---|---|---|---|---|---|---|
| Initial emission Inventory | ■ | ■ | | | | | | | |
| Enabling condition Strengthening* | ■ | ■ | ■ | ■ | ■ | | | | |
| Project Preparation | | | | | | | | | |
|    Project definition** | | | ■ | | | | | | |
|    Project feasibility*** | | | ■ | ■ | | | | | |
|    Project structuring**** | | | | ■ | ■ | | | | |
|    Transaction support | | | | | ■ | | | | |
| Bond structuring | | | | ■ | ■ | | | | |
| Monitoring, reporting and verification (MRV) | | | | | | | ■ | ■ | ■ |
| Bond Issue | | | | | ■ | | | | |

\* Designing enabling legislation; designing regulatory approaches; projecting relevant institutional reforms; consensus building for projects).  The support given here will be related to specifically unlocking projects.
\*\* Identification of desired outputs; action planning; terms of reference, etc.; pre-feasibility studies.
\*\*\* Organizational/administrative; financial modelling; economic, social, technical/engineering and environmental studies.
\*\*\*\* Public/private options assessment; technical/engineering; project finance and legal structuring.
\*\*\*\*\* Legal structuring; procurement; negotiation and post-signing financial agreements.

This phase will be financed by a public or philanthropic grant and will produce valuable and relevant air pollution and GHG emissions related information that can be used for parallel projects that are developed by stakeholders.

### 8.4.2 PHASE II – ISSUING THE BOND

The second phase is issuing the bond to investors, and using the proceeds to support projects. The technical assistance in this phase pivots to focus on measurement, reporting and verification (MRV) training. This phase is estimated to last 3 months.

### 8.4.3 PHASE III – MEASURING RESULTS AND INCENTIVES

Each Breathe Better Bond Initiative will have an independent organization that will conduct ongoing impact assessment oversight and project monitoring once the projects are fully operational, Each Initiative will establish its reporting metrics depending on the project and local context. The separate results-based agreement will be triggered by a pre-agreed metric (details to be agreed upon at the conclusion of Phase I) in consideration of important variables such as method of payment, "trigger" mechanisms, and timing. These features can be a valuable aspect that can lower the issuing body's cost of financing.

## 8.5 METHODOLOGY FOR CREATING THE CITY SELECTION TOOL

| I. Calculation of the Conducive Enviroment Coefficient |
| --- |
| STEP 1: Generate long list of cities based on database from C40, BreatheLife Campaign, GCOM & ICLEI |
| STEP 2: Elimante all cities who are located in Annex I countries |
| STEP 3: Cross reference the cities with CCAC member countries. |
| STEP 4: Assign a Corruption Index Acceptability threshold using Transparency International's CPI. |
| STEP 5: Cross reference with Bloomberg terminal to gauge historic bond issue experience and creditworthiness |
| Result: 29 cities to be ranked by 5 categories |
|       1 Bond issue experience |
|       2 Existing monitoring capabilities |
|       3 Credit rating at or near investment grade |
|       4 Engaged in pollution initiatives |
|       5 Working relationship with IFC |
| STEP 6: Results transferred into "0-1" format |

| II. Calculation of Air Pollution and GHG Coeficcient |
| --- |
| Step 1: Assign PM2.5 measure using using mean annual exposure figures to list generated from above. |
|       1 Air Visual and Index Mundi were used in our analysis. |
|       2 In cases were city measure was not found, country average was used. |
| Step 2: Result transferred to "0-1" format |
| Step 3: Find GHG emissions for country where the city is located and assign it to the city |
| Step 4: Result transferred to "0-1" format |
| Step 5: Create coefficient by weighing each result at 50% and adding both figures |

| III. Create a third variable (size of bubble) at convenience. In this case city population data was used. |
| --- |

- The tool is customizable and results vary depending on the user's allocation of weighting to unique characteristics.
- The tool considered several factors, including air pollution, GHG data and conducive environment characteristics such as historic bond issues, creditworthiness and involvement in pollution initiatives.

## 8.6 OTHER RESULTS FROM COST OF BORROWING MODEL

**Total Donor Contribution ($100mm issue, 10-year tenor, interest buydown in year 3)**

| | | Senior Tranche Interest Rate | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | | 6.70% | 7.70% | 8.70% | 9.70% | 10.70% | 11.70% | 12.70% |
| **Maximum** | 0.95% | 3,449,834 | 3,470,275 | 3,490,414 | 3,510,240 | 3,529,747 | 3,548,925 | 3,567,771 |
| **Donor Rate** | 1.20% | 4,357,685 | 4,383,505 | 4,408,944 | 4,433,988 | 4,458,627 | 4,482,853 | 4,506,658 |
| | 1.45% | 5,265,536 | 5,296,736 | 5,327,474 | 5,357,735 | 5,387,508 | 5,416,781 | 5,445,545 |
| | 1.70% | 6,173,387 | 6,209,966 | 6,246,004 | 6,281,483 | 6,316,389 | 6,350,709 | 6,384,432 |
| | 1.95% | 7,081,238 | 7,123,196 | 7,164,534 | 7,205,230 | 7,245,269 | 7,284,637 | 7,323,319 |
| | 2.20% | 7,989,089 | 8,036,427 | 8,083,063 | 8,128,978 | 8,174,150 | 8,218,564 | 8,262,207 |
| | 2.45% | 8,896,940 | 8,949,657 | 9,001,593 | 9,052,725 | 9,103,031 | 9,152,492 | 9,201,094 |

Each cell on the table above shows the total amount that a donor would have to provide in order to buy down interest starting in year 3 per % of interest buy down for different senior tranche interest rates.

**Total Donor Contribution ($100mm issue, 10-year tenor, 9.7% senior pricing)**

| | | Year of results accomplishment | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| **Maximum** | 0.95% | 4,632,099 | 4,062,099 | 3,510,240 | 2,978,283 | 2,468,157 |
| **Donor Rate** | 1.20% | 5,851,072 | 5,131,072 | 4,433,988 | 3,762,041 | 3,117,672 |
| | 1.45% | 7,070,046 | 6,200,046 | 5,357,735 | 4,545,800 | 3,767,187 |
| | 1.70% | 8,289,019 | 7,269,019 | 6,281,483 | 5,329,559 | 4,416,701 |
| | 1.95% | 9,507,993 | 8,337,993 | 7,205,230 | 6,113,317 | 5,066,216 |
| | 2.20% | 10,726,966 | 9,406,966 | 8,128,978 | 6,897,076 | 5,715,731 |
| | 2.45% | 11,945,939 | 10,475,939 | 9,052,725 | 7,680,835 | 6,365,246 |

Each cell on the table above shows the total amount that a donor would have to provide in order to buy down interest if these started in year 1-5 and comparing to different buy down % options.

**Average Effective Issuer Interest Rate (40% concessional tranche, 9.7% senior pricing, 6% concessional pricing, 10-year senior tenor)**

| | | Concessional Tranche % of Total Issuance | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 0.00% | 10.00% | 20.00% | 30.00% | 40.00% | 50.00% | 60.00% |
| **Maximum** | 0.00% | 9.70% | 9.06% | 8.61% | 8.27% | 8.02% | 7.81% | 7.65% |
| **Donor Rate** | 0.50% | 9.30% | 8.73% | 8.33% | 8.03% | 7.80% | 7.62% | 7.47% |
| | 1.00% | 8.90% | 8.40% | 8.05% | 7.79% | 7.59% | 7.43% | 7.30% |
| | 1.50% | 8.50% | 8.07% | 7.77% | 7.55% | 7.38% | 7.24% | 7.13% |
| | 2.00% | 8.10% | 7.75% | 7.50% | 7.31% | 7.17% | 7.05% | 6.96% |
| | 2.50% | 7.70% | 7.42% | 7.22% | 7.07% | 6.95% | 6.86% | 6.78% |
| | 3.00% | 7.30% | 7.09% | 6.94% | 6.83% | 6.74% | 6.67% | 6.61% |

Each cell on the table above shows the interest rate the issuing body would be paying assuming a interest rate buydown starting in year 3 for different concessional trache proportions and comparing that to different buy down % options.

## 8.7 LEAP-IBC MODELLING

The Long-range Energy Alternatives Planning System linked with the Integrated Benefits Calculator (LEAP-IBC) uses demographic, energy, non-energy sources, and economic data to estimate current emission levels in terms of $CO_2$, methane, HFCs, black carbon, and other emissions that contribute to PM2.5 concentrations, and other relevant pollutants, especially those that are precursors to ground-level ozone formation.

The modeling used in this report followed a three step process to forecast emission a in a simulation city. The images below display each of these steps:

| **I. Certain simulation city characteristics established within LEAP-IBC (user can enter conext specific data available)** |
|---|
| Population: 17.15 million and projected to increase to 20.9 million by 2030. |
| GDP: Growth rate of 7.2% is assumed from 2018-2030 |
| Electricity generation Mix: 89% Natural Gas, 4% diesel, 5% Heavy fuel oil and 2% Hydro. |
| Residential cooking: 27% of households assumed to use traditional biomass stoves |
| Industry: Fuel mix as electricity (46%), natural gas (37%), coal (10%), fuel oil (4%) and diesel (2%) |
| Commerical and Public services: Electricity (58%), and natural gas (42%) |
| Agricultural Energy Use: diesel (91%) and electricity (8%) |
| Transport: Fuel used diesel (43%) and natural gas (39%) and gasoline (18%) |
| Waste: Assume 50% of waste generated is sent to landfills |
| Waste: Assume no methane recovery system in place in landfills |

The model uses characteristics such as the above to establish baseline emissions scenarios for a specified period. In this case for a period ending 2030.

**II. The baseline results generate emissions per sector of the economy. (all in thousands of metric tonnes) For Example:**

| PM2.5 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|---|---|---|---|
| Transport | 2.27 | 2.445 | 2.62 | 2.82 | 3.02 | 3.25 | 3.48 | 3.745 | 4.01 |
| Energy: | 0.19 | 0.205 | 0.22 | 0.235 | 0.25 | 0.265 | 0.28 | 0.3 | 0.32 |
| Waste: | 17.89 | 18.065 | 18.24 | 18.405 | 18.57 | 18.72 | 18.87 | 19.02 | 19.17 |
| CO2 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
| Transport | 2135 | 2300 | 2465 | 2655.5 | 2846 | 3066 | 3286 | 3540.07 | 3794.14 |
| Energy: | 5506 | 5892 | 6278 | 6725 | 7172 | 7690 | 8208 | 8809.305 | 9410.61 |
| Waste: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CH4 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
| Transport | 1.11 | 1.195 | 1.28 | 1.38 | 1.48 | 1.595 | 1.71 | 1.84 | 1.97 |
| Energy: | 0.12 | 0.13 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 | 0.19 | 0.2 |
| Waste: | 70.79 | 71.485 | 72.18 | 72.825 | 73.47 | 74.07 | 74.67 | 75.27 | 75.87 |

The user can then input implementation projects in order to gauge the effect that these would have on all emissions. The results in this report our based on the following implementations:

**III. Mitigation measures are entered into the model and improvements can be observed**

Electricity Generation-Reduce fossil fuel mix from 98% to 96%. 2% will be covered by renewable energy.

Transport-Lower diesel fuel used from 43% to 39%.

Waste-Reduction of 420,000 tons of municpal waste openly burned.

## 8.8 ESTIMATING URBAN AIR POLLUTANT CONCENTRATIONS AND HEALTH BENEFITS FROM EMISSION REDUCTIONS

LEAP-IBC is able to estimate the impact of mitigation on urban air quality and human health can be estimated. The following are required:
- an emission inventory for all sources of pollution giving rise to small particulate matter in the city and surrounding regions that contribute to the pollution in the city.
- an atmospheric transport model that can model the chemical transformations of the emitted substances in the atmosphere and model the movement in the wind at different heights above the surface; this then can then estimate the concentration in PM2.5 that will result in the city from all sources of the particulate air pollution.
- application of concentrations-response functions that relate the PM2.5 concentrations to health outcome, such as the number of premature deaths, which requires other input data, including baseline mortality figures from the city and population.
- mitigation scenarios that quantify the reduction in emissions anticipated from the application of measures which can then be run through the atmospheric model and concentration-response functions to then give the benefit of the investment for human health (e.g. number of premature deaths avoided, compared with the baseline projection).

Running an atmospheric transport model for a city requires investment and expertise, often absent in a city. Therefore, SEI has developed an approach (the Integrated Benefits

Calculator) where the modelling is done for a city by an experienced modeller using the GEOS-Chem Adjoint model which provides linear coefficients for a city that relate the emissions from grids in the city and from surrounding areas to the population-weighted mean PM2.5 concentrations in the city. Practitioners can then estimate the health benefits of the emission reductions, which can be estimated by the LEAP tool developed by SEI (see https://www.energycommunity.org/default.asp?action=IBC).

Note: the Concentration-Response Functions are derived from large epidemiological studies that are in the peer-reviewed academic literature and used by the WHO, Global Burden of Disease and other studies to estimate health impacts of air pollution.

## 8.9    OPPORTUNITIES FOR INVOLVEMENT

1.  As investors in the bond
2.  As Lead Manager role for the bonds
3.  For Donors/Philanthropic org. focused on innovative climate funding (for results based payment (i.e. interest buy-downs or lump sump payments) and project co-investment).
4.  Technical assistance funding opportunities (through strategic partners)
    o   Identify/model pollution sources, evaluate impact (pollution and GHG reduction, health, financial, other) provide scenario analysis reflected potential interventions
    o   Support capacity building to identify, evaluate and execute potential interventions.
    o   Identifying most effective potential implementations
    o   Bond structuring support
    o   Project formulation support
    o   Identification of related existing programs sponsored by DFIs, Donors/Philanthropies
    o   Provide learning from existing successful instruments used in the sector
5.  For Strategic partners that provide technical assistance/capacity building for items under 4.