



INNOVATIVE FINANCE  
SOLUTIONS FOR CLIMATE-SMART  
INFRASTRUCTURE

# NEW PERSPECTIVES ON RESULTS-BASED BLENDED FINANCE FOR CITIES



INNOVATIVE FINANCE  
SOLUTIONS FOR CLIMATE-SMART  
INFRASTRUCTURE

**NEW PERSPECTIVES ON  
RESULTS-BASED BLENDED  
FINANCE FOR CITIES**



© 2019 International Bank for Reconstruction and Development / The World Bank  
1818 H Street NW,  
Washington, DC 20433

Telephone: 202-473-1000  
Internet: [www.worldbank.org](http://www.worldbank.org)

Some rights reserved  
1 2 3 4 19 18 17 16

This work is a product of the staff of The World Bank with external contributions. The findings, interpretations, and conclusions expressed in this work do not necessarily reflect the views of The World Bank, its Board of Executive Directors, or the governments they represent. The World Bank does not guarantee the accuracy of the data included in this work. The boundaries, colors, denominations, and other information shown on any map in this work do not imply any judgment on the part of The World Bank concerning the legal status of any territory or the endorsement or acceptance of such boundaries.

Nothing herein shall constitute or be considered a limitation upon or waiver of the privileges and immunities of The World Bank, all of which are specifically reserved.

#### Rights and Permissions



This work is available under the Creative Commons Attribution 3.0 IGO license (CC BY 3.0 IGO) <http://creativecommons.org/licenses/by/3.0/igo>. Under the Creative Commons Attribution license, you are free to copy, distribute, transmit, and adapt this work, including for commercial purposes, under the following conditions:

**Attribution**—Please cite the work as follows: GPRBA (Global Partnership for Results-Based Approaches). 2018. *New Perspectives on Results-Based Blended Finance for Cities: Innovative Finance Solutions for Climate-Smart Infrastructure*. World Bank, Washington, DC. License: Creative Commons Attribution CC BY 3.0 IGO.

**Translations**—If you create a translation of this work, please add the following disclaimer along with the attribution: *This translation was not created by The World Bank and should not be considered an official World Bank translation. The World Bank shall not be liable for any content or error in this translation.*

**Adaptations**—If you create an adaptation of this work, please add the following disclaimer along with the attribution: *This is an adaptation of an original work by The World Bank. Views and opinions expressed in the adaptation are the sole responsibility of the author or authors of the adaptation and are not endorsed by The World Bank.*

**Third-party content**—The World Bank does not necessarily own each component of the content contained within the work. The World Bank therefore does not warrant that the use of any third-party-owned individual component or part contained in the work will not infringe on the rights of those third parties. The risk of claims resulting from such infringement rests solely with you. If you wish to re-use a component of the work, it is your responsibility to determine whether permission is needed for that re-use and to obtain permission from the copyright owner. Examples of components can include, but are not limited to, tables, figures, or images.

All queries on rights and licenses should be addressed to the Publishing and Knowledge Division, The World Bank, 1818 H Street NW, Washington, DC 20433, USA; fax: 202-522-2625; e-mail: [pubrights@worldbank.org](mailto:pubrights@worldbank.org).

# Acknowledgements

This report was prepared by the Global Partnership for Results-Based Approaches (Shoba Shetty, Practice Manager). It was written by Charis Lypiridis and Michael Kuzio. Many World Bank Group colleagues and experts provided critical input that shaped this knowledge product. They ensured the quality and clarity of this report. The authors are grateful for the insightful review and expert input from Klaus Oppermann, Stephen Hammer, Marc Forni, Mesky Brhane, Steven Baillie, Veronique Morin, Davison Muchadenyika, Rajesh Advani, Shagun Mehrotra and Amsale Bumbaugh for her support during the production process. Editing services were provided by Ingrid Maria Imelda Pakulski. Report design and production assistance was provided by The Word Express, Inc. Creative design, layout, and printing services were provided by the World Bank's in-house printing and multimedia team, led by Adam Broadfoot. Copy-editing services were provided by Burness. The preparation of the report was supported by the Global Partnership for Results-Based Aid (GPRBA).\*

---

\* When this paper was initially written, GPRBA was known as the Global Partnership on Output Based Aid (GPOBA). All references to GPOBA in this report have an asterisk on them which refers to the name change to GPRBA.



## About GPRBA

The Global Partnership for Results-Based Approaches (GPRBA), formerly known as the Global Partnership on Output-Based Aid (GPOBA) until February 2019, provides innovative financing solutions that link funding to achieved results. GPRBA's **results-based financing (RBF)** approaches provide access to basic services like water and sanitation, energy, health and education for low-income families and communities that might otherwise go unserved. By bringing together public and private sector funders to maximize resources and designing effective incentives for service providers to reach underserved low-income communities, GPRBA gives people the chance for a better life.

Established in 2003 and housed within the Social, Urban, Rural and Resilience (GSURR) Global Practice at the World Bank, GPRBA amplifies GSURR's goals to help countries build sustainable, inclusive, resilient, and productive communities. With its mandate to explore and apply innovative results-based financing solutions for enabling access to basic services, GPRBA is positioned at the forefront of the World Bank's efforts to end extreme poverty and boost prosperity among the poorest 40 percent in low- and middle-income countries. GPRBA supports RBF approaches in a variety of sectors in 29 countries.





# Table of Contents

<b>Executive Summary</b> .....	<b>1</b>
<b>Overview</b> .....	<b>5</b>
<b>1. Why Cities Matter and the Importance of Urban Infrastructure</b> .....	<b>7</b>
<b>2. Understanding Cities' Infrastructure Financing Challenges</b> .....	<b>11</b>
<b>3. The Financing Context of Results-Based Blended Finance (RBBF)</b> .....	<b>17</b>
3.1 Blended Finance .....	18
3.2 Results-Based Finance (RBF) .....	20
<b>4. Framework for Applying RBBF Approaches in Cities</b> .....	<b>29</b>
<b>5. Deep Dive on Innovative Finance Solutions</b> .....	<b>33</b>
5.1 Raising Capital .....	33
5.1.1 Municipal Debt Swaps .....	33
5.1.2 Crowd-based Financing .....	35
5.2 Determining Financial Incentives .....	37
5.2.1 Auction Facilities .....	37
5.3 Deployment of Funds .....	41
5.3.1 <i>Performance-Based Contracting: Environmental Impact Bonds (EIBs)</i> .....	41
5.3.2 <i>Energy Services Company (ESCO) Model</i> .....	42
5.4 Bond Schemes .....	45
5.4.1 <i>Resilience Bonds</i> .....	45
5.4.2 <i>Green City Bonds</i> .....	48
<b>6. The Way Forward</b> .....	<b>55</b>
<b>Appendix</b> .....	<b>57</b>
<b>Notes</b> .....	<b>63</b>
<b>References</b> .....	<b>65</b>

## List of Boxes

Box 3-1	Instruments Relevant to Blended Finance for Infrastructure	19
Box 3-2	Case Study: Off Grid Electric (OGE) in Tanzania	24
Box 3-3	Case Study: Solid Waste Management (SWM) for Cleaner Cities in Nepal	25
Box 5-1	Denver’s Mini-Bond Initiative	38
Box 5-2	Case Study – Housing Market in India	40
Box 5-3	Example EIB Project: DC Water and Sewer Authority (DC Water)	43
Box 5-4	Public Street lighting in Jaipur, Rajasthan, India	46
Box 5-5	Municipal Green Bond in Cape Town, South Africa.	52

## List of Figures

Figure 1-1	Integrated Approach Potential for Climate-Smart Projects in Cities	8
Figure 1-2	Investment Potential by Sector and Region in by 2030 (US\$, billions)	8
Figure 2-1	Common Challenges of Financing Infrastructure Investments	12
Figure 2-2	Types of Returns in Infrastructure Investments	13
Figure 2-3	Major Investment Barriers	15
Figure 3-1	The Efficient Frontier of Climate-Smart Projects.	17
Figure 3-2	Example of Unviable Project	18
Figure 3-3	Levers of Concessionality	19
Figure 3-4	Effects of Typical One-Off RBF Subsidy on Project Viability	21
Figure 3-5	Indicative OBA Scheme.	23
Figure 3-6	RBF Project Design Roadmap for Pro-Poor and Climate-Smart Urban Investments	23
Figure 3-7	Unit Economics (2013)	24
Figure 3-8	Rounds of Equity Raised and Financial Structure (US\$, millions)	24
Figure 3-9	OBA Subsidy Contribution to Total Revenues (US\$)	26
Figure 4-1	Framework for Analyzing the Applicability of RBBF In Cities	30
Figure 5-1	Typical Debt Swap Structure	34
Figure 5-2	Crowdfunding Scheme	36
Figure 5-3	Energy Ladder.	39
Figure 5-4	Construction Timeline and Auction Mechanism Milestones	40
Figure 5-5	DC Water Contingency Payment Arrangements	43
Figure 5-6	Shared Savings Model	44
Figure 5-7	Guaranteed Savings Model	44
Figure 5-8	The Chauffage Model	45
Figure 5-9	Application of Blended Finance within a Resilient Bond Structure	47
Figure 5-10	Segregation of Green Bond Proceeds	50

Figure 5-11	Green Bond Issuance Volume (US\$, billions) . . . . .	50
Figure 5-12	Most Common Use of Proceeds in 2017 . . . . .	51

**List of Tables**

Table 5-1	Mechanics of the Auction. . . . .	40
Table 5-2	Types of Green Bonds. . . . .	49
Table A-1	Public Finance Instruments. . . . .	57
Table A-2	Debt Finance Instruments . . . . .	58
Table A-3	Equity Finance Instruments. . . . .	59





# List of Acronyms

<b>CCFLA</b>	Cities Climate Finance Leadership Alliance
<b>CO<sub>2</sub></b>	carbon dioxide
<b>CPI</b>	crisis prevention and intervention
<b>CSO</b>	combined sewer overflow
<b>DFI</b>	development finance institution
<b>EIB</b>	environmental impact bond
<b>ESCO</b>	energy services company
<b>GDP</b>	gross domestic product
<b>GHG</b>	greenhouse gas
<b>GPOBA</b>	Global Partnership on Output-Based Aid*
<b>GPRBA</b>	Global Partnership for Results-Based Approaches
<b>HIPC</b>	Heavily Indebted Poor Countries
<b>IFC</b>	International Finance Corporation
<b>IRR</b>	internal rate of return
<b>IVA</b>	independent verification agent
<b>JV</b>	joint venture
<b>M&amp;E</b>	monitoring and evaluation
<b>MTCO<sub>2</sub></b>	millions of (metric) tons of carbon dioxide
<b>NDC</b>	nationally determined contribution
<b>NGO</b>	nongovernmental organization
<b>NPV</b>	net present value
<b>ODA</b>	Official Development Assistance
<b>PFI</b>	private finance initiative

<b>PPP</b>	public-private partnership
<b>RBBF</b>	results-based blended finance
<b>RBF</b>	results-based finance
<b>REDD+</b>	Reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries
<b>SPV</b>	special-purpose vehicle
<b>SWM</b>	solid waste management
<b>UNFCCC</b>	United Nations Framework Convention on Climate Change

*All dollar amounts are U.S. dollars unless otherwise indicated.*

# Executive Summary

## The Opportunity for Results-Based and Blended Schemes in the Urban Climate Agenda

There is clear evidence on the need for cities to rapidly scale-up their investments in climate change mitigation programs and build strong foundations for climate-resilient communities. Investing in low carbon infrastructure and climate resilience can generate competitive returns and is crucial for preventing a reversal of the development gains made in low-income countries up until now.

Overcoming the barriers in financing climate-smart infrastructure in cities means adjusting their currently unattractive and inadequate risk-return investment profile. Our analysis explains that well-targeted concessional funding can derisk the financing structure of a project and turn a typical non-bankable project to financial viable one. Additionally, it makes the case for results-based blended finance approaches that strengthen the accountability in project development by linking financing to the achievement of measurable, pre-agreed results.

Addressing the lack of creditworthiness, the limited accountability and capacity in institutions and service delivery practices should be at the center of urban investment strategies. The report highlights the need for technical assistance and capacity building programs that will support cities bring order to their financing and accounting practices, support shadow credit ratings and help them become creditworthy. It is estimated that only 20 percent of the 500 largest cities in developing countries are considered creditworthy.

Cities and development partners face a common challenge: Making the most effective use of available public finance instruments and disburse scarce public (concessional) funds in a way that maximally leverages private sector co-investments.

Results-based blended financing can directly address three of the main risks in infrastructure investments:

- Construction risks: Contractors are incentivized to deliver the pre-defined results on time and within budget. Because outputs are clearly defined, and payments are linked to the achievement of these results, cost overruns can be avoided because payment amounts are fixed and therefore do not cover additional costs.
- Operation risks: Payments can be sequenced to reflect the various project milestones and provide incentives throughout the operations phase of the project.
- Counterparty risks: Structuring the project around the result verification by an independent agent assures that all parties involved in a transaction are focused on delivering verifiable results. Should a counterparty not live up to its contractual obligations or go out of business, concessional financing would not be paid.

Results-Based Blended Finance (RBBF) approaches are inherently flexible and offer major advantages for climate-smart city planning and financing that address the institutional, infrastructure, and service needs of cities, holistically and across sectors.

- Institutions and investors benefit from the transparency and accountability that results-based approaches require.
- Infrastructure development supported with results based blended financing has the potential to mobilize private capital, while ensuring climate-smart design standards that are also inclusive for marginalized communities.
- Results-based municipal services could provide incentives to public or private service providers for targeting low-income households in a climate-smart way.

The development community has a dual role to play in assisting the climate finance agenda for cities.

First, it can help crowd-in investments in cities by promoting programs that:

- *Blend scarce public funding with private sector commercial capital* to realize innovative, high impact climate-smart infrastructure projects that do not yet have a commercial track record.
- *Establish result-based approaches in project delivery*, which strengthen accountability by disbursing financing only after measurable, pre-agreed results have been agreed and verified.

Second, it can spark financial innovation by incubating and accelerating experiences with financing models that:

- *Incubate innovation from one sector to another*. For example, the well-established model in the energy sector, with Energy Services Companies can be transferred across different urban practices that seek performance improvements.
- *Accelerate the transfer of innovation from cities in developed countries to emerging cities of less developed countries*. For example, the impact bond model which has been initially realized to support social outcomes and has now been applied in several US cities for environmental outcomes can be tested in climate programs in less developed countries.

## **Call for Innovation in Climate-Smart Urban Infrastructure Financing: Deep Dive on Selected Financing Schemes for Development and City Partners**

The classic model of infrastructure financing that depends on aid without accountability and misses progress in the policy agenda towards creditworthiness is inadequate to address the challenges that lie ahead for cities. Therefore, finding new approaches to incentivize public and private investments in cities is essential. The report brings into the development dialogue, financing schemes that:

- Have not been tested in less-developed countries for climate-related municipal investments (e.g. crowd-financing, environmental impact bonds);



- Have been tested only in specific sectors—and there may be opportunities for testing in municipal infrastructure and climate operations (e.g. debt swaps for environmental conservation, ESCOs);
- Hold great promise for solutions, but also carry financial and institutional complexity (bond structures).

*Municipal debt swaps* are a financial arrangement between a creditor and an indebted city or municipality to cancel debt in exchange for climate-smart investments. In the 1980s, debt swaps were extensively used, particularly at the national level. Such debt swaps could prove to also be a viable and attractive instrument for indebted cities and municipalities seeking to reduce their debt volumes, while local communities would benefit from the additional investments. Results-Based Financing (RBF) can be applied within a debt swap as an incentive for debtors to provide debtor relief and finance more projects.

*Crowd-based financing* sources capital from communities and individuals (crowd), and experiences from US cities indicate that could be an alternative finance source for climate-smart urban infrastructure investments. Crowd-based financing is a relatively new approach that has been predominantly used in the technology sector. Crowd-based financing mitigates several investment barriers that are inherent in traditional project finance in many cases by applying microfinance practices but also brings additional considerations in project structuring, especially for communities with low income and low institutional capacity.

*Auction facilities* is an effective way to help identify the lowest possible amount of results-based subsidies required to enable climate-smart investments in cities. Originally developed to boost investments in methane-reducing projects, auction facilities are now being explored as mechanisms that could enable investments in resource-efficient residential buildings, primarily new construction developments.

*Environmental impact bonds (EIBs)* are an innovative finance technique to apply results based financing contracts to green infrastructure projects. EIBs are tax-exempt, *pay-for-success* instruments, allowing governments to limit their losses if projects turn out unsuccessful, thus encouraging them to try novel climate-smart infrastructure solutions. However, EIBs are not really bonds because they are not a fixed-income borrowing instrument with a steady stream of repayments, nor can they be traded. Instead, EIBs are a form of Public-Private Partnership (PPP) with performance-based contracting. Impact Bonds have been widely used in the US and UK and several less-developed countries are now piloting the approach targeting social outcomes. EIBs can leverage the classic performance-based contracting approach in infrastructure development and allow municipal and city governments to partner with private sector investors.

*Energy service companies (ESCOs)* can help develop, implement, or make arrangements for upfront, results-based energy investments. Generally, there are three different ESCO models. The “shared-savings” and the “guaranteed savings” energy performance contracting (EPC) models are the most common forms; a third model, the “chauffage” model, is predominantly used in Europe. The main advantage of the ESCO model is that the client (city or municipality) is not required to make any upfront capital investments and is only responsible for periodic service fee payments to the ESCO based on the energy savings achieved.

*Municipal bonds* for climate resilient and low carbon development could deliver significant impact but the development of bond schemes in cities requires significant institutional and financial capacity, both

of which are associated with the creditworthiness of cities. The specialized bond schemes are presented at conceptual basis considering that cities in less developed countries should first have the capacity to issue simple municipal bonds before progressing to bonds that tackle climate resilience and low-carbon development.

## Looking Ahead

The analysis aspires to support a dialogue within the international development and impact finance community for developing financing schemes that strengthen accountability in the delivery of results for climate and cities. Innovative results-based approaches in cities that blend public and private funding hold great promise for delivering scalable paradigms for climate-resilient and inclusive growth.

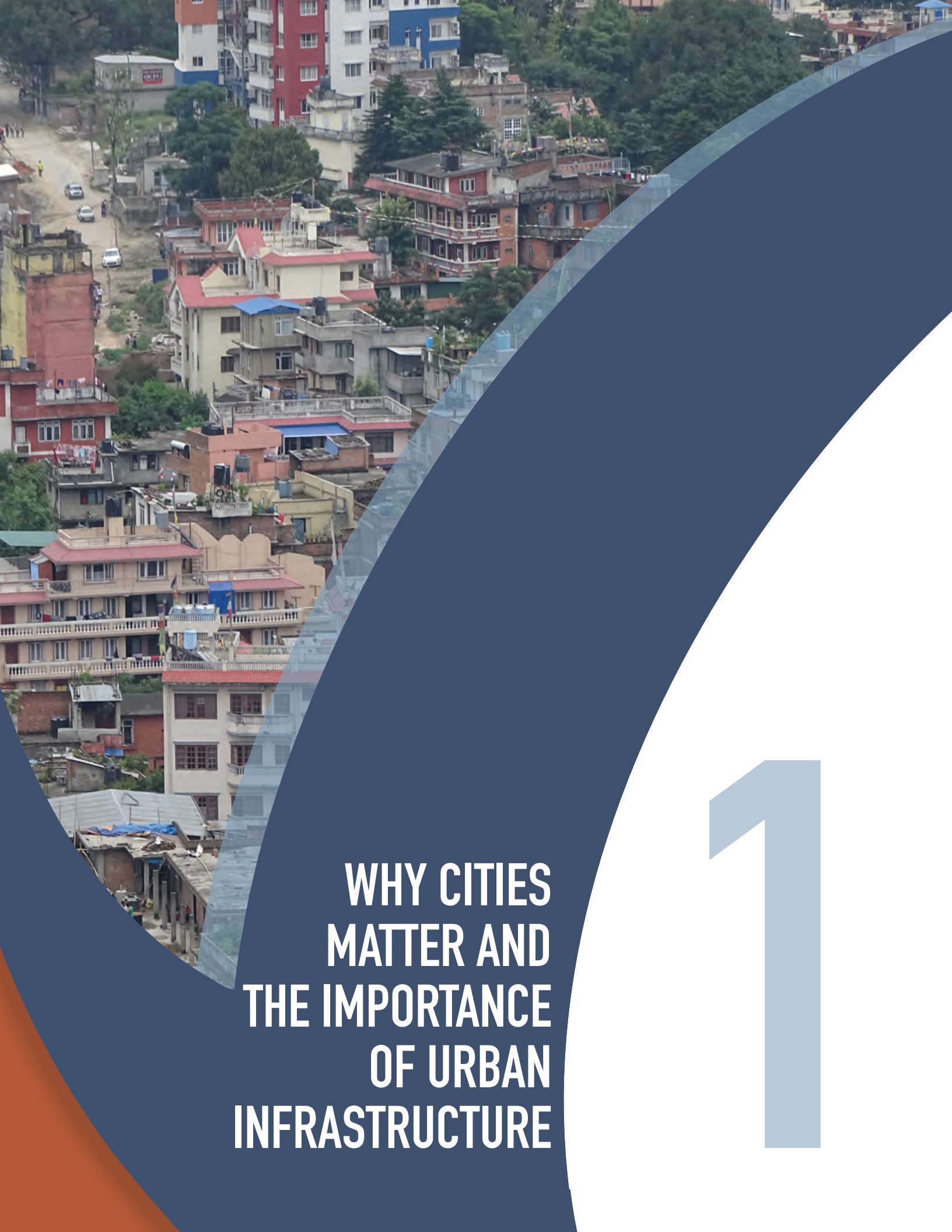
# Overview

**This report is a call for action on innovative financing for low-carbon and climate resilient cities.** The report discusses the context for applying results-based approaches in blending scarce public concessional funds with private sector commercial capital to finance low-carbon and resilient infrastructure in cities. Furthermore, it assesses the significance of results-based and blended finance solutions for the climate and urban infrastructure agenda and analyzes selected instruments in the toolbox of international development agencies. The report is structured in two parts: The first part addresses the opportunity for results-based and blended schemes in the urban climate agenda, and the second part constitutes a deep dive analysis of selected results based and blended finance schemes.

**Drawing upon the 15 years of GPRBA experiences in developing innovative financing solutions that link funding to achieved results, the analysis for this report supports GPRBA's strategy for developing innovative blended finance schemes for low-carbon and climate resilient projects.**

**While the report focuses on financial innovation, it also assesses the context for applying results-based approaches at the institutional level and the significance of the enabling environment in developing blended finance schemes.** It acknowledges that financing low-carbon and resilient infrastructure assets is a major challenge, particularly for city and municipal governments that have weak institutional and accounting practices and face budgetary deficits and high debt levels. It makes the case that institutions and investors benefit from the transparency and accountability that results-based approaches require. The analysis stresses the significance for developing initiatives that tackle the inadequate creditworthiness of city authorities and municipal agencies.

**Overall, the analysis aspires to support a dialogue within the international development and impact finance community for developing financing schemes that strengthen accountability in the delivery of results for climate and cities.** GPRBA experiences show that by disbursing financing only after measurable, pre-agreed results have been achieved and verified, there are added value improvements in project delivery, institutional capacity, targeting of marginalized communities, and donor and investors' confidence.



**WHY CITIES  
MATTER AND  
THE IMPORTANCE  
OF URBAN  
INFRASTRUCTURE**

**1**

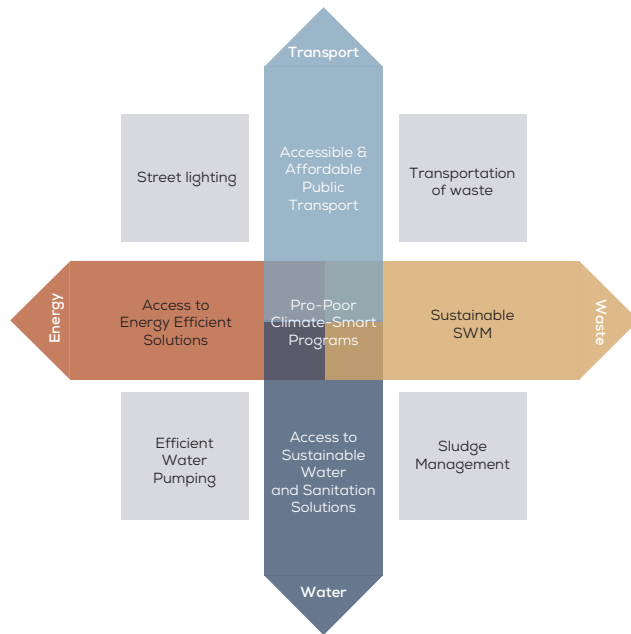
# 1. WHY CITIES MATTER AND THE IMPORTANCE OF URBAN INFRASTRUCTURE

**Cities are catalysts of economic prosperity and key stakeholders in the global and local efforts to mitigate and adapt to climate change.** Today, more than half of the worldwide population, a record-breaking number, lives in cities. Urban areas are economic powerhouses and account for about 75 percent of global economic output (C40, Citi, and Siemens 2015, 8). They consume over 65 percent of the world's energy resources, generate huge quantities of water and wastewater, and emit over 70 percent of global CO<sub>2</sub> emissions (GPOBA\* 2017, 2). The urbanization trend will continue at a rapid pace, and by 2050, the global urban population will exceed 6.7 billion; 80 percent of this growth will take place in low- and middle-income countries, predominantly in Asia and Africa.

**Climate change poses significant challenges to cities' critical infrastructure—such as transport networks, waterways, and electricity grids—which is essential for economic activity and development.** Urban climate change-related risks are increasing. These risks arise from inadequate designs and locations of the built environment as well as poor urban planning and construction under changing climate conditions (Long Finance and WWF 2015, 15). For example, 75 percent of cities are in coastal areas at risk of sea level rise (C40, Citi, and Siemens 2015, 8). With one out of three urban residents in developing countries living in a slum, the urban poor population will be affected most. Their unplanned settlements are often built in high-risk locations like floodplains, with inadequate access to basic services such as water, sanitation, and electricity, providing little resilience against the effects of climate change (GPOBA\* 2017, 2).

**The low capacity to withstand the impacts of climate change and disasters will cost cities an estimated \$314 billion every year by 2030 (World Bank 2015, 14). This presents a significant dilemma for cities.** Because every dollar can only be spent once, cities must prioritize between helping address the causes of climate change (mitigation) and dealing with its consequences for people and ecosystems (adaptation). Adaptation projects, which focus on addressing *short-term* effects on a local scale, are particularly important for urban poor and marginalized people, as these are disproportionately affected by climate change. Given that their livelihoods depend on fewer assets and their consumption levels are close to subsistence levels, they take longer to recover from and reconstruct after natural disasters (Hallegatte et al. 2017, 1). At the same time, however, a compelling case can be made for directing investments towards mitigation to address the *long-term* effects of climate change on a global scale. About 70 percent of current global greenhouse gas (GHG) emissions arise from infrastructure construction and operations, such as power plants, buildings, and transport, with two thirds of emissions emanating from the energy sector. By 2050, the current rate of emissions from key infrastructure sectors will push more than 720 million people into extreme poverty (World Bank 2018, 4). Therefore, investing in low-carbon infrastructure is crucial, especially to prevent a reversal of the development gains made in emerging and developing countries so far.

**FIGURE 1-1. Integrated Approach Potential for Climate-Smart Projects in Cities**

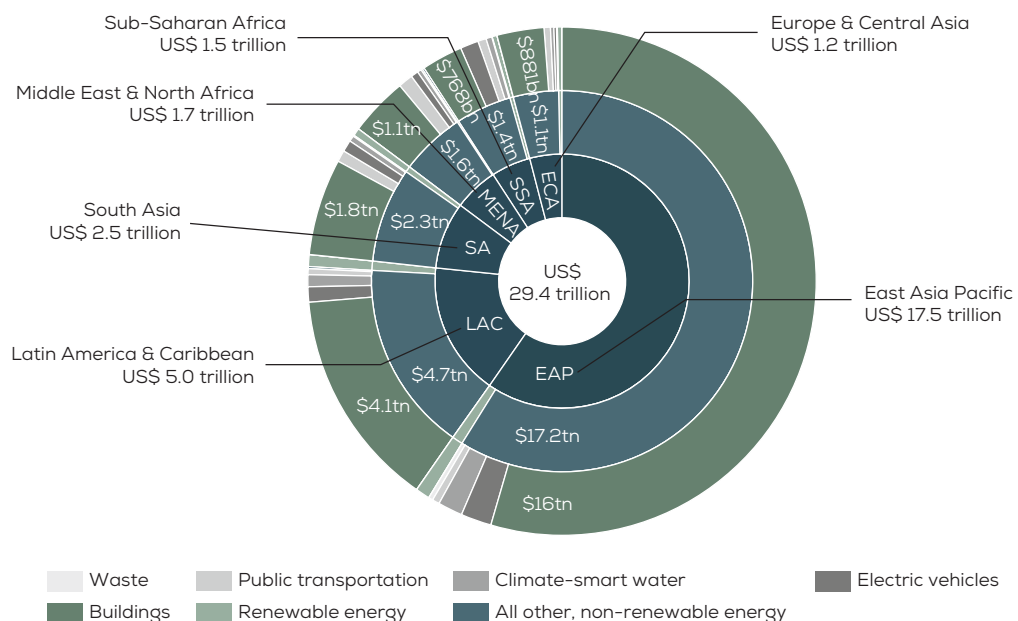


Source: Adapted from GPOBA.

Note: SWM = solid waste management.

The infrastructure investment agenda of cities holds a significant investment potential and is critical for achieving growth that is resilient to climate change. The fact that 60 percent of the areas to be urbanized by 2030 have not been developed yet signals the investment opportunity and gives reason for optimism in finding climate-smart solutions (IFC, 2018). In addition, infrastructure spending generally has a positive multiplier effect on economic growth. While the multiplier effect in high-income countries lies between 1.0 and 2.5 over a 3-year period, the impact is greatest in emerging economies—in fact, it is more than double these figures in markets such as Brazil, India, and China (C40, Citi, and Siemens 2015, 10). Overall, cities’ worldwide infrastructure investment demand is estimated at around \$57 trillion (C40, Citi, and Siemens 2015, 10) between now and 2030, of which \$29.4 trillion are expected to be in emerging markets (figure 1–2) (IFC, 2018), thus providing a solid opportunity for leveraging private sector investments.

**FIGURE 1-2. Investment Potential by Sector and Region in by 2030 (US\$, billions)**



Source: Based on IFC estimates (2018).







**UNDERSTANDING  
CITIES'  
INFRASTRUCTURE  
FINANCING  
CHALLENGES**

**2**



## 2. UNDERSTANDING CITIES' INFRASTRUCTURE FINANCING CHALLENGES

**Financing the required infrastructure assets is a major challenge, particularly for city and municipal governments that face budgetary deficits and high debt levels.** Current estimates reflect significant gaps in infrastructure investments to achieve the targets set in the Paris Agreement. For example, it is estimated that an additional \$5.4 trillion in clean energy investments will be needed until 2040 to keep total temperature rise at 2°C.<sup>1</sup> Especially in developing countries, cities lack the institutional capacity and the required financial resources to fund the infrastructure needed to cope with their rapidly growing urban populations (Long Finance and WWF 2015, 16). Over \$100 trillion of institutional capital from private, public, and philanthropic sources is available worldwide, yet less than 2 percent of this capital is invested in infrastructure and even less into making infrastructure low emission and climate resilient. Moreover, 79 percent of current climate investments are funded *domestically*, indicating investors' strong preference for investing where country risks are well-understood.

**The inadequate creditworthiness of city authorities and municipal agencies is one of the main reasons why the use of bonds in cities, particularly in developing countries, is still in its infancy.** Generally, creditworthiness refers to a lender's expectation about whether service payments will be made fully and on time. Estimates suggest that only about 20 percent of the 500 largest cities in developing countries are considered creditworthy. However, investors are reluctant to provide debt or equity financing to cities with low creditworthiness or do so only at prohibitively high rates. The cost of borrowing can vary significantly for different borrowers, as demonstrated in the credit ratings. For example, a BBB+ rated borrower can pay up to 2 percent more on an equivalent loan than an AAA rated borrower. The higher interest rate for a BBB+ rated borrower reflects the higher risk of default compared to that of an AAA rated borrower (PPIAF 2009, 8). According to World Bank estimates, every \$1 invested in improving creditworthiness leverages \$100 of additional private sector financing. Therefore, improving creditworthiness should be a major priority for municipalities seeking to reduce borrowing costs and tap into more financial resources.

The fundamental prerequisite to increase municipal's creditworthiness is that operating income (which includes government grants) exceed operating expenditures (which includes interest on existing debt). Such a surplus can then be used to make service payments on any new loan (PPIAF 2009, 17). Municipalities that already have a sound revenue base may merely have to make some critical enhancements—for example, to its accounting and reporting systems, credit control operations, and cash flow management—to achieve credit upgrades. Other municipalities, however, may either have a longer way to go for achieving an investment grade credit rating because of their deficient revenue base compared to expenditures or may need to significantly improve their organizational structure and financial performance.

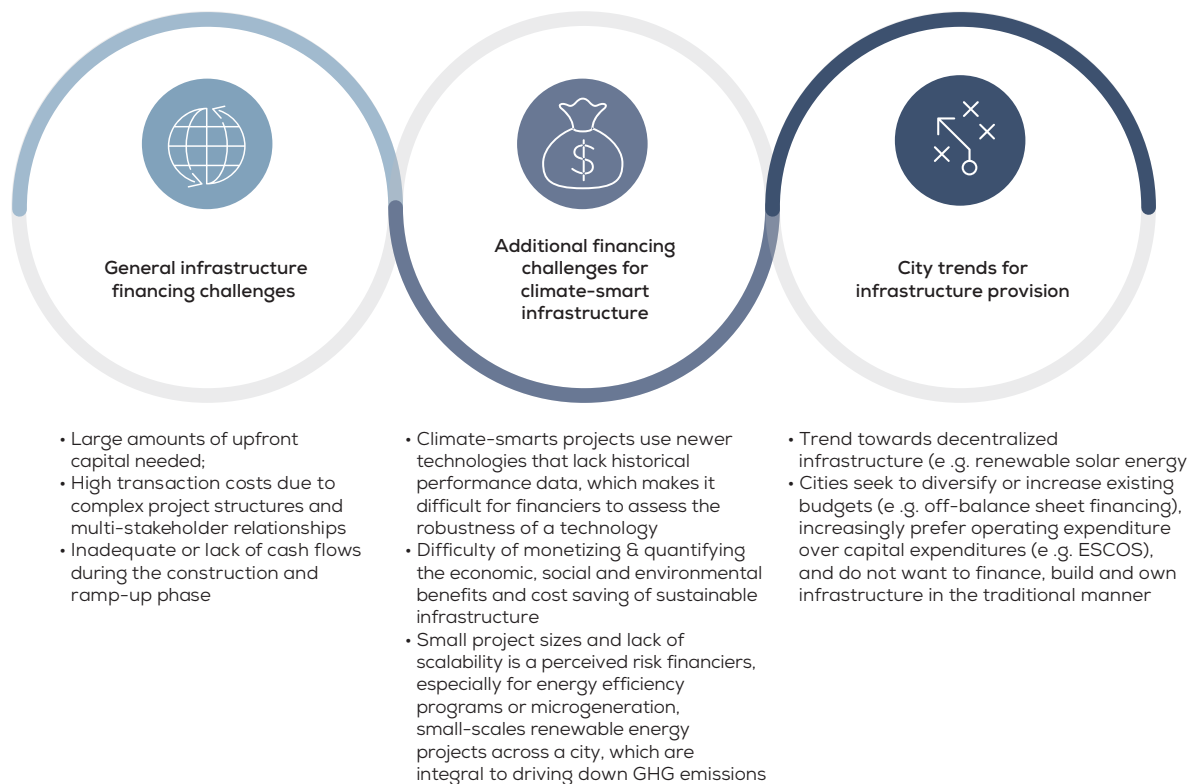
---

<sup>1</sup> More information is available at Bloomberg New Energy Finance. "Efforts to Address Climate through Clean Energy Lag in Emerging Markets" (<https://about.bnef.com/blog/efforts-address-climate-clean-energy-lag-emerging-markets/>).

**The lack of bankable projects is the main impediment to sustainable infrastructure investments at large scale, not the lack of finance.** Generally, policy makers evaluate climate-smart projects from an *economic* viability perspective, meaning that capital and operating costs, along with nonfinancial costs, are assessed against project benefits, such as revenues and nonfinancial benefits and avoided environmental costs of carbon emissions, health and productivity improvements, etc. By contrast, nonphilanthropic private investors, such as banks, institutional investors, and specialized funds, primarily focus on the *financial* viability of investment projects and a given project’s bankability depends on its risk-return profile. The main reason for the financing gap is the inadequate and unattractive risk-return profile of climate-smart infrastructure investments. But climate-smart investments are not only hindered by general financing barriers, but also by the market’s failure to monetize the impacts of pollution and climate change on economies, the environment, and societies at large (figure 2–1).

Currently, 75 percent of the funding for climate investments is provided on *commercial* terms, which is not a problem for projects with clear payback models. However, most of the low-carbon and resilience projects do not have clear payback models and do not provide investors adequate returns that justify market-rate financing (figure 2–2). As a result, many economically beneficial climate-smart projects fail to progress

**FIGURE 2-1. Common Challenges of Financing Infrastructure Investments**



Source: Author’s research; adapted from C40, Citi, and Siemens 2015.

Note: ESCOS = Energy Services Companies.

because of financial viability gaps and therefore require a share of financing that is concessional (CCFLA 2015, 24).

**Transaction costs represent a big barrier for high-impact but small-scale projects, as a relatively small project scale is considered unattractive for investors.** Since due diligence costs for investors can range from \$0.5 million to \$1 million per project regardless of a project’s size, investors view small projects as unattractive. Therefore, private investors are reluctant to finance projects requiring less than \$25 million in financing (GPOBA\* 2012,10). In addition, small-scale projects are often delivered by small- and medium-sized enterprises and organizations such as nongovernmental organizations (NGOs). Because these entities usually have short track records as well as high failure rates, investors perceive them as highrisk (GPRBA 2012).

**Additional project-related financing barriers include a lack of project preparation finance and long payback periods.** Given that project preparation costs can represent up to 10 percent of construction costs

**FIGURE 2-2. Types of Returns in Infrastructure Investments**



Source: Adapted from World Bank 2018.

(GPOBA\* 2012,9), insufficient access to initial project preparation finance can be a significant investment barrier for private investors. Moreover, investors strongly prefer shorter payback periods. Consequently, the higher the upfront costs of a project without support and the longer its payback period, the more difficult it will be to secure finance for it.

**In addition, cities face the following financing constraints:**

- Fiscal rules limit cities' ability to access innovative financing models, such as public-private partnerships (PPPs);
- Many cities do not have the required technical and/or financial expertise required to deliver complex infrastructure projects;
- Cities lack an understanding of the repercussions of changing technologies for market structures, which is necessary to be able to effectively finance instruments, such as performance guarantees;
- Jurisdictions prevent cities from accessing international capital markets directly and require that international funding be provided either through national governments or require that national governments explicitly agree to this financing arrangement through a sovereign guarantee.

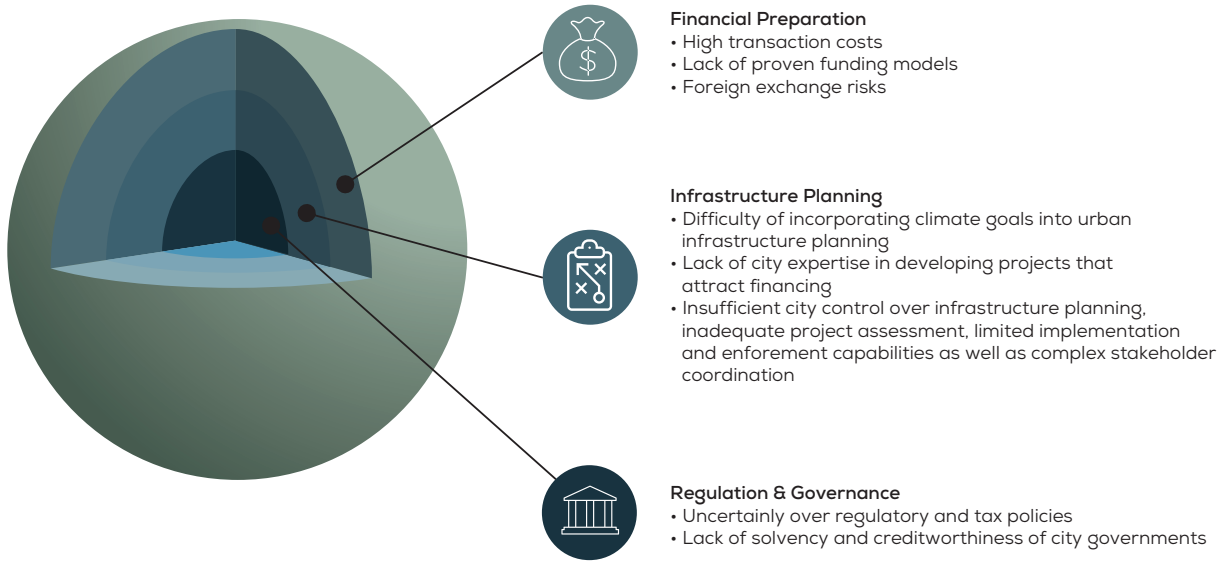
**As a result, policy makers have recognized the need for enabling action in the form of finance and risk mitigation instruments to mobilize the required private sector capital at scale.** Cities need more than just access to capital as they are also constrained by a range of other factors that prevent investments in sustainable infrastructure. This is especially true for emerging markets, where several factors prevent private sector capital engagement in the first place (figure 2–3).

**Governments provide the necessary institutional capacity and regulatory environment in which the private sector operates and invests.** As a result, the public sector will play a key role in achieving the targets set in the Paris Agreement. However, policy makers acknowledge that only the private sector will be able to fill the multi-billion-dollar financing gap for much of the needed low-carbon energy, water, and transport projects. They recognize the investors' need to reduce investment risks and thus offer financial incentives in the form of philanthropic and public finance to bridge viability gaps and crowd in private sector capital.

**Blended finance** is an approach that blends scarce public concessional funds with private sector commercial capital to realize innovative, high-impact infrastructure projects that do not yet have a commercial track record. Through a variety of concessional instruments—concessional loans and guarantees, among others—blended finance helps rebalance investors' risk-return profiles and allows the leveraging of public funds to crowd in private sector capital. Simultaneously, existing donor funds and subsidies will need to be disbursed in a form that overcomes as many of the investment barriers as possible, strengthens accountability, improves project delivery, and optimally leverages private sector investments to reduce the cost to the public.

**Result-based financing (RBF)** allows cities to effectively leverage their toolbox of blended concessional funds to encourage private sector financing for sustainable climate-smart infrastructure. By disbursing

FIGURE 2-3. Major Investment Barriers



Source: Adapted from CCFLA 2015 and World Bank 2018.

financing only after measurable, pre-agreed results have been achieved and verified, RBF strengthens accountability and improves project delivery. Furthermore, RBF approaches that target the funding gap can increase the rate of return on investments and make a project financially viable – as analyzed in section 3.2. As a result, RBF allows the needed financing for climate-related projects to be scaled up and the project's cost to the public to be reduced.

Innovative **results-based blended finance (RBBF)** schemes can help address the specific investment barriers that cities face with their climate-smart infrastructure agenda. RBBF models have been successfully implemented globally in sectors such as low-carbon energy, municipal solid waste management, urban transport, and water solutions. RBBF approaches can be structured flexibly to create effective incentives for cities and investors that will benefit local populations.





**THE FINANCING  
CONTEXT OF  
RESULTS-BASED  
BLENDED  
FINANCE (RBBF)**

3

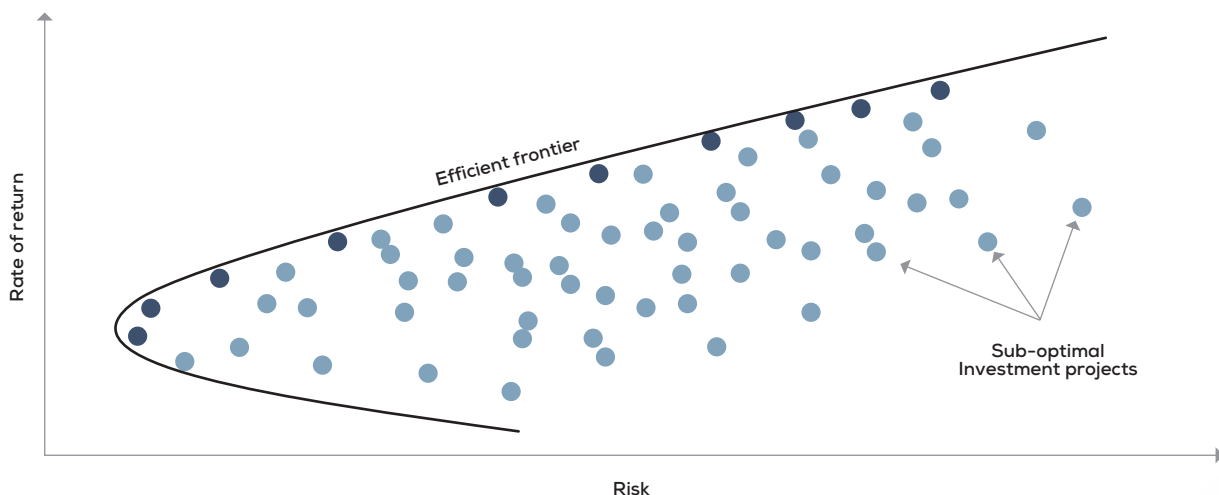
### 3. THE FINANCING CONTEXT OF RESULTS-BASED BLENDED FINANCE (RBBF)

**An inadequate risk-return profile is the main obstacle to attracting private sector capital for infrastructure projects.** The ideal project is one that provides the highest expected return for a given level of risk, or the lowest risk for a given level of return. This risk-return relationship is represented by the so-called *efficient frontier* (figure 3-1).

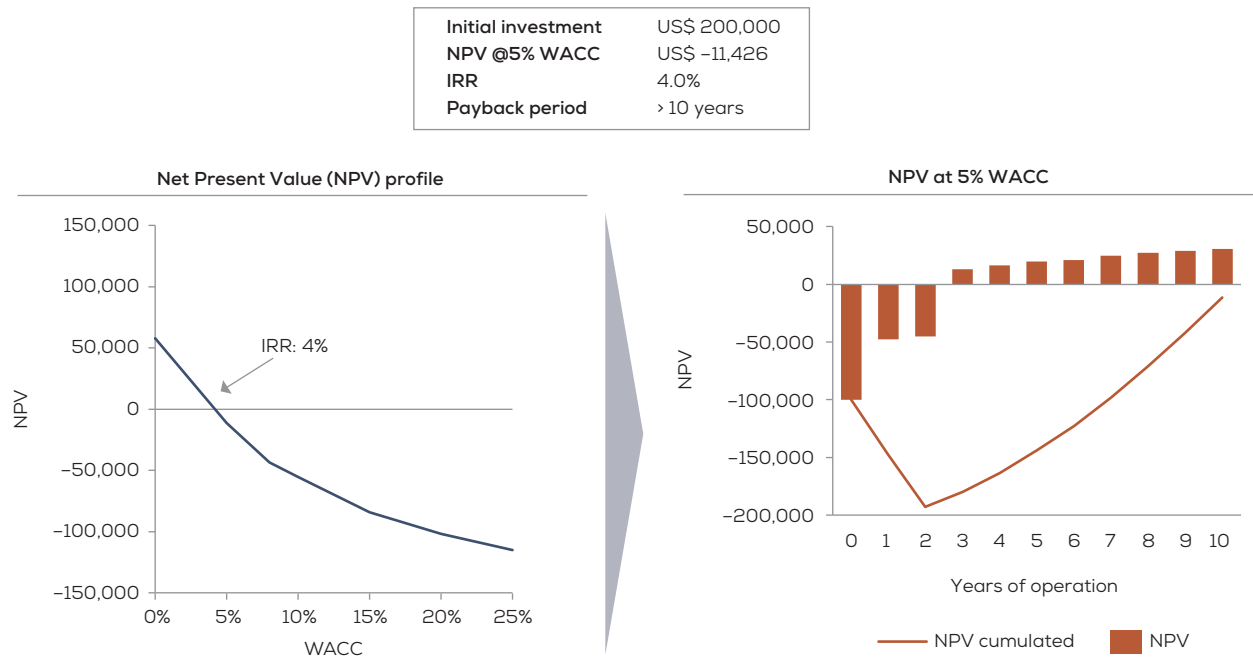
While investments beyond the frontier are impossible, projects below the frontier are suboptimal because they either do not provide sufficient returns for the level of risk they entail, or they are too risky for a given level of return. Therefore, projects on the efficient frontier are considered optimal and investors' risk appetite determines their exact position on the frontier.

As sustainable urban infrastructure projects tend to have a cost premium ranging from 9 to 27 percent (CCFLA 2015, 15) and carry more risk (financial, technology, etc.) than comparable, conventional projects, these higher upfront capital costs need to be offset by cash flows over the lifetime of the project to provide investors with a viable financial return. This relationship can be described as follows: the *weighted average cost of capital (WACC)* represents the investor's opportunity cost of taking the risk of investing money in a project. A project's *internal rate of return (IRR)* is the rate of return at which its net present value (NPV) equals zero, that is, the point at which the project's future cash flows equal project costs. If an investor's WACC is higher than the project's expected IRR, the project will not be realized.

FIGURE 3-1. The Efficient Frontier of Climate-Smart Projects



**FIGURE 3-2. Example of Unviable Project**



Note: IRR = internal rate of return; NPV = net present value; WACC = weighted average cost of capital.

Figure 3–2 illustrates how high cash flows in combination with insufficient project returns can render a project unviable. In the example, for an initial investment of \$200,000, the project yields an IRR of 4 percent over a 10-year period. As the investor’s WACC is 5 percent, the NPV is negative and amounts to \$11,426. Thus, the project’s future cash flows are not high enough to recover the initial investment, given the investor’s cost of capital; the investor would lose money if he invested in this project.

The problem is that markets fail to price in all benefits associated with a sustainable urban infrastructure project. For example, the extra cost of adapting the built environment to improve its resilience may not have a clear and immediate repayment source. As a result, low financial returns and viability gaps often characterize those projects.

### 3.1 Blended Finance

**Blended finance provides financial support to high-impact projects that would otherwise not attract funding on fully commercial terms (box 3–1).** To attract private sector capital, cities and municipalities must first reduce the level of risk (and therefore investors’ WACC) by implementing micro- and macro-economic, as well as institutional policy, reforms to create an effective and transparent regulatory framework. Such reforms should not only aim to align operating revenues with operating expenditures to lower the creditworthiness barrier but should also create a framework that allows for the implementation of innovative models for PPPs. Subsequently, *blended finance* can help re-balance the risk-reward profiles

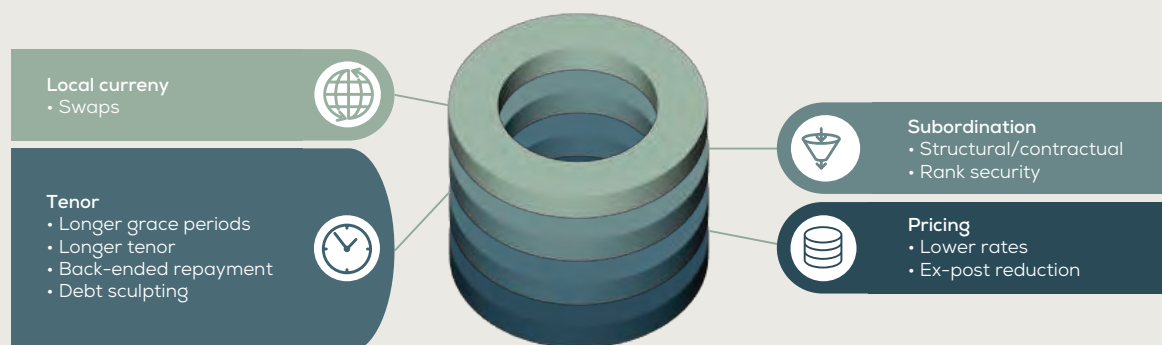


### BOX 3-1 Instruments Relevant to Blended Finance for Infrastructure

The main blended finance instruments that can be used for infrastructure investments are:<sup>a</sup>

- **Debt – Concessional loans:** Concessional loans include features such as low or no interest rates, extended payment schedules, and interest rate modifications during the life of the loan (figure 3-3). In most cases, such flexible loans are blended with some sort of multilateral support like technical assistance grants. These kinds of loans can have a strong potential for encouraging climate-smart investments, provided subsidies are either linked to a clear, transparent use of funds, demonstrated higher costs, or the achievement of milestones (e.g., an ex post interest rate reduction once targets are achieved).
- **Debt – Bonds:** Bonds are tradable, fixed-income securities through which an entity borrows money from investors for a defined period of time at fixed interest rates. Various forms of bonds exist that are relevant for financing infrastructure. Infrastructure bonds, for example, are often issued in emerging markets and usually applied in public-private partnership (PPP) contracts and linked to public guarantees. Another example are green bonds, which work like conventional bonds but focus on raising capital for projects that contribute to a low-carbon economy. Green bonds can be issued at the city, country, financial institution, corporate, or project level, and are one of the most relevant instruments to foster climate-smart infrastructure investments (section 4.1.5).
- **Guarantees:** In developing countries with underdeveloped financial markets and/or restricted access to capital markets, guarantees from governments and development finance institutions can support the debt finance provision (CCFLA 2015, 31). Guarantees are commitments in which a guarantor fulfills the obligations of a borrower to a lender in the event of a borrower’s nonperformance or default on its obligations, in exchange for a fee. Guarantees can mitigate the risk of attracting debt capital on terms that are unfeasible for the project. Guarantees can cover an entire project or only parts of it and can assume resource, regulatory, off-taker credit, or technology risks. For example, a performance guarantee can reduce the risk of construction cost overruns or technology underperformance; a credit guarantee can cover the risk of a contracted off-taker or purchaser going out of business. Lastly, a regulatory guarantee can insure against the loss of tax credits or tariffs provided by a host government or public utility company.

**FIGURE 3-3. Levers of Concessionalality**



Source: IFC presentation on blended climate finance, held in 2015.

(continued on next page)

### BOX 3-1 Instruments Relevant to Blended Finance for Infrastructure *(continued)*

- **Equity:** Equity is an important financing vehicle for private infrastructure, and equity investors can be characterized as „unlisted“ or „listed,“ depending on whether their shares are traded on public markets. Equity investors typically include utility and infrastructure companies, as well as equity and thematic funds. As large owners of significant infrastructure assets, equities can exert major influence over the promotion of sustainable infrastructure, depending on whether the investment strategy targets capital expenditures toward low-carbon infrastructure. Moreover, joint ventures (JV) and special-purpose vehicles (SPVs) are commonly used to structure the financing for very capital-intensive projects, including sustainable infrastructure projects like renewable energy and public transport infrastructure.
- **Public – Grants & subsidies:** Grants and subsidies are financial awards and benefits to eligible groups, companies, or individuals.

*Note:*<sup>a</sup> A more comprehensive list of financing instruments is given in the appendix.

of sustainable investments by using a range of financial tools, including concessional loans, equity, grants, technical assistance, and guarantees.

Through these tools, blended finance helps investors overcome the real or perceived risks of investments with a limited commercial track record but high development impact and strong demonstration effect (IFC 2016, 21). This in turn stimulates a series of follow-on investments, often on fully commercial terms. Therefore, blended finance is a highly effective catalyst to mitigate early-entrant costs and project risks by demonstrating viability of innovative projects. For example, the World Bank successfully applied blended finance in sectors such as clean energy, energy access, clean technologies, and adaptation,<sup>2</sup> which investors initially perceived as either too risky (or unviable) to be financed and/or mispriced.<sup>3</sup> Overall, blended finance creates markets in climate-smart industries and enables projects that otherwise may not happen. At the same time, however, the poor use of concessional finance in private sector investments can lead to market distortions, such as oversubsidization, windfall gains, and inappropriate risk allocations, which undermine market creation and transformation (IFC 2016, 22).

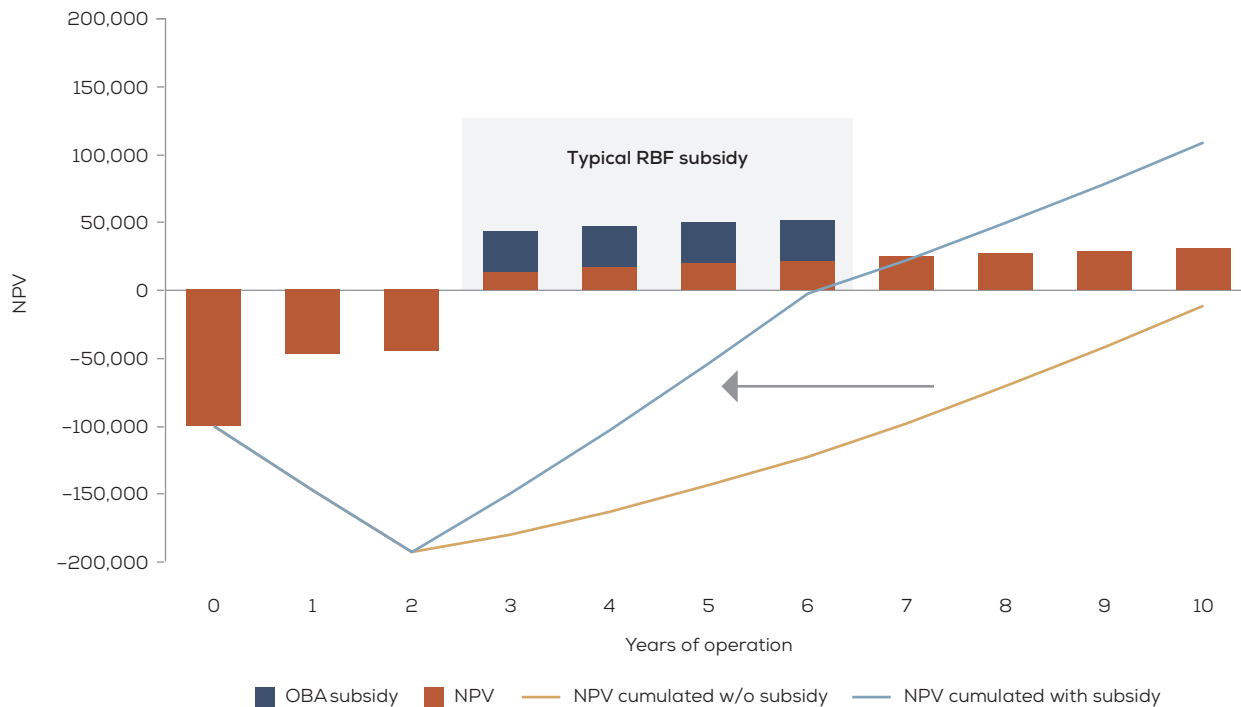
## 3.2 Results-Based Finance (RBF)

**The challenge for cities and municipalities is to make the most effective use of available public finance instruments and disburse scarce public (concessional) funds in a way that maximally leverages private sector co-investments.** The question is how cities can avoid blended finance pitfalls and disburse public (concessional) funds, such as grants and subsidies, in a way that fills a financing gap that markets would otherwise not fill on their own. RBF allows cities and municipalities to get a “bigger bang for the buck” by supporting follow-on sustainable investments, either by generating financing (e.g., tolls and user charges),

<sup>2</sup> For more information, see “Blended Climate Finance: Climate Proofing Hydro Power Projects,” a presentation given by the IFC in 2015.

<sup>3</sup> More details may be found at the website of Climate Finance Advisors. “Blending Finance for (Climate) Resilience.”

**FIGURE 3-4. Effects of Typical One-Off RBF Subsidy on Project Viability**



Source: Author's analysis; Adapted from GPRBA.

Note: OBA = output-based aid; NPV = net present value; RBF = Results-Based Finance.

or by leveraging additional infrastructure funding (e.g., debt and equity). Results-based subsidy payments from a subsidy provider (e.g., city, municipality, or development bank) to businesses or households close the so-called viability or affordability gap but are provided only after measurable, pre-agreed results have been achieved and verified.

By providing a subsidy, the project's Net Present Value (NPV) curve shifts to the left and thus raises its viability (figure 3-4). This has several positive implications. First, RBF subsidies can enhance access to local finance institutions by demonstrating the financial viability of climate-smart projects. Being able to show a formal contract from a credible funding body confirming these subsidy payments (with the potential for providing further credit cover in addition to the project), demonstrates an enhanced cash flow and therefore reduces the credit risk of local service providers (GPOBA\* 2012, 21). Second, RBF incentives shift the financial and performance risks from the city to a third-party service provider—municipal utility companies, private corporations, or NGOs. As the pre-agreed subsidy payments are triggered by the service provider's achievement of *concrete outputs* and not actual costs, RBF directly addresses three of the main infrastructure risks:

- **Construction risks:** Contractors are incentivized to deliver the pre-defined outputs on time and within budget. Because outputs are clearly defined, and subsidy payments are linked to the achievement of these

results, cost overruns can be avoided because the subsidy amount is fixed and therefore does not cover additional costs

- **Operation risks:** Subsidy payments can be sequenced to reflect the various project milestones and provide incentives throughout the operations phase of the project
- **Counterparty risks:** Structuring the project around the output verification by an independent agent assures that all parties involved in a transaction are focused on delivering verifiable results. Should a counterparty not live up to its contractual obligations or go out of business, subsidy grants would not be paid.

Unlike in conventional, upfront, nonperformance related finance, an independent agent verifies the achievement of the targeted results. Consequently, RBF creates transparency and increases accountability in the infrastructure provision.

In general, RBF schemes involve the following steps:

1. A **service provider** (public, private, or PPP) self-finances and delivers predefined outputs and reports on the outputs delivered to an independent verification agent (IVA).
2. The **IVA** is responsible for verifying the predefined results and ensuring the sustainability of the outcomes. The IVA reports back to the funding bodies on the actual quantity of the outputs delivered.
3. Based on the verification reports, the **fund providers** release funds to the implementing agency.
4. The **implementing agency** in turn releases the funds or gives low-cost loans as subsidy payments to the service provider.
5. The **IVA** gathers information on output delivery throughout the course of the project and delivers an ex-post evaluation review to the funding bodies at its close.

RBF subsidies can be structured in multiple ways to mobilize private capital. First, subsidies can be used to cover one-off, upfront connection-type costs (e.g., the costs of connecting to the electricity grid), with ongoing costs paid by the consumer. Second, the subsidy can be a cross-subsidy directed at a utility company to enable the otherwise unviable purchase of, for instance, energy from renewable energy sources. Third, RBF can also be structured to benefit low-income households, through *output-based aid (OBA) approaches* (figure 3–5), which typically address the following issues:

- A misallocation of resources to improve or expand infrastructure for low-income households;
- The cost of accessing services is too high for low-income households;
- Existing investments do not produce results for low-income households.

To address these issues, RBF/OBA subsidies can either be applied to incentivize utility companies to connect low-income households to the grid, or they can be used as a transitional subsidy to cover the difference between actual market prices (e.g., of electricity) and the amount low-income consumers can afford. For example, the payments could be per amount of electricity supplied or per household connected to the grid.

**FIGURE 3-5. Indicative OBA Scheme**

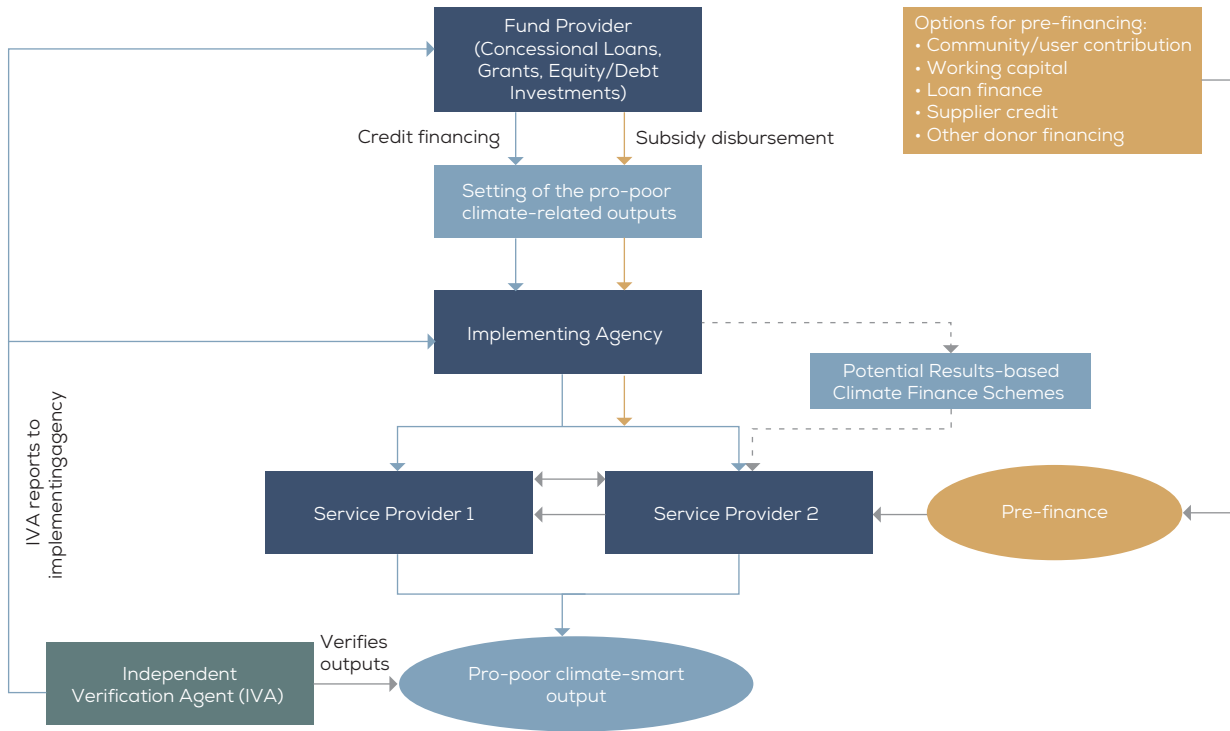
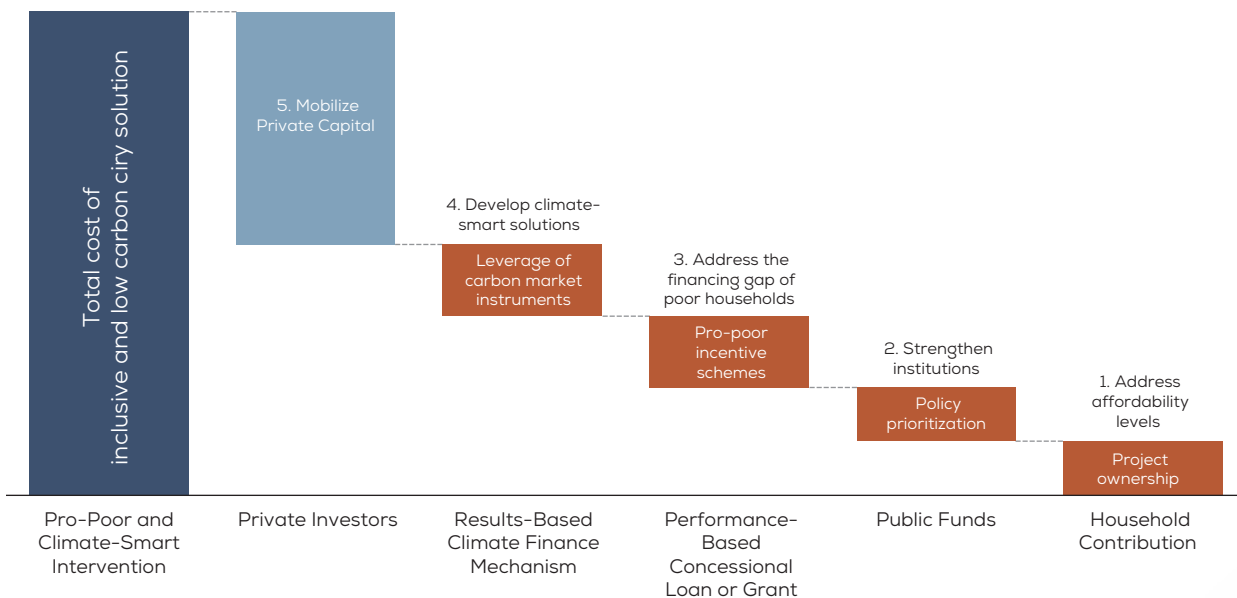


Figure 3-6 illustrates how RBF can be used in pro-poor and climate-smart urban investments.

**FIGURE 3-6. RBF Project Design Roadmap for Pro-Poor and Climate-Smart Urban Investments**



Source: Author's analysis, GPRBA.

## BOX 3-2 Case Study: Off Grid Electric (OGE) in Tanzania

**Situation:** Of the 51 million Tanzanians, 80–90 percent lack access to electricity but extending the grid would be prohibitively expensive, amounting to \$2,800 per household. As a result, most families in rural off-grid areas use harmful dim kerosene lamps at night. However, small-scale solar systems can be deployed for less than 5 percent of the grid connection costs on a commercial basis.<sup>a</sup>

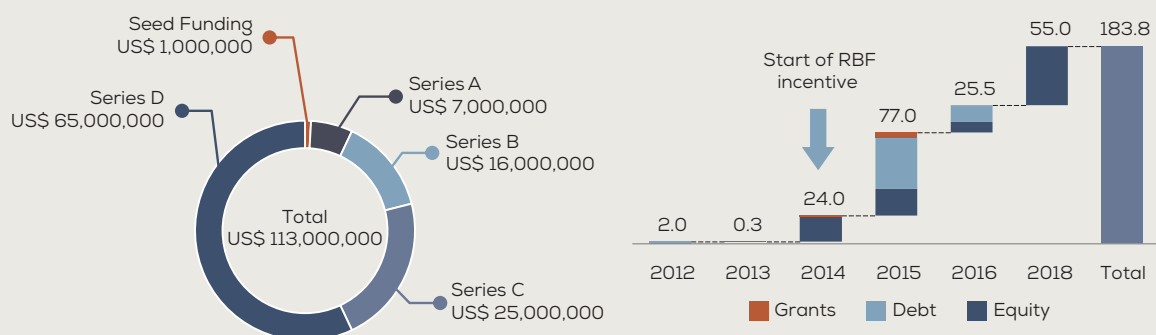
### Business model and unit economics

- *Service:* OGE does not sell solar products but offers “solar as a service” and leases the equipment to customers, who can choose among different solar system sizes
- *Pay-as-you go:* Customers pay a one-time installation fee of \$6 to \$10 and daily fees of \$0.18 to \$0.63, depending on the service level chosen.<sup>b</sup> Payments can be made through mobile phone or at a local kiosk, and customers can pay one day at a time or in advance, thus providing flexibility for customers with, for instance, a seasonal income. At the same time, OGE covers all transfer charges to the mobile money provider so there is no financial penalty for those customers who make small top-up payments
- *Service:* Rooftop panels are delivered by a local sales force; customers have access to 24/7 toll-free service line; OGE provides in-home repair, replacement, or upgrade at no cost
- *RBF incentive:* OGE received a one-time RBF incentive of ~\$60 (€50) per solar system installed<sup>c</sup> from the Netherlands Development Organization (SNV).

FIGURE 3-7. Unit Economics (2013)

YEARLY REVENUE	\$72.00
Insurance	-2.10
Payment Gateway & SMS	-3.40
Ongoing Agent Commissions	-5.25
Repair/Replacement	-6.50
Interest	-4.00
Net Cash Flow Contribution	\$50.75
Capital Cost	\$130
Cash on Cash Yearly return	39%

FIGURE 3-8. Rounds of Equity Raised and Financial Structure (US\$, millions)



Source: Author's research.

(continued on next page)

### BOX 3-2 Case Study: Off Grid Electric (OGE) in Tanzania *(continued)*

#### Impact<sup>d</sup>

- 140 kg of CO<sub>2</sub> and 1.45 kg of black carbon avoided per household per year
- 149 percent time increase for potentially productive activities
- 40 new jobs created per month
- Goal: Provide lighting to 10 million households throughout Africa within 10 years and expand operations into Ghana, Ivory Coast, Tanzania, and Rwanda.

Note: <sup>a</sup> See the Huffington Post/Skoll Foundation website. "How to light the Off-Grid World in a Decade." ([https://www.huffingtonpost.com/skoll-foundation/how-to-light-the-off-grid\\_b\\_7564126.html](https://www.huffingtonpost.com/skoll-foundation/how-to-light-the-off-grid_b_7564126.html)).

<sup>b</sup> The Fletcher School (Tufts University). *Off Grid: ELECTRIC; Lighting the World One Village at a Time*, page 4.

<sup>c</sup> Huffington Post/Skoll Foundation. "How to Light the Off-Grid World in a Decade."

<sup>d</sup> See the Off Grid Electric website: <http://offgrid-electric.com>.

### BOX 3-3 Case Study: Solid Waste Management (SWM) for Cleaner Cities in Nepal

**Situation:** Post-consumer waste is estimated to account for 5 percent of global GHG emissions. In addition, methane from landfills represent 12–15 percent of total global methane emissions, which has a global warming potential 21 times greater than CO<sub>2</sub>. In Nepal, municipalities generate about 700,000 tons of waste per year, but less than 50 percent of the waste gets collected and almost all of the collected waste is dumped in a haphazard manner. As municipal spending on SWM only provides services to less than 50 percent of citizens, cost recovery is also low due to inefficiencies in the service provision and citizen's resulting "unwillingness-to-pay."

#### Subsidy model and revenue economics

- Provide \$4.28 million in grant-based subsidies to five Nepalese municipalities—no repayment required, but municipalities assume the performance risk
- The grant payments are contingent upon verified improvements in the service provision *and* collection of service fees, and are complemented with technical assistance
- Subsidies to municipalities are paid based on agreed multiples of verified collection of fees from customers; as the municipalities' revenue increases, the OBA subsidies will gradually (over 4 years) be lowered and finally phased out entirely
- By the end of the project, the municipalities will be able to sustain the SWM service with the tariff and same level of government subsidy.

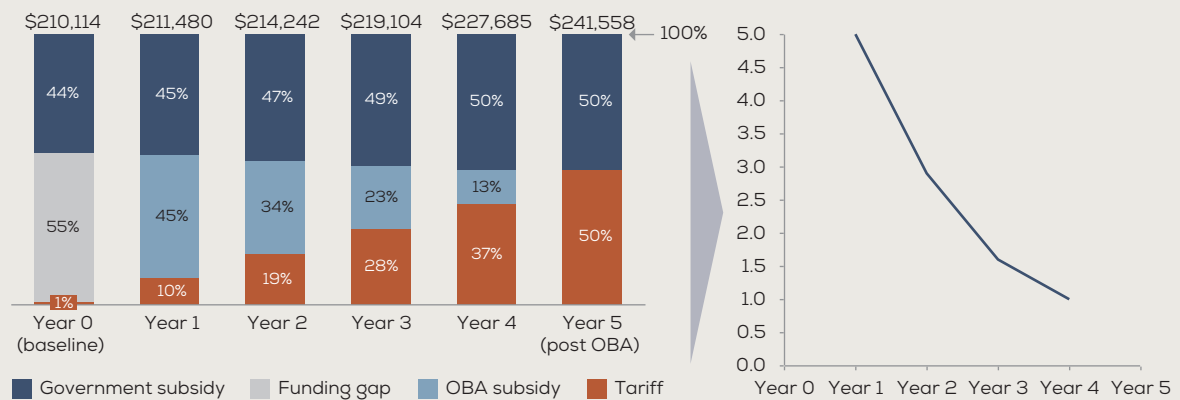
#### Impact

- All the participating municipalities have established dedicated units for complaint handling along with a responsible municipal officer, who is responsible for tracking beneficiaries' comments, the recording arrangement for complaints registration, remedial action taken, and reporting to the Chief Executive Officer (CEFO) of the municipality.
- Dhankuta was named the cleanest city in Nepal.

*(continued on next page)*

**BOX 3-3 Case Study: Solid Waste Management (SWM) for Cleaner Cities in Nepal** *(continued)*

**FIGURE 3-9. OBA Subsidy Contribution to Total Revenues (US\$)**



Note: OBA = output-based aid. Subsidy represents a multiple of collected revenues (local currency) in the Dhankuta municipality.

Source: Webinar on "Pay for Success in Solid Waste Management – Results-based Financing for Cleaner Cities in Nepal," which includes a presentation held on March 22, 2018; <https://olc.worldbank.org/content/pay-success-solid-waste-management-results-based-financing-cleaner-cities-nepal-0>.

Overall, RBF approaches can be applied to different climate-related sectors—including energy solutions (energy access, renewable energy, energy efficiency); municipal solid waste management; urban transport; and urban water solutions (GPOBA\* 2017, 4)—and have been successfully tested in climate-related programs (e.g., REDD+) to mitigate GHG emissions. While service providers or project financiers are required by RBF arrangements to have the capacity to prefinance the project components agreed on, they are willing to take the risk because the subsidy payment will include a premium payment or other benefits such as refinancing at attractive rates once the service has been verified (GPOBA\* 2012, 14).







**FRAMEWORK FOR  
APPLYING RBBF  
APPROACHES IN CITIES**

4

## 4. FRAMEWORK FOR APPLYING RBBF APPROACHES IN CITIES

With the increasing urbanization, cities and metropolitan areas need to rapidly scale up their climate change mitigation efforts and build the foundation for more robust and resilient communities. Given the diversity of cities and their respective risk profiles, the RBBF framework can either be implemented through a centralized approach led by the national government and implemented by the city or through a decentralized approach led and implemented by the city. Regardless of the implementation approach chosen, it is important to ensure that the risks resulting from the implementation of RBBF instruments are adequately allocated to improve accountability and avoid complex coordination issues (Ecofys, n.d., 73).

RBBF approaches are inherently flexible and offer major advantages for climate-smart city planning and financing that address the institutional, infrastructure, and service needs of cities, holistically and across sectors.

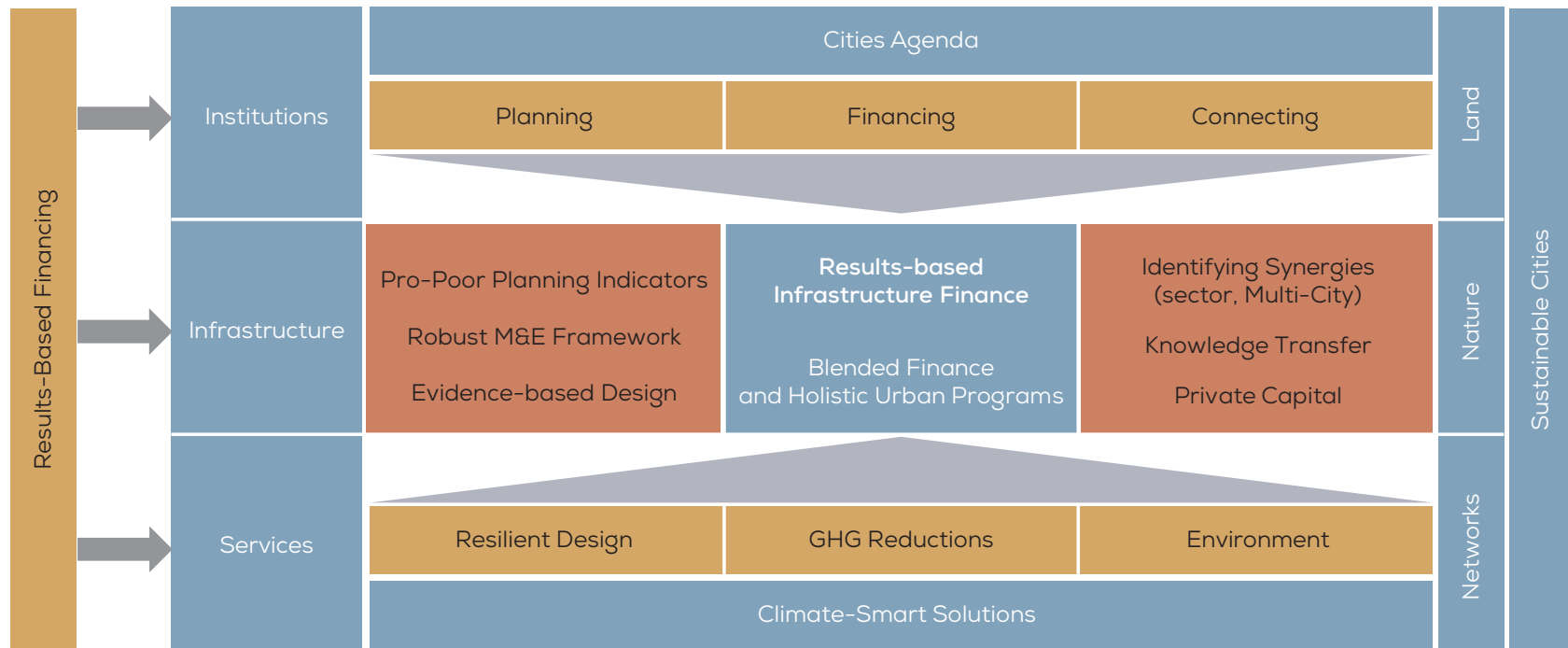
**Institutions and investors benefit from the transparency and accountability that results-based approaches require.** The performance-based structures involving city agencies and service providers, in which the provision of public funds or assets depends on progress made on pre-agreed targets, promote transparency and accountability.

**Infrastructure development through RBBF has the potential to mobilize private capital, while ensuring pro-poor and climate-smart design standards.** Performance-based capital grants or concessional loans that target the gap in financing climate-smart infrastructure can instill the necessary confidence in private investors, operators, and banks to support projects with high-perceived risks. Moreover, a focus on results allows city authorities and investors to benchmark operations across cities, leverage synergies for institutional coordination, service provision, and infrastructure delivery, as well as raise capital for multisectoral or multi-city projects.

**Municipal services through RBBF could provide incentives to public or private service providers for targeting low-income households in a climate-smart way.** As with infrastructure development, results-based capital grants or concessional loans could provide incentives to public or private service providers, utilities, or city authorities to extend services to poor households or communities by subsidizing the cost of the service provided, thus encouraging operators to enter markets they would otherwise not find profitable. Furthermore, if implemented holistically, incentives could be provided to address major barriers for low-income city households, related to land tenure and access to municipal networks.

**Overall, RBBF can strengthen planning and financing of urban development.** Results-based approaches can enhance pro-poor city planning initiatives by incorporating well-defined monitoring and evaluation indicators that address poverty-related issues in city plans which can significantly contribute to improvements in the built environment, mitigate carbon emissions, and improve climate resilience.

FIGURE 4-1. Framework for Analyzing the Applicability of RBBF In Cities









**DEEP DIVE ON  
INNOVATIVE  
FINANCE  
SOLUTIONS**

**5**

## 5. DEEP DIVE ON INNOVATIVE FINANCE SOLUTIONS

**The integrated RBBF approach can be structured flexibly throughout the investment lifecycle, from capital raising to deployment.** The combination of blended finance with RBF into *RBBF* allows cities and municipalities to profit from the advantages of both concepts and overcome investment barriers, close financing gaps, and make the most effective use of existing funds. The next section will introduce selected innovative financing solutions that can support cities' efforts to overcome financing barriers at different points in the investment cycle, from capital raising to deployment. Throughout the discussion, it is important to recognize that the key characteristics (e.g., repayable/nonrepayable) of the *financing instruments* to be blended (such as subsidies/grants, debt, equity) do not change, although features such as tenor, subordination, and pricing can be structured according to the needs of a given project. However, what will change are the *mechanics*, that is, the way these instruments are applied in the context of RBF to provide incentives and account for specific factors—different types of investors, target beneficiaries, different project types and sizes, timing of cash flow, etc.

Section 5.1 focuses on making capital available for climate-smart investments by exchanging municipal debt for low-carbon and resilient investments (*municipal debt swaps*) and increasing the investor base (*crowd-based financing*). Once this financial leeway has been created, the next step is determining the lowest possible financial stimulus needed to incentivize the upgrading of the built environment and “crowd-in” private sector capital on a concrete project portfolio basis (*auction facilities*). The mechanisms for doing so are discussed in section 5.2. Sections 5.3 and 5.4 explores opportunities to deploy these financial incentives upon achievement of concrete results, aimed at minimizing performance risk (*performance-based contracting through so-called EIBs*), directing financing flows to certain investment fields (*resilience and green city bonds*), and maximizing their impact. The bond schemes are described separate, in section 5.5, because their implementation carries significant financial and institutional complexity.

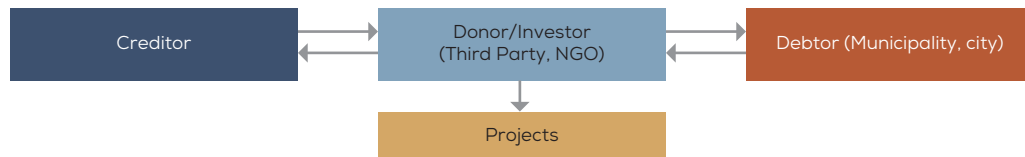
### 5.1 Raising Capital

#### 5.1.1 Municipal Debt Swaps

**Municipal debt swaps are a financial arrangement between a creditor and an indebted city or municipality to cancel debt in exchange for climate-smart investments.** In the 1980s, debt swaps were extensively used, particularly at the national level in emerging market countries. Such debt swaps could prove to also be a viable and attractive instrument for indebted cities and municipalities seeking to reduce their debt volumes, while local communities would benefit from the additional investments.

The general idea is that creditors and debtors negotiate and agree on a set of projects to be implemented by a third party, such as an NGO. The creditor then cancels debt in exchange for the debtor investing part

**FIGURE 5-1. Typical Debt Swap Structure**



Source: Author's research, adapted from Eurodad 2007.

Note: NGO = nongovernmental organization.

of the cancelled amount into the pre-agreed projects. The following example explains the mechanism: A creditor, donor, and debtor agree to swap \$100 million in exchange for \$60 million of investments in climate-smart infrastructure projects. The creditor sells \$100 million of debt to a donor or investor at a discount, for example, 40 percent. The donor/investor then presents the cancelled debt note to the debtor (city or municipality), who transfers \$60 million into a separate account, managed and administered by the donor/investor for reinvestment into the pre-agreed green infrastructure projects in the corresponding debtor city or municipality (figure 5-1) (Eurodad 2007, 9).

Municipal debt swaps could be attractive for *creditors* mainly for two reasons:

- **Recovering distressed debt:** In the case of nonconcessional loans, it might be attractive for creditors to swap the debt if the recovery is otherwise unlikely, therefore avoiding/minimizing the cumulation of nonperforming loans. By swapping the debt, the investor can at least recover part of the outstanding debt;
- **Improving official development assistance (ODA):** Depending on the type of creditor (e.g., development bank), the cancellation of debt counts as ODA without having to disburse additional funds to the debtor.

Other reasons why creditors would want to engage in debt swaps are the increased visibility as well as the guaranteed and adequate use of funds for concrete projects.

The main reasons why municipal debt swaps are attractive for *debtors* are the fact that they:

- **Allow for debt reduction:** The indebted city or municipality reduces its stock of debt and therefore improves its creditworthiness. Of course, the higher the discount rate, the more attractive the swap. In addition, debt swaps also benefit municipalities in countries that are not part of current *Heavily Indebted Poor Countries (HIPC)*<sup>4</sup> initiatives;
- **Increase climate-smart infrastructure investments:** Instead of paying the creditor, the funds are reinvested in the debtor city, offering an immediate debt relief in combination with tangible benefits for local communities.

<sup>4</sup> The HIPC are a group of 37 developing countries with high levels of poverty and debt overhang that are eligible for special assistance from the International Monetary Fund and the World Bank.



Besides these advantages, municipal debt swaps could also mobilize additional resources for climate-smart investments and enhance the predictability of funding, as well as attract further funding for well-defined and managed projects under the agreement. These projects may be run either by third parties, such as NGOs and foundations, or by the cities and municipalities themselves.

However, debt swaps have proven not to be a silver bullet and can entail the following (major) challenges (Perspectives GmbH 2015, 7):

- **Inverse relationship between debt for municipal swap and governance quality:** One of the main challenges is the link between high levels of indebtedness and low quality of governance. The inherent implication of debt swaps is that the higher the discount rate on the full recovery amount of the debt is, the higher the corresponding debt cancellation will be. This means that cities/municipalities with the highest debt levels benefit the most from such swaps. Moreover, there is a risk of moral hazard in the sense that debt may be bought out cheaply in the future again. Therefore, the kind of investment barriers outlined in figure 2–3 should be addressed first before considering the financing of sustainable infrastructure with municipal debt swaps;
- **High transaction costs:** Debt swaps can entail high transaction costs because of long deal negotiations and structuring periods as well as potentially changing donor requirements;
- **Budget constraints:** Highly indebted cities/municipalities may not have sufficient budgetary leeway to deposit the (discounted) funding requirements under the swap agreement for sustainable infrastructure projects.

RBF can be applied as an incentive for debtors in two ways:

- **To finance more projects.** Donors/investors could match the deposited amount by the debtor at a certain rate (e.g., 20%) to finance more projects. For example, if the debtor is required to deposit \$60 million into the investment account, donors could provide another \$12 million of additional funding and therefore finance projects worth \$72 million;
- **To provide debtor relief.** If debtors are unable to deposit the agreed (discounted) debt amount, donors/investors can match debtor payments at a certain rate (e.g., 20 percent) to reduce the overall share the debtor needs to deposit. For example, if the debtor is required to deposit \$60 million into the investment account, donors could provide \$12 million in funding, leaving debtors with a remaining contribution to be made of \$48 million.

## 5.1.2 Crowd-based Financing

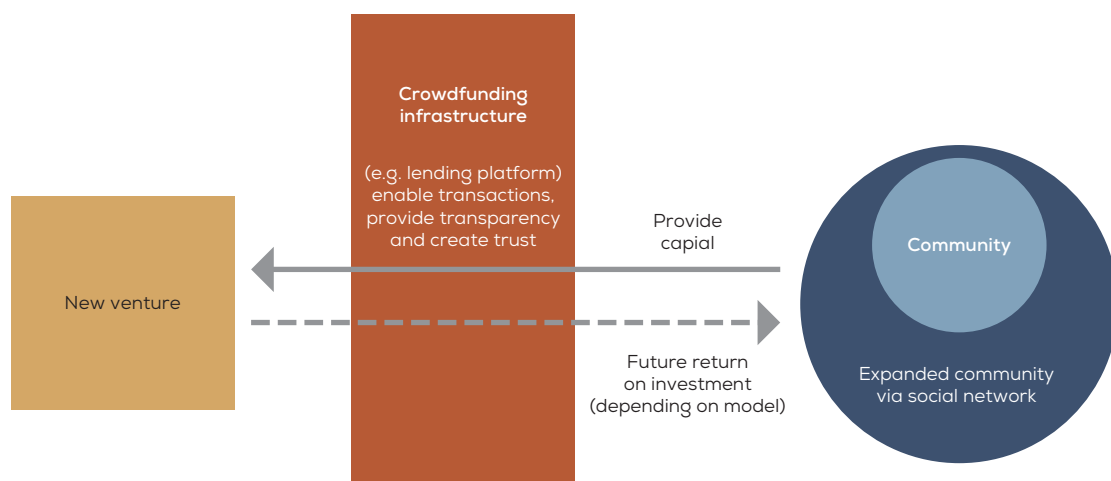
**Crowdfunding allows financing from communities and individuals (crowd) and is an alternative finance source for climate-smart urban infrastructure.** Crowdfunding is a relatively new approach that has been predominantly used in the technology sector. Although the application of crowdfunding in the infrastructure sector has been limited so far, the overall market is expanding rapidly and provides interesting opportunities that hold the potential to serve an important infrastructure finance niche.

Traditionally, *microfinance* provided low interest rate loans to low-income beneficiaries and is now also being used as a financing strategy for small initiatives. *Crowdsourcing*, on the other hand, leverages a community-driven network through an open call for proposals. These two approaches taken together, in the form of *crowdfunding* (figure 5–2), allow a large base of individual investors to empower small ventures (Stanford University 2015, 5). Crowdfunding includes a range of financing and funding techniques, among others (Correia de Freitas and Amado 2013, 6):

- **Donations:** Donations are earmarked for specific projects;
- **Rewards:** Rewards of symbolic value (lower value than the donation but greater perception value);
- **Pre-sales:** Donation guarantees that product will be made (and sold at a discount);
- **Lending:** Company borrows money from the public instead of a bank;
- **Social lending:** Lending to social projects without charging interest;
- **Peer-to-peer lending:** Used by borrowers looking for a lower interest rate; does not create new money;
- **Peer-to-business lending:** Equivalent to peer-to-peer but on a small and medium business scale;
- **Equity crowdfunding:** Similar to business angels, investors are looking for some return on their investment.

**Crowdfunding mitigates several investment barriers that are inherent in traditional project finance in many cases by applying microfinance practices.** First, it allows access to a type of investment that has traditionally been unavailable to individual investors. This allows communities to drive their own infrastructure agenda, which reduces demand risks. Because individual investors “vote with their dollar,” they confirm demand projections. At the same time, providing funding to a project creates a sense of ownership for crowdfunded

**FIGURE 5-2. Crowdfunding Scheme**



Source: Adapted from *infoDev/World Bank* 2013.

infrastructure assets. Second, crowdfunding supports the realization of projects that may otherwise be delayed or not get funded due to contrary political priorities or constrained public budgets. In this case, crowdfunding increases political will because politicians may find it easier to support an infrastructure project (especially in the early stages of project development) that is supported by a large community. Concurrently, it helps budget-constrained public actors to raise new capital and therefore allows otherwise underfinanced projects to proceed.<sup>5</sup> Lastly, crowdfunding can be applied as a form of strategic financing. For example, when municipal grants require that matching funds be secured on a nongrant basis, *last mile funding* can help mature initiatives satisfy such grant requirements. Moreover, crowdfunding can be used as *seed funding* for infrastructure development by providing initial funding for an infrastructure project to create momentum for the remaining funds to be secured via larger private investors. This approach allows gauging the success of a project prior to its full implementation, which reduces entry risks for risk-adverse investors (Stanford University 2015, 7).

**The integration of crowdsourcing and traditional project finance for climate-smart infrastructure projects is possible, but important factors need to be considered.** Crowdfunding and traditional project finance provide certain benefits but for different reasons. As a result, a comprehensive expert project analysis is required that includes factors such as available technical expertise, transaction fees, revenue streams, etc. Ultimately, project characteristics and the community profile determine the most appropriate integration strategy of crowdsourcing into project finance structures (Stanford University 2015, 8).

For example, the currently prevailing crowdsourcing model of patronage donation, where individual donations are not expected to yield financial returns, is somewhat unsustainable because it requires a large community base with disposable income. As such, patronage donation models are best suited for small-scale projects with no revenue streams that require additional funding. In larger-scale projects, these models can complement user fees and availability payments at best. However, in large-scale projects, peer-to-business lending could be a more suitable option to supplement existing financing channels to balance investor return expectations with the smaller scale of crowdfunded contributions.<sup>6</sup> Here, the community crowd becomes a conglomerate of investors and benefits from being either an equity or debt partner.

Box 5–1 illustrates the successful use of seed financing to cover the cost of over 300 projects approved earlier by the residents of the city of Denver.

## 5.2 Determining Financial Incentives

### 5.2.1 Auction Facilities<sup>7</sup>

**Originally developed to boost investments in methane-reducing projects, auction facilities are an efficient way to help identify the lowest possible amount of RBF subsidies required to enable investments**

<sup>5</sup> For more information, see Arup Global Research, “Crowdfunding As an Alternative Finance Source for Urban Infrastructure” (<https://research.arup.com/projects/crowdfunding-platforms-as-alternative-source-of-finance-for-urban-infrastructure/>).

<sup>6</sup> For more information, see Arup Global Research, “Crowdfunding As an Alternative Finance Source for Urban Infrastructure” (<https://research.arup.com/projects/crowdfunding-platforms-as-alternative-source-of-finance-for-urban-infrastructure/>).

<sup>7</sup> This section draws on World Bank and Carbon Trust. 2018. *Study on Using the Climate Auction Model to Catalyse Energy, and Resource Efficient Buildings*. London, United Kingdom: The Carbon Trust.

## BOX 5-1 Denver's Mini-Bond Initiative

**Location:** Denver, Colorado

**Date:** October 28, 2014–December 12, 2014

**Type:** General Infrastructure Fund

**Capital raised:** \$50 million (of which \$12 million crowd-based and \$38 million through traditional markets)

**Type of funding:** Seed financing

**Number of crowd investors:** Approximately 1,000

**The situation:** Prior to the mini-bond offering, Denver's infrastructure maintenance spending fell short by \$25 million annually. As a result, Denver decided to tap into the municipal bond market and offer a new type of bond to attract investors and close the financing gap.

**Mini-bond structure:** Traditional municipal bonds have been sold for \$20,000 but Denver decided to sell mini-bonds for \$500 each. A 9-year bond with a 50 percent maturity would yield \$750 (a 4.8% return), and a 14-year bond with a 100 percent maturity rate would yield \$1,000 (likewise a 4.8% return). The mini-bond returns are three times higher than the bank rate of 1.5 percent on traditional bonds, but the city sought to involve more residents into the infrastructure development process.

### Impact

The mini-bonds financed the "Better Denver initiative," a program consisting of over 300 projects that had been previously approved by voters. The program was especially successful because it got much local publicity and allowed the introduction of new financial policies that changed the thinking about municipal bonds.

*Source:* Stanford University. 2015. "Funding Municipal Infrastructure: Integrating Project Finance and Crowdfunding." Working Paper Global Projects Center, page 11.

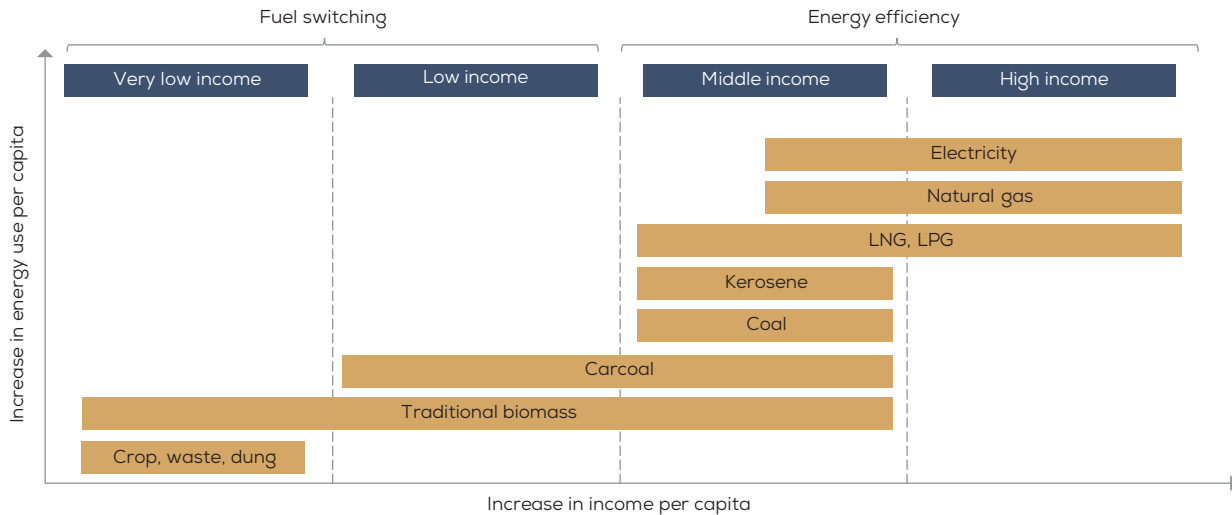
### in energy- and resource-efficient residential buildings, primarily new construction developments.

The purpose of auction facilities is to determine the lowest possible RBF subsidy required to promote investments in green buildings. Through such a mechanism, the subsidy provider (e.g., city or municipality) ensures that a desired green building design standard is implemented at the lowest possible financial incentive in the form of put options,<sup>8</sup> thus reducing the cost to the public.

Generally, investing in green residential buildings is a top priority; by lowering the energy bills for vulnerable households, it cuts CO<sub>2</sub> emissions and reduces poverty. Because 60 percent of the population growth until 2030 will be driven by cities with more than 300,000 inhabitants, this trend will significantly raise demand for new residential buildings. At the same time, 80 percent of this demand growth will be driven by middle-income countries (World Bank and Carbon Trust 2018, 11), and because income per capita is directly correlated with energy use, this trajectory has important implications for the potential of increasing energy efficiency (figure 5-3).

<sup>8</sup> A *put option* is a stock market instrument that gives the owner the right, but not the obligation, to sell an asset, at a specified price, by a predetermined date to a given party.

**FIGURE 5-3. Energy Ladder**



Source: WHO Fuel for Life, 2006.

Note: LNG = Liquefied natural gas; LPG = Liquefied Petroleum Gas.

The auction in this context works like a reverse auction (*Dutch auction*), where bidders bid down instead of up, to determine the exercise price of the put options. More specifically, the auction involves the following steps: first, the auction host (e.g., the World Bank) announces the bidding criteria—like a percentage reduction in energy consumption per unit area versus a local benchmark (World Bank and Carbon Trust 2018, 3) and targeting poor populations—the overall auction budget, and the exercise price (dollar amount of financial incentive) for acquiring the options. Second, project developers and investors assess whether their project meets the criteria and develop a bidding strategy, including the maximum number of options they might want to buy as well as the lowest exercise price they would be willing to accept. On the day of the auction, bidders log into an online platform and the auction begins at the predetermined exercise price. Bidders then have a window of time to enter the volume of options they wish to acquire at the given exercise price. After that, all bidders learn the total demand for options at the specific exercise price. If the demand for options at the given exercise price exceeds the overall auction budget, the auction goes on and a new bidding round starts at a lower exercise price. As the exercise price decreases, some bidders will drop out, and the demand for options to be purchased decreases up to a point where the demand for options is at or below the overall auction budget.<sup>9</sup> Table 5–1 gives a numerical example to clarify this process.

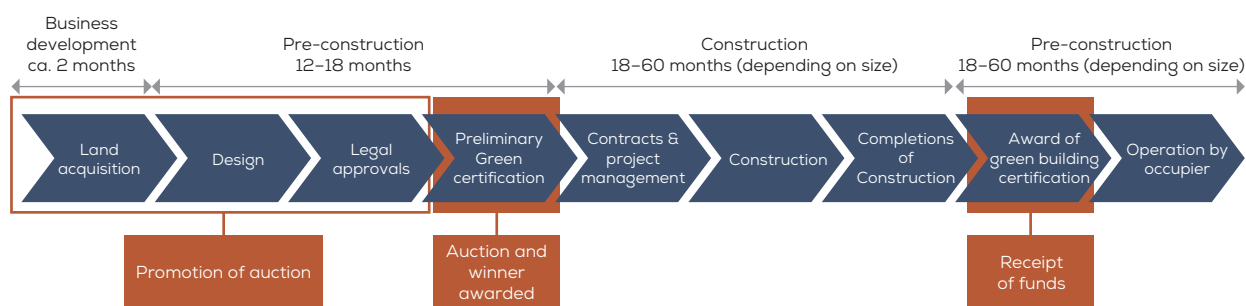
In the years following the award of the option, the winners of the incentive payment can sell on the contract to another bidder who meets the eligibility criteria of the scheme. The actual payment would be made upon verification by a third-party auditor at construction completion.

<sup>9</sup> For more details on these auctions, see the website <https://www.pilotauctionfacility.org/content/auctions-0>. The Pilot Auction Facility (PAF) is an innovative pay-for-performance instrument that uses auctions to maximize the use of limited public resources for climate change mitigation while leveraging private sector financing.

**TABLE 5-1. Mechanics of the Auction**

	EXERCISE PRICE (US\$)	NUMBER OF OPTIONS DEMANDED	TOTAL DEMAND (US\$)	AUCTION BUDGET	
<b>Round 1</b>	15.00	25,000,000	375 million	100 million	Excess demand > round 2
<b>Round 2</b>	12.00	20,000,000	240 million	100 million	Excess demand > round 3
<b>Round 3</b>	9.00	10,000,000	90 million	100 million	Auction ends; bidders receive number of options requested

**FIGURE 5-4. Construction Timeline and Auction Mechanism Milestones**



Source: World Bank and Carbon Trust 2018.

**BOX 5-2 Case Study – Housing Market in India**

**Country analysis**

Large cities with over 300,000 inhabitants in middle-income countries have been identified as the most relevant target for an auction-based pay-for-performance mechanism, given that these cities will experience the lion’s share of future population growth and, therefore, housing demand. The case of India is of high practical relevance because it is estimated that over 50 percent of urban infrastructure needed until 2030—that is, housing, energy, transport, water, and waste disposal—is yet to be built.<sup>a</sup> Moreover, the Indian government has committed to reducing the emissions intensity of its GDP by up to 25 percent compared to 2005 levels by 2030,<sup>b</sup> and buildings are mentioned in its nationally determined contributions (NDC) as one of the key levers to achieve this goal.

**Green buildings standard**

In a first step of this analysis, it was determined that the IFC’s Excellence in Design for Greater Efficiency (EDGE) is the most appropriate output-based certification standard for green buildings. EDGE is a software platform that specifically targets emerging markets and allows developers to estimate water savings, energy savings, and embodied energy in material savings of a green building against a local baseline. A minimum EDGE certification requires that a building achieve a 20-percent reduction in all three categories against a local benchmark.

*(continued on next page)*

## BOX 5-2 Case Study – Housing Market in India (continued)

### Cost-benefit analysis

Taking the EDGE standard as a basis, the analysis showed a cost premium for green buildings in the range of 3 to 25 percent for construction costs, varying from \$17 to \$70 per square meter, depending on the income levels of the building areas (high income, upper middle income, lower middle income, low income). However, India has no national policy that incentivizes the development of new green buildings. As a result, the study assessed the potential impact of a \$50 million auction budget to close the unfunded cost premium and found that such an incentive could lead to:

- Construction of 1.7 to 2.9 million m<sup>2</sup> of green building space,
- Avoided carbon emissions ranging from 1.4 to 2.3 MtCO<sub>2</sub>,
- Energy savings ranging from 1,400 to 2,100 GWh,
- Water savings ranging from 56 to 146 billion litres, and
- Lowering of the energy bills for 100,000 to 410,000 people.<sup>c</sup>

### Impact

The overall impact of the auction on energy savings for the economy has been highly dependent on the discount rate used. At a 10-percent discount rate, a \$50 million auction can create energy savings of up to \$60 million for the economy, but at a 0-percent discount rate, energy savings could amount to as much as \$250 million.<sup>d</sup> Moreover, the analysis confirmed that carbon, energy, and water savings on a per capita basis increase with income level, resulting in a higher potential for decarbonization at higher income levels. However, the highest number of people supported is part of the low-income segment; green buildings can reduce a low-income household's energy bill by up to \$200 per year, which is about 5 percent of total household budget.<sup>e</sup>

Note: <sup>a</sup> UNFCCC. n.d. *India's Intended Nationally Determined Contribution: Working Towards Climate Justice*, page 6.

<sup>b</sup> UNFCCC. n.d. *India's Intended Nationally Determined Contribution: Working Towards Climate Justice*, page 8.

<sup>c</sup> World Bank and Carbon Trust 2018, page ix.

<sup>d</sup> World Bank and Carbon Trust 2018, page 20.

<sup>e</sup> World Bank and Carbon Trust 2018, page 19.

## 5.3 Deployment of Funds

### 5.3.1 Performance-Based Contracting: Environmental Impact Bonds (EIBs)

**EIBs are an innovative finance technique to apply RBF contracts to green infrastructure projects.** EIBs are tax-exempt, *pay-for-success* instruments, allowing governments to limit their losses if projects turn out unsuccessful, thus encouraging them to try novel climate-smart infrastructure solutions. However, EIBs are not really bonds because they are not a fixed-income borrowing instrument with a steady stream of repayments, nor can they be traded. Instead, EIBs are a form of PPP with performance-based contracting. This type of contracting has shown to deliver superior results in areas such as road repair and maintenance because it gives vendors and contractors the flexibility to design new solutions. For example, by providing bonus payments to reward overperformance rather than penalizing underperformance, contractors are given the flexibility to manage their performance and take ownership of project outcomes (Harvard Kennedy School 2018, 19–28).

EIBs leverage the performance-based contracting approach and allow municipal and city governments to partner with private sector investors. Together, they find environmentally friendly solutions to address specific

infrastructure problems. A public partner (city or municipality) and a private investor actor (e.g., local financial institution or pension fund) agree on a climate-smart investment project with well-defined, measurable performance metrics that represent financial, economic, and environmental results. The private sector investor then provides equity financing to a service provider (such as a local utility or construction company) to build the asset and assumes *equity-like risks* (without receiving a share in the project). As in the case of OBA, the project is strictly monitored by an independent intermediary who is external to the service provider. Upon achievement of pre-agreed results, the city or municipality reimburses the private investor its principal investment and pays an additional premium. By doing so, an EIB allows the investor to generate a return on investment and the public sector to only pay if the pre-agreed results have been achieved. If, however, the predefined targets have not been achieved, the private investor loses his capital. An EIB therefore makes it easier for public entities to manage the financial risks associated with green infrastructure by shifting them to the private sector.

However, EIBs are not designed as a cost-cutting instrument. On the one hand, an EIB can generate project cost savings for public entities if project completion is accelerated thanks to private financing, thus compensating the additional premium paid to the investor. On the other hand, EIBs can cost more than other programs that are *not* results-based. This is due to the need to set up systems to support data collection, as well as project monitoring and evaluation, which are critical to measuring and assessing outcomes but can be particularly challenging in emerging markets. In any case, EIBs impose greater discipline and accountability on the project than may otherwise be the case. The enhanced efforts required at the beginning of the project to structure EIBs and define which criteria determine success can ensure that a project delivers the benefits sought by the community.

EIBs are still in their infancy and investors in this phase are primarily donor agencies and mission-driven foundations. While EIBs have so far only been tested in the United States (box 5–3), it has been pointed out (Chesapeake Bay Foundation and Quantified Ventures, n.d.) that similar financing structures could be implemented for climate-smart infrastructure in other cities around the world because:

- EIBs work within existing procurement processes and can be applied within traditional (Built-Operate-Transfer or Design-Build-Operate) models. In addition, they can be used for innovative full delivery procurement;
- As institutional investors and local investors prefinance innovative climate-smart infrastructure projects to meet sustainability and community investment goals, EIBs can be structured to fit municipalities' finances;
- EIBs can be structured to also include co-benefits and corresponding metrics—such as local job and business creation, flood control, and climate resilience—as part of the evaluation.

### 5.3.2 Energy Services Company (ESCO) Model

**Energy service companies (ESCOs) can help develop, implement, or make arrangements for upfront, results-based energy investments.** Whenever bank financing is not directly available to cities or municipalities, the financing of ESCOs can be a viable alternative that allows the entry of private sector capital for the instant modernization of electrical systems, such as the retrofitting of existing streetlight systems with energy-efficient lamps and fixtures (IFC, n.d.). Generally, there are three different ESCO models. The “shared-savings” and the



**BOX 5-3 Example EIB Project: DC Water and Sewer Authority (DC Water)**

**Location:** Washington D.C., United States

**Total investment:** \$25 million

**Initial term rate:** 3.43%

**Maturity:** 30 years

**Investors:** Goldman Sachs Urban Investment Group, Calvert Foundation

**Transaction coordinator:** Quantified Ventures

**Project scope:** Bioretention facilities (e.g., green roofs, rain gardens) and permeable pavements

**Climate impact:** Absorbs and slows surges of stormwater during periods of heavy rainfall to reduce the incidence and volume of combined sewer overflows (CSOs) that pollute the District’s waterways. CSOs occur when the volume of wet weather flows exceeds the capacity of the sewer system, resulting in stormwater and sanitary sewer overflows into area watersheds. Currently, approximately two billion gallons of CSOs overflow into the Anacostia and Potomac Rivers and Rock Creek on an annual basis, adversely affecting the water quality of the rivers and tributaries in the region. Because of climate change, the frequency and severity of intense rainfall has increased, turning the reduction of CSO into an urgent environmental challenge.

**Program evaluation:**

- *Step 1:* Preconstruction monitoring to measure existing stormwater runoff without green infrastructure
- *Step 2:* DC Water and an independent engineering established outcome ranges predicting the expected reduction in stormwater runoff
- *Step 3:* Postconstruction monitoring to measure the actual stormwater runoff with green infrastructure.

**Outcome ranges:** Depending on the infrastructure’s effectiveness, a contingency payment may be due. If green infrastructure outperforms expectations and the stormwater runoff reduction is greater than 41.3 percent, DC Water will make an additional outcome payment to investors for sharing the project risk. If, on the other hand, green infrastructure underperforms expectations and the stormwater runoff reduction is less than 18.6 percent, the investors will have to make a so-called Risk Share Payment to DC Water.

**FIGURE 5-5. DC Water Contingency Payment Arrangements**

PERFORMANCE TIER	OUTCOME RANGES	CONTINGENT PAYMENT
1	Runoff Reduction > 41.3%	DC Water will make an Outcome Payment to Investors of \$3.3 million.
2	18.6% < Runoff Reduction ≤ 41.3%	No contingent payment due.
3	Runoff Reduction < 18.6%	Investors will make Risk Share Payment to DC Water of \$3.3 million.

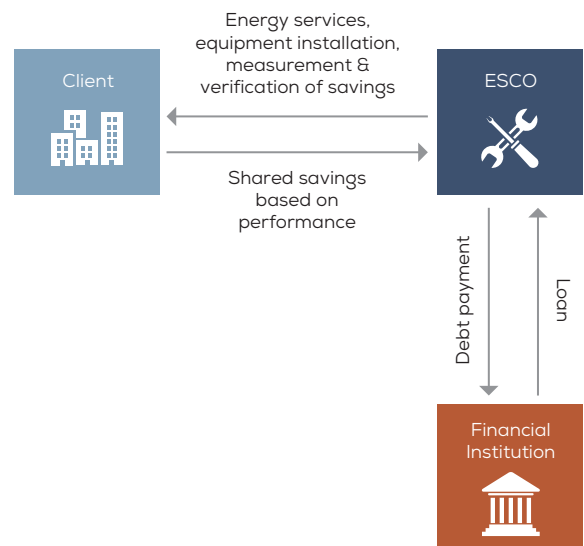
Source: Goldman Sachs, 2016. Fact Sheet – DC Water Environmental Impact Bond.

“guaranteed savings” energy performance contracting (EPC) models are the most common forms; a third model, the “chauffage” model, is predominantly used in Europe. The main advantage of the ESCO model is that the client (city or municipality) is not required to make any upfront capital investments and is only responsible for periodic service fee payments to the ESCO based on the energy savings achieved (IFC 2011, 2).

### Shared-savings energy performance contracting

In this model, the ESCO prefinances the entire upfront capital cost of the project and is responsible for repaying the lender. The client pays the ESCO a certain percentage or a fixed amount of the energy savings achieved, and the ESCO can use these proceeds to repay the lender and cover his costs. In this model, the client assumes no direct obligation to repay the lender.

FIGURE 5-6. Shared Savings Model



Source: IFC 2011.

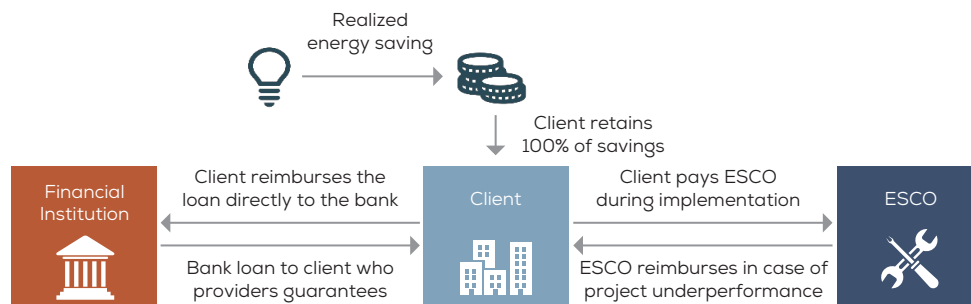
### Guaranteed savings energy performance contracting

In a guaranteed savings EPC, the client (city or municipality) takes out a loan from a financial institution, prefinances the project, and uses the energy savings realized to service debt payments. In this model, the client assumes the obligation to repay the lender, not the ESCO. However, the ESCO guarantees savings performance and reimburses the client in the case of project underperformance.

### Chauffage

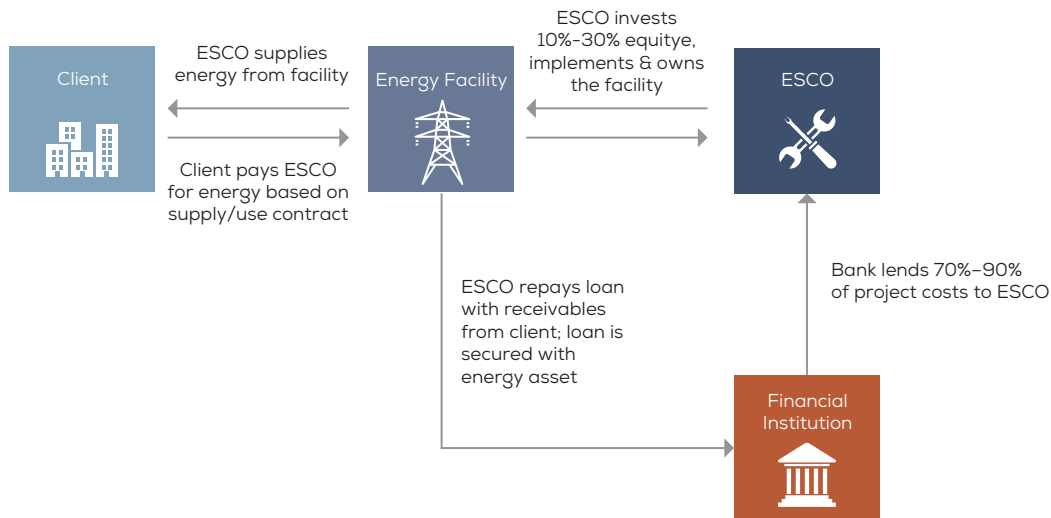
In the chauffage model (IFC 2011, 3), the ESCO invests his own equity (typically 10–30%) and borrows the remaining 70–90 percent from a financial institution to implement and own the energy facility (figure 5-8).

FIGURE 5-7. Guaranteed Savings Model



Source: IFC 2011.

FIGURE 5-8. The Chauffage Model



Source: IFC 2011.

The ESCO and the client then agree on a long-term supply and demand contract (typically for 10–25 years). Both parties agree on a base year of previous energy costs. The client then pays the ESCO a specified percentage of the previous energy costs (e.g., per unit of energy consumed) that would have been incurred, discounted from the agreed base year of energy cost. The ESCO then uses the client proceeds to cover all expenses and repay the loan, which is typically secured with the energy asset. Such a chauffage model is appropriate in cases where the client has significant energy savings potential (e.g., hospitals, universities, large office buildings) and typically also involves energy management plans.

## 5.4 Bond Schemes

The development of bond schemes in cities requires significant institutional and financial capacity, both of which are associated with the creditworthiness of cities. The specialized bond schemes analyzed here are presented at a conceptual basis considering that cities in less developed countries should first have the capacity to issue simple municipal bonds before progressing to resilience and green city bonds.

### 5.4.1 Resilience Bonds<sup>10</sup>

**Resilience bonds are an innovative conceptual application of RBBF in the context of resilience projects. It hasn't been tested yet because of the very high underwriting costs. These costs are due to the need for sophisticated detailed modeling at the project level and the high transaction costs to consider the investment.** *Resilience bonds* are an extension of conventional *catastrophe bonds (CAT bonds)*, which

<sup>10</sup> This section draws on Re:focus 2017.

## BOX 5-4 Public Street lighting in Jaipur, Rajasthan, India

**Situation:** The Jaipur Municipal Corporation (JMC) operates and maintains over 100,000 public street lights in the city of Jaipur, the capital city of Rajasthan, a low-income state in India. Due to limited public budgets, other services and infrastructure were frequently prioritized over public lighting. To avoid additional costs, maintenance was contracted out to over 20 small private sector contractors using “material plus labor” contracts, whose monitoring was a challenge. As a result, maintenance was limited to replacing burned-out lamps, and one in three lamps were not functioning at all. This situation resulted in low lighting levels in several parts of the city, causing serious problems for city traffic and safety issues for residents. Despite the low quality, JMC incurred significant electricity costs from the lighting network. In fact, estimates suggested that electricity consumption could be reduced by 50 percent if newer technologies were used and the system was properly operated and maintained, but JMC and its contractors lacked the expertise to overhaul the system.

### Project scope

JMC decided to launch a large PPP program. A large consortium, led by an Indian energy services company (ESCO) as well as a manufacturer of LED lights, won a 10-year energy performance contract (EPC) in December 2014. The contract included the commitment to invest \$12 million for retrofitting at least 70,000 street lamps with energy-efficient LED lamps, as well as their operation and maintenance. In addition, the contract included the installation of additional lights if required. Moreover, the ESCO committed to install a fully computerized centralized control and monitoring system and create a round-the-clock public grievance system. JMC, on the other hand, agreed to pay a share of the energy savings achieved by the ESCO for these investments and services. The state of Rajasthan guaranteed payments to the ESCO. Overall, the EPC was structured to:

- Balance risks,
- Make the project sustainable and viable,
- Protect the rights of all parties involved, and
- Provide measurable investment and performance objectives.

### Impact

The winning bid committed to achieving over 77 percent in energy savings of which over 30 percent would be shared with JMC. The program had the following impacts:

- Fiscal savings of \$1 million per year thanks to reduced energy consumption,
- At least \$12 million in private investments,
- Improved streetlight services to over 1,650,000 people daily,
- GHG emissions reduced by 36,750 metric tons/year,
- Enhanced safety and security of Jaipur city, and
- Replication potential throughout the country.

*Source:* IFC. 2015. Public-Private Partnership Stories – India: Rajasthan Public Street Lighting.

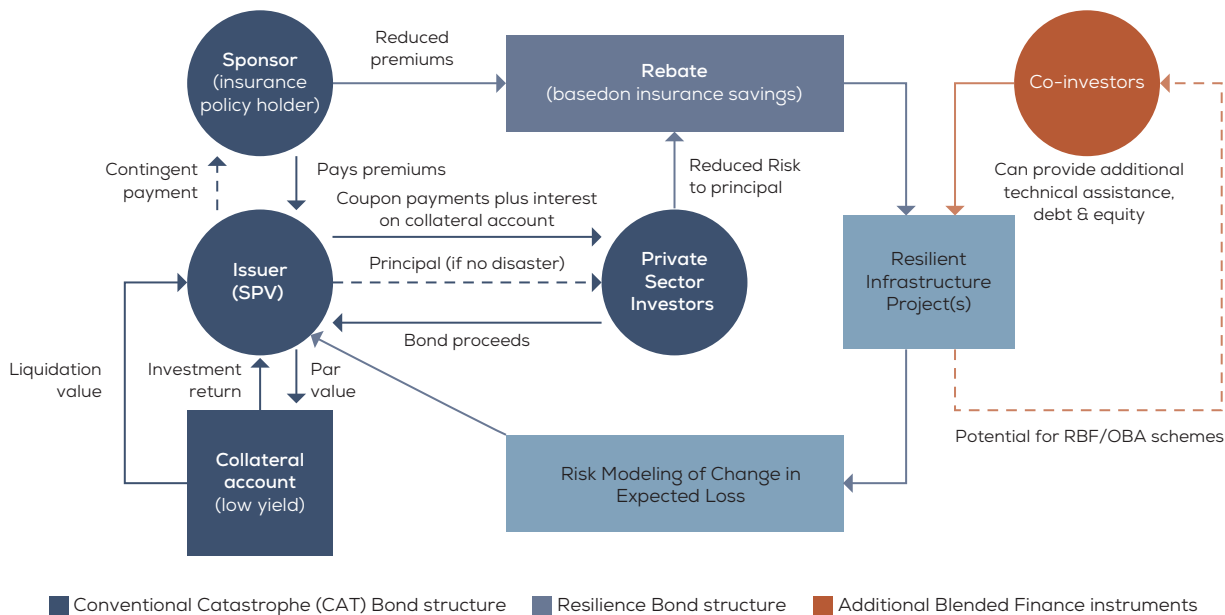
serve as a kind of insurance instrument against natural disasters. In addition, resilience bonds provide an opportunity to scale up investments in resilience infrastructure.

The structuring of CAT bonds fundamentally involves three main actors: a special purpose vehicle (SPV), an investor, and a sponsor. They play the following roles:

- The CAT bond is usually issued by a **special purpose vehicle (SPV)**, which is set up by insurance companies and/or investment banks. These companies are responsible for structuring the transaction, creating legal implementation frameworks, getting the bond to the market, and managing the funds in the collateral account.
- **Investors** provide capital (principal), which is held in a low-yield collateral account for the term of the bond in exchange for regular coupon payments. While the type of investors can vary, ranging from individuals to large-scale pension funds, investors are generally looking for portfolio diversification as well as a return on their investment, and are willing to accept more risk (including the risk of losing their entire principal), in exchange for higher returns.
- **The sponsor**, who can be a city or municipality, is equal to an *insurance policy holder* and is responsible for making regular premium payments. If there is no triggering disaster event during the term of the bond, the investor gets back his principal at the bond's maturity date, just like in any conventional bond. In addition, he receives the sponsor's regular coupon payments, plus interest from the collateral account, which provides investors with a return on their investment. If, however, a triggering event occurs during the term of the bond, the investor loses all, or part of the principal invested. In this case, the funds are used as payouts to the bond sponsors.

While the relationship between investors, issuers, and sponsors does not change in *resilience bonds*, these bonds explicitly incorporate the value of reduced risk of asset losses thanks to a resilience project. In a first step, the issuer uses catastrophe models to financially assess if and by how much a certain resilience

**FIGURE 5-9. Application of Blended Finance within a Resilient Bond**



Source: Author's research; adapted from re:focus 2017.

Note: OBA = output-based aid; RBF = results-based finance; SPV = special purpose vehicle.

project would reduce asset losses in the case of a catastrophic event. The idea is that if a resilience project is in place when such an event occurs, it lowers the investors' risk of losing their invested principal. As a result, the sponsor's coupon payments are reduced as well, thus creating a *resilience rebate*. In a second step, the value of the reduced coupon savings is captured and used to finance resilience projects.

In addition, CAT and resilience bonds provide the benefit of sponsors only being responsible for coupon payments, but not for repaying the bond principal, as in the case of municipal bonds. In this way, cities and municipalities can overcome concerns about debt capacity limits or credit rating impacts. Moreover, disaster risks are uncorrelated with the risks of other investments, allowing portfolio diversification, which in combination with attractive rates of return, makes these bonds appealing to investors. Lastly, co-investors like Multilateral Development Banks (MDBs) can apply a range of instruments to increase the reach of resilient infrastructure projects. For example, they can match the funds invested in resilient infrastructure projects to scale up and/or realize even more such projects. In addition, MDBs can provide technical assistance in selecting, planning, and implementing these projects as well as results-based incentives if these projects extend to the local poor population in return for concessional funding and grants.

## 5.4.2 Green City Bonds

**With green bonds, investors do not have to choose between financial returns and climate benefits.** Green city bonds were created to provide a low-cost financing tool for cities and municipalities to address the infrastructure funding gap as well as the climate challenge. Green bonds enable investments in low-carbon and climate-resilient transport, water, power, and building projects while offering the same financial terms as traditional bonds. The advantage of green bonds is the focus on specific green projects and physical assets. It is not important whether the issuer itself is considered "green" (Climate Bonds Initiative 2015a, 4). As a result, green bonds can be issued by a range of interested parties—including cities and municipalities, as well as city-affiliated entities such as utilities, companies, and development banks (Climate Bonds Initiative 2015a, 2).

Overall, green bonds can take the form of general obligation bonds, revenue bonds, project bonds, and securitized bonds (Climate Bonds Initiative 2015b, 3), as shown in figure 5–2.

Green bonds in the form of *general obligation bonds* are backed by the issuer's entire balance sheet and, as a result, have the same credit rating as the issuer's other, non-green bonds. By contrast, green bonds in the form of *revenue bonds* are not backed by the issuer's full balance sheet, but by specific revenue streams, such as water/sewer fees or tax revenues. Similarly, *project bonds* are backed by the financial performance of a specific green project and allow investors to gain exposure to green project risks and returns. Lastly, *securitized bonds* are bonds that are backed by a pool of smaller green projects. Such bonds provide another option for investors seeking exposure to the risk-reward profiles of green projects (Climate Bonds Initiative 2015b).

The issuing process of a green city bond and segregation of proceeds involves the following steps (Climate Bonds Initiative 2015b):

**TABLE 5-2. Types of Green Bonds**

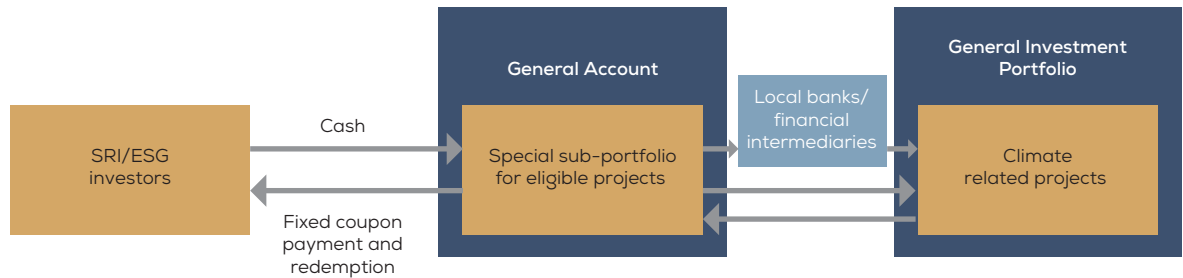
TYPE	PROCEEDS RAISED BY BOND SALE	DEBT RECOURSE
General obligation bond	Earmarked for green projects	Full recourse to the issuer; therefore, same credit rating applies as to the issuer's other bonds
Revenue bond	Earmarked for green projects	Revenue streams from the issuer, such as taxes or user fees, provide repayment for the bond (e.g., the Hawaii State—backed by surcharge on electricity fee on electricity bills of the state utilities)
Project bond	Ring-fenced for the specific underlying green project(s)	Recourse is only to the project's assets and revenue
Securitized bond	Either (i) earmarked for green projects or (ii) goes directly into the underlying green projects	Recourse is to a group of financial assets that have been grouped together as collateral (e.g., solar leases or green mortgages)

Source: Climate Bonds Initiative 2015b.

1. **Identification of qualifying green projects and assets.** Projects and assets must follow established criteria for the use of bond proceeds, including green asset categories, as well as qualifying assets or projects within these categories.
2. **Independent review:** In addition to issuers' self-labelling as a green bond, based on the projected use of the bond's proceeds, an independent review and certification improves investor confidence in the quality of a green investment by providing reassurance about the environmental benefits of the investment.
3. **Tracking and reporting:** To ensure that all proceeds from the bond are invested into green projects, the issuer must establish dedicated reporting processes. The amount of the bond must equal or exceed cash on hand plus amounts invested in green projects and assets.
4. **Green bond issuance** follows the usual steps of conventional bond issuances and includes steps such as working with an investment bank to structure the bond and/or obtaining a credit rating.
5. **Monitoring of use of proceeds and reporting:** To confirm that funds are adequately allocated to green projects, the issuing city or municipality (or designated auditor) should at least annually prepare a public report.

**Green bonds are constantly oversubscribed, showing strong investor demand.** As green bonds offer the same yield, credit rating, and comparable price as conventional bonds, the green benefit is another bonus feature. For those investors who would like to address climate risks but are restricted from doing so by their mandates from asset owners, green bonds are a highly interesting investment vehicle. For those investors, on the other hand, who do not see climate change as their main priority, green bonds can still be an attractive investment opportunity because they are not different from conventional, similarly rated bonds and may be used for portfolio diversification purposes. In fact, the price of green bonds is the same as that of ordinary

**FIGURE 5-10. Segregation of Green Bond Proceeds**



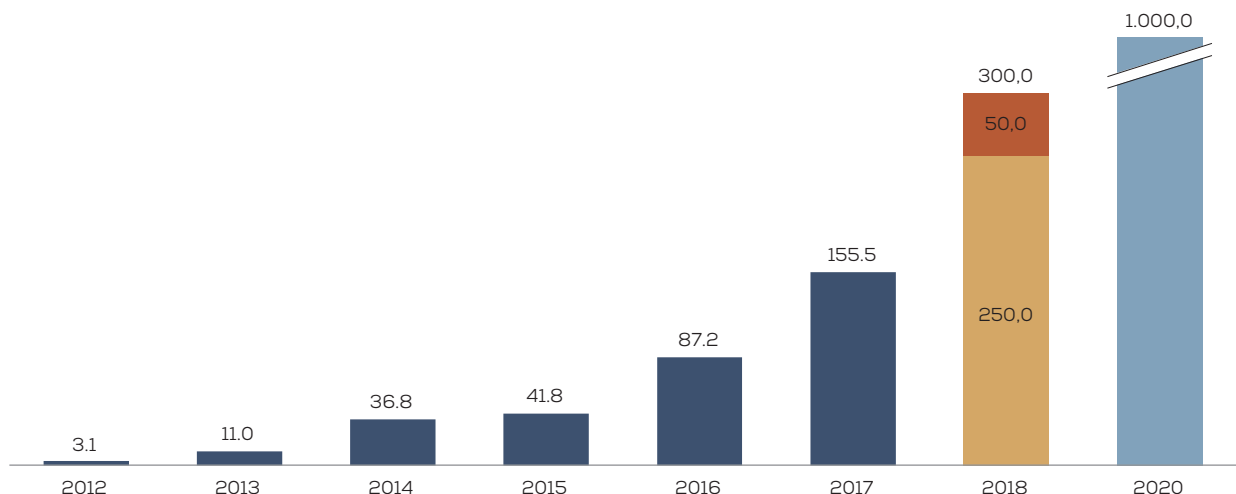
Source: Adapted from IFC.

Note: ESG = environmental, social, and governance; SRI = socially responsible investing.

bonds of the same issuer (there is no additional cost) and because the credit profile is also the same as that of other vanilla bonds, green bonds are *pari passu* (Climate Bonds Initiative 2015b). These advantages have led to the rapid growth of the green bond market, reaching a cumulative issuance volume of \$155.5 billion in 2017, with emerging markets and subsovereign issuance showing significant increases. Overall, the market is expected to reach a volume of between \$250 and \$300 billion in 2018, implying a 60 percent growth on 2017 figures, with the goal of reaching \$1 trillion by 2020.

**Providing targeted incentives can be a game changer for the green bond market.** The provision of results-based incentives and other forms of financial support by public sector entities has shown to be a game changer, unlocking the significant growth potential of green bonds. For example, in 2017, the Monetary Authority of Singapore announced a grant scheme to absorb the costs of external green bond reviews. In Malaysia, the Securities Commission announced a tax incentive for socially responsible and green sukuk.

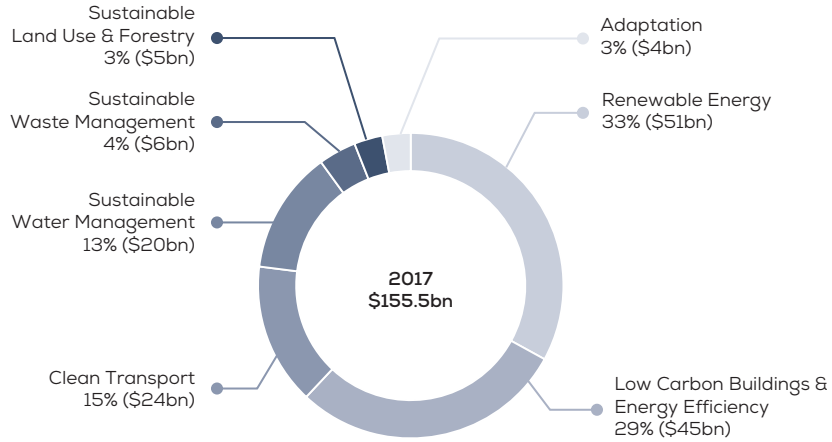
**FIGURE 5-11. Green Bond Issuance Volume (US\$, billions)**



Source: Adapted from Climate Bonds Initiative.



**FIGURE 5-12. Most Common Use of Proceeds in 2017**



Source: Climate Bonds Initiative.

Lastly, China for the first time implemented fast-tracking of green bonds, giving green bond approval priority over non-green bond issuances at the local level (Climate Bonds Initiative 2018a, 2). Overall, such incentives facilitate the market entry of new issuers and can absorb additional costs such as those associated with independent third-party verification.

## BOX 5-5 Municipal Green Bond in Cape Town, South Africa

**Deal type:** Green Municipal Bond

**Date of Issuance:** 17 July 2017

**Deal Size:** ZAR 1 billion (\$76 million)<sup>a</sup>

**Deal Structure:** Senior unsecured

**Issuer:** City of Cape Town

**Tenor:** 10 years

**Coupon:** 10.17%

**Spread:** R186 (local-currency government bond) + 133 basis points (bp)

**Issue rating:** National scale: Aaa.za // Global Scale (Moody's): Baa3/GB1

**Listing:** Johannesburg Stock Exchange

**Bookrunner:** Rand Merchant Bank

The City of Cape Town used the proceeds of the ZAR 1 billion green bond for a range of projects, including:

- Procurement of electric buses;
- Energy efficiency in buildings;
- Water management initiatives (incl. installation of water meters and replacements, water pressure management, upgrade of reservoirs)
- Sewerage effluent treatment
- Rehabilitation and protection of coastal structures.

The bond is compliant with Climate Bonds Initiatives' use of proceeds criteria and achieved a Moody's rating of GB1, which is the highest achievable for a green bond. Within two hours of the *Dutch Auction*, the bond was four times oversubscribed, generating ZAR 4.2 billion in demand. Ultimately, the price levelled off at ZAR 186 + 133 bp, which is 7 bp below the initial guidance range of 140–160 bp. The bond issuance marked Cape Town's return to the local capital markets, from which the city had been absent for a few years, and it was the city's first push into this asset class.

*Source:* Bonds & Loans. 2017. "Case Study: Cape Town Wins Race to Issue Africa's First Municipal Green Bond" (<http://www.bondsloans.com/news/article/1627/case-study-cape-town-wins-race-to-issue-afric>).

*Note:* a. Climate Bonds Initiative: "This Green Bond () will allow the City of Cape Town to invest in projects that are consistent with the city's sustainability goals and that will help the city adapt to and mitigate climate change. The bulk of the proceeds will go toward helping the city manage its water infrastructure."





**THE WAY  
FORWARD**

6

## 6. THE WAY FORWARD

Future growth and climate-resilient development requires action at the city level. It also requires new ways for financing infrastructure in less-developed urban communities.

The classic model of infrastructure financing that depends on aid without accountability and misses progress in the policy agenda towards creditworthiness is inadequate to address the challenges that lie ahead for cities. Therefore, finding new approaches to incentivize public and private investments is essential.

Results-based and blended finance projects can bring confidence to donors, investors and service providers, to overcome barriers, increase the return on investments and develop a pipeline of financially viable, climate smart projects in cities. The experiences of GPRBA point to the direction of this opportunity. Results-based approaches can turn unsustainable traditional financing practices to scalable paradigms that address the affordability gap for communities, institutional inefficiencies and mitigate investment risks.

The analysis of the report shows how selected results-based instruments can help overcome investment barriers and make low-carbon and resilient infrastructure a bankable asset class for local and international investors. Development partners and city officials with this report have a now a resource which could help them:

1. Drive strategic decisions for developing results-based and blended finance schemes for climate investments in cities;
2. Analyze a toolbox of financial instruments that have not been-tested or mainstreamed in development finance operations in cities; and
3. Catalyze partnerships for financing solutions that deliver results with accountability for public institutions, service providers and financiers.

Without bold, innovative results-based financing approaches in cities that blend public and private funding we'll not be able to deliver climate resilient and inclusive growth.



## Financing Instruments

TABLE A-1. Public Finance Instruments

INSTRUMENT	POTENTIAL FOR SUPPORTING SUSTAINABLE INFRASTRUCTURE	EXPLANATION
<b>Land sales</b>	Low	One-off source of finance, limited impact. Difficult to incentivize sustainable infrastructure development once land is sold.
<b>Land or asset leasehold</b>	Low	Would depend on government policies and targets. Contracts should stipulate sustainability performance objectives. Difficult to monitor.
<b>Public-private partnerships (PPPs) and private finance initiatives (PFIs)</b>	Medium	Depends on the type of project and government policies and targets. Could include sustainability targets.
<b>Taxes</b> (e.g., property or business tax)	Medium to high	Depends on tax design and scope, for example, tax to favor density over urban sprawl or low-carbon energy over fossil fuel sources. Requires coordination across departments and tax incentives.
<b>Land value capture mechanisms</b> (e.g., tax-based, building rights, and development impact charges or fees)	Medium to high	Depends on design and government policies and targets. Could mandate the achievement of sustainability objectives (e.g., energy efficiency targets).
<b>User charges and fees</b>	Medium to high	Depends on the integration of externalities and incentives encouraging sustainable use of infrastructure (e.g., public transport) or resource conservation.
<b>Grants and subsidies</b>	Medium to high	Depends on design. Given limited public resources, these instruments should be targeted at projects that have significant potential of leveraging additional finance sources while delivering sustainable benefits.
<b>Building rights and planning permits</b>	Medium to high	Depends on whether planning process and permit allocation are tied to sustainability requirements.

Source: Long Finance & WWF, page 26.

**TABLE A-2. Debt Finance Instruments**

INSTRUMENT	POTENTIAL FOR SUPPORTING SUSTAINABLE INFRASTRUCTURE	EXPLANATION
<b>Loans</b>	Medium	Depends on instrument.
<ul style="list-style-type: none"> <li>• Concessional or flexible loans</li> </ul>	Medium to high	Depends on design and scope. Terms and conditions should stipulate specific sustainability objectives when possible, for example, energy efficiency mortgages.
<ul style="list-style-type: none"> <li>• Syndicated loans</li> </ul>	Low to medium	Depends on sustainability being integrated into lending criteria.
<b>Bonds</b>	Medium	Depends on scope and purpose. Can be combined with tax efficiency measures.
<ul style="list-style-type: none"> <li>• Infrastructure bonds</li> </ul>	Medium	Depends on sustainability being integrated into design, scope, and disclosure.
<ul style="list-style-type: none"> <li>• Green bonds</li> </ul>	High	Depends on standards and disclosure. Project selection criteria should be specified upfront and monitored throughout.
<b>Debt funds</b>	Medium	In theory possible. Depends on scope of the fund and integration of sustainability criteria.
<b>De-risking and credit enhancement instruments</b> (e.g., guarantees—credit, partial risk)	Medium	Depends on whether they are targeted at sustainable infrastructure projects that need credit status enhancement.
<b>Debt refinancing instruments</b> (e.g., securitization techniques including forfeiting and subordinate debt financing)	Medium to high	Could provide refinancing for long-term, sustainable infrastructure projects, e.g., renewable energy. Further development of “green securitization” market required.

Source: Long Finance & WWF, page 31.



**TABLE A-3. Equity Finance Instruments**

INSTRUMENT	POTENTIAL FOR SUPPORTING SUSTAINABLE INFRASTRUCTURE	EXPLANATION
<b>Infrastructure equities—listed</b>	Medium to high	Own significant amounts of infrastructure assets. Depends on companies' capital expenditure strategy toward low-carbon infrastructure and on policy requirements.
<b>Equity funds—listed/unlisted</b>	Low to medium	Depends on stock selection strategy, scope of the fund, and disclosure.
<b>Equity-funded direct investments in infrastructure</b>	Medium	Depends on type of infrastructure, investment strategy, and government policy. Future potential depends less on the instrument and more on the suitability of sustainable infrastructure projects being financed through this type of vehicles.
Special-purpose vehicles (SPVs)	Medium	Commonly used for renewable energy projects. Depends on type of infrastructure and government involvement.
Joint ventures (JVs)	Medium	Depends on type of infrastructure and JV scope.

Source: Long Finance & WWF, page 35.

## Financial model\*

### EXAMPLE of a viable project

	YEAR 0	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
<b>Cash Flow</b>	-100,000	-50,000	-50,000	15,000	25,000	30,000	35,000	45,000	55,000	65,000	70,000
<b>PV @5% WACC</b>		-47,619	-45,351	12,958	20,568	23,506	26,118	31,981	37,226	41,900	42,974
<b>WACC</b>	NPV	IRR	8.40%								
<b>0%</b>	140,000										
<b>5%</b>	44,258										
<b>8%</b>	0										
<b>10%</b>	-16,743										
<b>15%</b>	-56,405										
<b>20%</b>	-81,454										
<b>25%</b>	-100,170										

### EXAMPLE of an unviable project

	YEAR 0	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
<b>Cash Flow</b>	-100,000	-50,000	-50,000	15,000	20,000	25,000	28,000	35,000	40,000	45,000	50,000
<b>PV @5% WACC</b>		-47,619	-45,351	12,958	16,454	19,588	20,894	24,874	27,074	29,007	30,696
<b>WACC</b>	NPV	IRR	4.00%								
<b>0%</b>	58,000										
<b>5%</b>	-11,426										
<b>8%</b>	-43,448										
<b>10%</b>	-55,536										
<b>15%</b>	-84,068										
<b>20%</b>	-101,943										
<b>25%</b>	-115,137										

**EXAMPLE of an unviable project with OBA subsidy**

	YEAR 0	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
<b>Cash Flow</b>	-100,000	-50,000	-50,000	15,000	20,000	25,000	28,000	35,000	40 000	45,000	50,000
<b>PV @5% WACC</b>	-100,000	-47,619	-45,351	12,958	16,454	19,588	20,894	24,874	27,074	29,007	30,696
<b>OBA subsidy</b>				30,000	30,000	30,000	30,000				
<b>NPV cumulated</b>	-100,000	-147,619	-192,971	-150,013	-103,559	-53,971	-3,077	21,797	48,871	77,878	108,574



## Notes

Most of infrastructure investments have a life span greater than 10 years. Discounting cash flows over a longer period would result in a greater IRR even if cash flows remain at the level observed in the example. It may be important to mention this to indicate that the project financial viability could be greater if the life span of this infrastructure is more than 10 years.

The WACC (opportunity cost) in many developing countries is often greater than 5%. This would mean that for the selected investment to be financially viable and attractive for a private investor, the expected cash flows would need to be greater than their current level; or once again, cash flow generation would need to be expected over a longer period, assuming that the investor has no alternative short term investment opportunity which provides a greater return.



# References

- C40/Citi/Siemens. 2015. New Perspectives on Climate Finance for Cities.
- Chesapeake Bay Foundation & Quantified Ventures. (no date). "Green Infrastructure Opportunity – Environmental Impact Bond Services for Green Infrastructure Investments in the Chesapeake Bay Watershed." Brochure.
- CCFLA (Cities Climate Finance Leadership Alliance). 2015. The State of City Climate Finance. CCFLA. New York. <https://sustainabledevelopment.un.org/content/documents/2201CCFLA-State-of-City-Climate-Finance-2015.pdf>.
- Climate Bonds Initiative. 2015a. "The Green City Bonds Overview – How to Issue a Green City Bond." (<https://www.climatebonds.net/files/files/How-to-Issue-Green-City-Bonds.pdf>)
- . 2015b. "How to Issue a Green Muni Bond – The Green Muni Bonds Playbook." (<https://www.climatebonds.net/files/files/Green%20City%20Playbook.pdf>)
- . 2018a. "Green Bond Highlights 2017."
- . 2018b. "Green Bonds Policy: Highlights from 2017."
- Climate Policy Initiative. 2017. Global Landscape of Climate Finance 2017.
- Correia de Freitas, João, and Miguel Amado. 2013. "Crowdfunding in Urban Planning: Opportunities and Obstacles." Conference Paper.
- Eurodad. 2007. Debt Swaps for Development. [http://eurodad.org/uploadedfiles/whats\\_new/reports/debt\\_%20swaps\\_%20eng\(1\).pdf](http://eurodad.org/uploadedfiles/whats_new/reports/debt_%20swaps_%20eng(1).pdf)
- Goldman Sachs. 2016. "Fact Sheet: DC Water Environmental Impact Bond." Fact sheet. <https://www.goldmansachs.com/media-relations/press-releases/current/dc-water-environmental-impact-bond-fact-sheet.pdf>.
- GPOBA\* (Global Partnership on Output-Based Aid). 2012. "Lessons from Output-Based Aid for Leveraging Finance for Clean Energy." Working Paper. Washington, DC: World Bank.
- . 2017. "Results-Based Financing for Pro-Poor and Climate-Smart Investments in Cities." Study by the World Bank Climate Change Group and GPOBA\*.

Hallegatte, Stephane; Vogt-Schilb, Adrien; Bangalore, Mook; and Julie Rozenberg. 2017. Unbreakable: Building the Resilience of the Poor in the Face of Natural Disasters. Climate Change and Development. Washington, DC: World Bank. © World Bank. <https://openknowledge.worldbank.org/handle/10986/25335> License: CC BY 3.0 IGO.

Harvard Kennedy School. 2018. Results-Driven Contracting Solutions Book: How Cities Are Improving the Outcomes of High-Priority Procurements. [https://govlab.hks.harvard.edu/files/siblab/files/rdc\\_solutions\\_book.pdf](https://govlab.hks.harvard.edu/files/siblab/files/rdc_solutions_book.pdf).

IFC (International Finance Corporation). 2011. IFC Energy Service Company Market Analysis.

———. 2015. Public-Private Partnership Stories: India – Rajasthan Public Street Lighting ([http://www.samudraled.com/images/IFC\\_Jaipur\\_Street\\_Lighting\\_March\\_4\\_2015.pdf](http://www.samudraled.com/images/IFC_Jaipur_Street_Lighting_March_4_2015.pdf)).

———. 2016. Climate Investment Opportunities in Emerging Markets. [https://www.ifc.org/wps/wcm/connect/51183b2d-c82e-443e-bb9b-68d9572dd48d/3503-IFC-Climate\\_Investment\\_Opportunity-Report-Dec-FINAL.pdf?MOD=AJPERES](https://www.ifc.org/wps/wcm/connect/51183b2d-c82e-443e-bb9b-68d9572dd48d/3503-IFC-Climate_Investment_Opportunity-Report-Dec-FINAL.pdf?MOD=AJPERES).

———. 2017a. Climate Investment Opportunities in South Asia.

———. 2017b. Green Bonds presentation.

———. (2018). Climate Investment Opportunities in Cities An IFC Analysis

———. (no date). Finance for Energy Efficient Street Lighting.

infoDev/World Bank. 2013. Crowdfunding's Potential for the Developing World. Washington, DC: World Bank. [https://www.infodev.org/infodev-files/wb\\_crowdfundingreport-v12.pdf](https://www.infodev.org/infodev-files/wb_crowdfundingreport-v12.pdf).

Landscape News. 2017. "Time to get it together in mitigation and adaptation." Landscape News.

Long Finance and WWF. 2015. Financing the Transition: Sustainable Infrastructure in Cities. [http://www.greengrowthknowledge.org/sites/default/files/downloads/resource/WWF\\_Financing\\_the\\_Transition.pdf](http://www.greengrowthknowledge.org/sites/default/files/downloads/resource/WWF_Financing_the_Transition.pdf).

Perspectives GmbH. (2015). Can debt for climate swaps be a promising climate finance instrument? [https://www.perspectives.cc/fileadmin/Publications/Can\\_debt\\_for\\_climate\\_swaps\\_be\\_a\\_promising\\_climate\\_finance\\_instrument\\_Warland\\_Linde\\_\\_Michaelowa\\_Axel\\_2015.pdf](https://www.perspectives.cc/fileadmin/Publications/Can_debt_for_climate_swaps_be_a_promising_climate_finance_instrument_Warland_Linde__Michaelowa_Axel_2015.pdf).

Public-Private Infrastructure Advisory Facility (PPIAF). 2009. Handbook for Municipalities: Creditworthiness, Credit Ratings and Borrowing to Fund Municipal Infrastructure.

re:focus. 2017. A Guide for Public-Sector Resilience Bond Sponsorship. <http://www.refocuspartners.com/wp-content/uploads/pdf/RE.bound-Program-Report-September-2017.pdf>.



- Skoll Foundation. 2015. How to light the Off-Grid World in a Decade. Huffington Post.
- Stanford Graduate School of Business. 2015. Off Grid Electric: Strategic Financing For Growth.
- Stanford University. 2015. "Funding Municipal Infrastructure: Integrating Project Finance and Crowdfunding." Working Paper Global Projects Center. <https://gpc.stanford.edu/publications/funding-municipal-infrastructure-integrating-project-finance-and-crowdfunding>
- The Fletcher School. 2016. Off Grid: Electric; Lighting the World One Village at a Time .
- World Bank. 2015. Investing in Urban Resilience. Washington, DC: World Bank.
- . 2018. Low-Carbon Infrastructure – Private Participation in Infrastructure (PPI), 2002 to first half of 2017. Washington, DC: World Bank.
- UNFCCC (United Nations Framework Convention on Climate Change). n.d. India's Intended Nationally Determined Contribution: Working Towards Climate Justice. <http://www4.unfccc.int/ndcregistry/PublishedDocuments/India%20First/INDIA%20INDC%20TO%20UNFCCC.pdf>.
- World Bank and Carbon Trust. 2018. Study on Using the Climate Auction Model to Catalyse Energy, and Resource Efficient Buildings. London, United Kingdom: The Carbon Trust.
- Platonova-Oquab, Alexandrina; Klein, Noemle; Woods, Eric; Zhang, Jialiang; Brand, Kristen; Jager, David de. 2018. Low Carbon Cities: Exploring New Crediting Approaches to Deliver Carbon and Climate Finance (English). Carbon Partnership Facility Innovation Series. Washington, D.C.: World Bank Group.

