

A GUIDE TO FINANCING CLEAN AIR



Clean Air Fund publication
Copyright © Clean Air Fund 2026
All rights reserved

This publication may be reproduced in whole or in part for educational or non-profit purposes without special permission from the copyright holder, provided that the source is acknowledged. Clean Air Fund and Asian Development Bank (ADB) publication offices would appreciate receiving a copy of any publication that uses this publication as a source.

No use may be made of this publication for resale or any other commercial purpose whatsoever without prior permission. Applications for such permission, with a statement of the purpose and extent of reproduction, should be addressed to the Head of Advocacy at Clean Air Fund, London.

Disclaimers

The designation of or reference to a particular territory or geographic area in this document does not imply the expression of any opinion whatsoever on the part of the Clean Air Fund or ADB concerning the legal or other status of any territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Mention of any firm, product, service or licensed process does not imply endorsement or criticism by the Clean Air Fund or ADB or the authors. The use of information from this document for publicity or advertising is not permitted. Trademark names and symbols are used in an editorial fashion with no intention of infringement of trademark or copyright laws.

The views expressed in this publication are those of the authors and do not necessarily reflect the views of the Clean Air Fund or ADB, or any governments they represent. We do not guarantee the accuracy of the data included in this publication and accept no responsibility for any consequence of their use.

Creative Commons licence

This report is published under Creative Commons Attribution-NonCommercial 4.0 International. To view a copy of this license, visit <https://creativecommons.org/licenses/by-nc/4.0/>

Suggested citation

Clean Air Fund (2026). A Guide to Financing Clean Air. London: Clean Air Fund.

URL: <https://www.cleanairfund.org/resource/guide-to-financing-clean-air/>.

Cover photo: A resident cleans the rooftop solar panels that power his home in Depok City, West Java, Indonesia (photo by Aji Styawan / Climate Visuals).

CONTENTS

ACKNOWLEDGMENTS	ii
HOW TO USE THIS GUIDE	iii
EXECUTIVE SUMMARY	v
1 INTRODUCTION: WHY FINANCE, WHY NOW?	1
2 THE CURRENT STATE OF CLEAN AIR FINANCING	3
3 WHAT COUNTS AS CLEAN AIR FINANCE? A WORKING TAXONOMY	4
4 VALUE CREATION AND REVENUE	6
4.1 POLLUTION PRICING AS A REVENUE-CREATION ROUTE	6
4.2 THE CO-BENEFIT FINANCING ROUTE	6
5 FINANCIAL INSTRUMENTS	8
5.1 GRANTS AND TECHNICAL ASSISTANCE (TA)	9
5.2 CONCESSIONAL DEBT AND THEMATIC BONDS	9
5.3 GUARANTEES AND RISK SHARING	13
5.4 BLENDED FINANCE	13
5.5 RESULTS-BASED FINANCE	13
5.6 PUBLIC PROCUREMENT AS A FINANCING LEVER	14
6 MOBILISING PRIVATE FINANCE	15
6.1 BARRIERS	15
6.2 CONDITIONS FOR INVESTMENT	15
6.3 WHAT PRIVATE INVESTORS AND FINANCIAL INSTITUTIONS CAN DO	15
6.4 WHAT MDBS CAN DO	16
7 LESSONS FROM ADJACENT PUBLIC-GOOD SECTORS	17
8 PRACTICE VALIDATION: WHAT WORKS, WHAT FAILS AND WHY	18
9 NEXT STEPS	23
9.1 IMMEDIATE ACTIONS	23
9.2 A DEVELOPMENT AGENDA	23
10 CONCLUSION AND FUTURE OUTLOOK	27
REFERENCES	29

ACKNOWLEDGMENTS

A Guide to Financing Clean Air is a collaborative product of the Clean Air Fund and the Asian Development Bank (ADB). This report is co-funded by Clean Air Fund and ADB under TA-10537-REG: Scaling Up Clean Air Actions for Better Health and Resilience supported by the Urban Resilience Trust Fund (URTF) financed by the Government of the United Kingdom and the Japan Fund for the Joint Crediting Mechanism (JFJCM).



Authors

Hassan Aftab Sheikh, Ben Caldecott, and Calvin Quek, Oxford Sustainable Finance Group.

Expert Reviewers

The following experts provided invaluable comments and technical reviews of the draft report:

Members of the World Economic Forum's Global Future Council on Clean Air, including Roddy Weller (World Economic Forum), Abdulla Mohammed Al Remeithi (Environment Agency Abu Dhabi), Katharina Amann (Allianz SE), Amy Lee (NationSwell), Eleni Myrivili (Atlantic Council), Yoko Watanabe (Asian Development Bank), Sergio Sanchez (Environmental Defense Fund), Jemilah Mahmood (Sunway University), Enkhuun Byambadorj (Breathe Mongolia), Engineer Bainomugisha (Makerere University), Drew Shindell (Duke University), Vikram Widge (Climate Policy Initiative), Gregga Baxter (Gulf International Bank), Young Sunwoo (Konkuk University), Amit Mehra (Reuters Market Light), Shirley Rodrigues (C40 Cities Climate Leadership Group), Hu Min (Institute for Global Decarbonization Progress), Anumita Roychowdhury (Centre for Science and Environment), Tolu Oni (University of Cambridge), Christa Hasenkopf (University of Chicago), Maria Glynda Bathan-Baterina (Clean Air Asia), and Jane Burston (Clean Air Fund).

The authors express special thanks to the experts who were interviewed as part of this process, including Vikram Widge (Climate Policy Initiative), Gregga Baxter (Gulf International Bank), Clint Bartlett (UNDP), Shirley Rodrigues (former Deputy Mayor for Environment and Energy, London), Hiroaki Takiguchi (JICA), and others who wish to remain anonymous.

The report also benefited from peer review and technical comments provided by Clean Air Fund (Sean Maguire, Rosie Childs, Ella Wingard, Anne Songole, Yannish Naik, Alexandre Batista, Fakri Karim, and Cheran Suriyaprakasam) and ADB (Zeeshan Ali, Bethany Cosgrove, Jennifer Romero-Torres, Maria Katherina Patdu, Karma Yangzom).

Project Coordination Team

The coordination team was responsible for the strategic direction, technical integration, and institutional management of the report.

- **Clean Air Fund:** Rosie Childs (Head of Advocacy); Anne Songole (Advocacy Manager); Ella Wingard (Senior Analyst)
- **ADB:** Yoko Watanabe (Director, Nature and Environment); Karma Yangzom (Principal Environment Specialist); Maria Katherina Patdu (Environment Specialist)

Editorial Team and Production

Copy editing was done by John Mercurio, and design and layout by Rocilyn Laccay.

HOW TO USE THIS GUIDE

This is a guide to the financial instruments, mechanisms, and institutional arrangements that can support clean air action. It draws on a scoping review of academic and grey literature, feedback provided during technical review, and practitioner consultations across multilateral development banks (MDBs) and World Economic Forum (WEF)'s Global Future Council on Clean Air.

This guide is written for practitioners who have already identified action to reduce air pollution, or are considering one and need to work out how to finance it. It is not an exhaustive introduction to air quality or a list of every financing mechanism in use.

One practical question this guide can help you answer is: *Given this intervention, who captures its value, who can pay for it, and which instrument fits?*

If you are part of an MDB or development finance institution (DFI) project team structuring a financing operation: you may start with the taxonomy (Section 3) to classify your intervention, then use Section 4 to identify the repayment source, and Section 5 to identify a suitable financing instrument and use the decision-tree. Section 6.4 sets out what MDBs can do.

If you are a private investor or part of a financial institution and are assessing whether a clean air intervention is suitable for investment: start with Section 6.2 (conditions for investment) and use Table 4 to assess which financial instruments may be suitable before going further.

If you work in a ministry of finance and clean air is part of your fiscal decisions: Section 4.1 (pollution pricing) and Section 9.1 address revenue and budget questions.

If you work in a city or town administration: Sections 6.1 and 9.1 set out the steps to consider, starting with regulation and procurement before seeking external finance.

While interconnected, each section can be read individually and can stand largely on its own; you do not need to read the guide end to end to use it for a specific decision.



The Kusile Power Station, a coal-fired power plant owned by state electricity utility Eskom, Witbank, Emalahleni, South Africa. Kusile Power Station (previously known as Project Bravo), a coal-fired power plant owned by state electricity utility Eskom, in Mpumalanga, South Africa (photo by Gulshan Khan/Climate Visuals).

EXECUTIVE SUMMARY

Air pollution is one of the world's largest environmental health risks, yet clean air action remains a small and highly concentrated part of development finance. Less than 1% of international development finance over 2020–2024 was directed towards outdoor air quality. Across total air quality funding over the same period, 89% took the form of loans, while grants represented nearly 8% (Clean Air Fund and Climate Policy Initiative, 2026). The central constraint is often a lack of projects that are ready and suitable for financing. The health, productivity and fiscal benefits of cleaner air are large, but they are spread across society and occur over the long-term and rarely captured by the entity expected to repay the finance.

The guide's central message is that clean air finance is constrained less by capital than by whether projects are ready for investment and have adequate measurement and contractual arrangements in place. However, capital constraints and institutional barriers frequently coexist. In lower-income countries facing debt distress, restricted fiscal space, high interest rates, and foreign exchange risk, access to highly concessional capital and grant funding remains an essential prerequisite.

Public authorities and financial institutions need credible information on pollution sources and ownership, enforceable standards and monitoring systems, clearly identified payers or repayment sources, and financing structures that match the underlying intervention. Where these elements exist, finance can support and accelerate cleaner investment. Where they do not, financial innovation cannot substitute for data, regulation, enforcement, public expenditure or institutional capacity.

This guide sets out a practical sequence for structuring clean air finance: identify the intervention; identify the benefits it creates; determine who receives those benefits; identify any reliable source of revenue or cost-saving stream; and only then select the appropriate financial instrument. The sequence matters because financial instruments cannot generate revenue where none exists. Debt, bonds, and guarantees work only when there are credible repayment sources, such as fares, tariffs, municipal revenues, budget appropriations, avoided fuel costs, pollution charges or outcome payments. Where there are

no such sources, grants, technical assistance and public expenditure remain indispensable.

The guide distinguishes four broad financing categories, based on how the intervention is funded and whether it generates revenue:

- First, grants, which finance public goods such as emissions inventories, monitoring networks, regulatory design, enforcement capacity, and project preparation. These generally do not generate revenue and depend on donor funding.
- Second, public finance, which finances interventions such as policy reform, public transport systems, municipal waste management, and household energy transitions supported by national or local government budgets.
- Third, commercial finance, which finances revenue-generating assets such as electric bus fleets, industrial retrofits, energy efficiency investments, clean power, and some waste-treatment facilities.
- Fourth, blended finance, which combines public and private finance to support projects where commercial returns are partial, risks are high, or affordability considerations prevent full cost recovery.

This guide also makes the case that the immediate opportunity is to integrate air quality objectives into climate, transport, energy, industrial, waste and urban programmes that are already financeable, rather than creating separate clean air financing systems. This approach only works if clean air indicators influence project selection, design and results frameworks, rather than appearing only as additional benefits in project descriptions.

Beyond these near-term measures, the guide sets out a development agenda to address the underlying conditions that continue to limit clean air finance. Six priorities are set out in Section 9.2. Three of them are foundational, addressing basic gaps in evidence: bringing local air pollutants alongside greenhouse gases into corporate, national and sub-national transition plans; linking asset-level emissions data to the companies and financial

institutions that own and finance polluting assets; and testing whether air pollution risk is already priced into financing costs. Public financial institutions have a distinct role in advancing each through technical assistance, capacity building, and support for financial transactions.

This guide's main recommendations are to:

- Assess potential revenue and repayment sources before selecting a financing instrument and avoid presenting financing structures as substitutes for regulation or public expenditure.
- Use grants and technical assistance to build the essential measurement systems needed for clean air investment, including: emissions inventories, monitoring, regulatory systems, project preparation and credible baselines.
- Integrate air quality indicators into existing climate and infrastructure investment pipelines, especially transport, energy, industry, waste and urban development.
- Use policy-based lending and results-based financing modalities to support regulatory reform and measurable implementation milestones, while using payments linked to ambient air pollution concentration only where changes can be reliably attributed to the intervention and monitored.
- Develop local currency revenue through pollution pricing, congestion charging, fuel and vehicle taxation, dedicated municipal revenues and budget commitments.
- Deploy guarantees and blended finance only where a viable underlying asset or repayment source exists and where de-risking would not mask a missing business model.
- Build a pipeline of transactions that can be replicated. Dedicated clean air bonds or clean air credit mechanisms should remain pilots until evidence, monitoring, reporting and verification (MRV) and issuer readiness improve.
- Treat regulation and public procurement as the primary ways to direct private capital towards clean air outcomes. The amount of private finance mobilised should be treated as an indicator that these measures are working, rather than a goal to be pursued through de-risking alone.

1 INTRODUCTION: WHY FINANCE, WHY NOW?



Air pollution damages health, productivity, and public finances. Exposure to fine particulate matter and other air pollutants contributes to premature mortality and chronic disease and increases the risk of cognitive decline, dementia (Committee on the Medical Effects of Air Pollutants 2022), cardiovascular and respiratory disease, lung cancer (Kampa and Castanas 2008), and diabetes (Bowe et al. 2018). Air pollution increases household and public health expenditures, reduces labour productivity and school attendance, and increases climate vulnerability. These impacts are concentrated in low- and middle-income countries, where pollution exposure is high (World Health Organization 2026) and financial capacity to respond is often constrained.

The financing problem is rooted in market failure. Cleaner air is largely a public good: one person's benefit does not substantially reduce another's, and beneficiaries cannot easily be excluded. Polluters also often do not pay the full social cost of emissions while the benefits from pollution reduction are distributed across households, employers, hospitals, insurers, and different levels of government. The result is a mismatch between who pays for an intervention and who benefits from it. This mismatch is especially acute for monitoring, enforcement, emissions inventories, and airshed management, which are essential to addressing air pollution but do not by themselves generate revenue.

This market failure also distinguishes clean air finance from climate finance. For climate change, a tonne of carbon dioxide equivalent (CO₂e) causes essentially the same amount of warming wherever it is emitted or avoided. This allows global carbon markets, offsets, and netting across countries or projects to function as coherent financial instruments. In contrast, a reduction in local air pollution generally produces no benefit for a population living in another airshed further afield. Air quality is therefore a local or regional public good rather than a global one.

This has important implications for financing. Standardised, globally tradeable financial instruments used for climate change cannot easily apply to air quality. Monitoring, reporting, and verification of air pollution must relate to the affected population and airshed rather than a standardised global protocol. As a result, it is harder to determine how much an intervention has contributed to air quality improvement than to a reduction in carbon emissions. Also, compared with climate change efforts, which focus mainly on fossil fuel combustion, air quality efforts deal with a broader set of sources, including biomass burning, domestic heating, agricultural activity, open waste burning, construction dust, and wildfires. Financing clean air must therefore span transport, power, industry, household energy, waste, agriculture and construction, together with the regulatory systems that govern them, rather than relying on a single technological pathway.

Because key functions such as monitoring, enforcement and standard setting generate no revenue, air quality improvement depends first on regulation and public action rather than on finance. For example, the post-2013 air pollution efforts of the People's Republic of China (PRC) illustrate how major improvements were driven by regulation, administrative targets, and enforcement rather than by financial innovation (Greenstone and Schwarz 2018). Finance plays a complementary role. It pays for cleaner infrastructure and technologies, helps meet the costs of complying with regulations, builds institutional capacity, and helps public authorities implement regulations without imposing unaffordable upfront costs on households, firms, or municipalities. Financial instruments therefore need to support a credible policy and delivery system.

Practitioners also report that public action generally comes before the private investment. A standard is set or a procurement rule is written, and private investment follows, rather than finance arriving first and driving policy change. Tightening a regulatory standard, as with European vehicle emission requirements, encourages fleets and manufacturers to invest in compliant

technologies, where there is credible testing and enforcement (Reynaert 2021), requiring no dedicated financing product. Public procurement operates in a similar way. When governments specify low-emission vehicles, equipment, or fuels in their own purchasing, they create a demand that manufacturers, suppliers, and lenders respond to. Mobilising private finance therefore depends on how deliberately public authorities use the regulatory and procurement measures they have available.

This guide sets out a sequence of practical questions for practitioners financing clean air. After reviewing the current state of clean air financing (Section 2), it asks what counts as a clean air investment (Section 3); what value the investment creates, who receives that value, and what revenue or cost savings it generates (Section 4), which financial options are suitable (Section 5), how private capital can be mobilised (Section 6); and where different approaches have worked, failed or remains untested (Sections 7 and 8), before setting out final recommendations (Section 9).

Air pollution near the Belchatow power plant in Rogowiec, Poland.
Belchatow coal-fired power plant. (photo by Anna Liminowicz / Climate Visuals).



2 THE CURRENT STATE OF CLEAN AIR FINANCING

Clean air finance is small, loan-dominated, and geographically concentrated, with less than 1% of international development finance during 2020–2024 supporting outdoor air quality (Clean Air Fund and Climate Policy Initiative, 2026). Loans accounted for 89% of total air quality finance over 2020–2024, with grants making up nearly 8%. Three recipients, the Philippines, India and Bangladesh, received over half of outdoor air quality funding in 2020–2024, and South Asia received nearly a third of total air quality finance in the same period, 44% more than the next largest region (Clean Air Fund and Climate Policy Initiative, 2026). These figures describe only the flows explicitly tracked and labelled as clean air finance; as the co-benefit discussion below illustrates, a substantial amount of finance already supports clean air outcomes without being counted, or recognized, as such.

This concentration partly reflects where existing financial systems can deploy capital. Transport, energy, and urban infrastructure can absorb large loans and often have sovereign backing, utility revenues, or identifiable assets. By contrast, air quality monitoring, enforcement, industrial compliance support, open burning reduction, and regional airshed management have weaker revenue potential and often require grants or public budget expenditure. The dominance of debt therefore does not necessarily show that debt is the most appropriate instrument. It may instead reflect development finance institutions deploying instruments they have at scale into sectors that can already support conventional lending.

A further issue is the classification of air quality as a co-benefit. Much of the finance that improves air quality is counted under climate mitigation, energy transition, transport or urban development. While this can be effective where air quality is material to project design and monitoring, it becomes problematic where the health benefit is only recognized after project design without influencing technology choice, geographic targeting, beneficiary selection, or results measurement. A credible co-benefit strategy must therefore move from simply recognizing clean air benefits to measuring them in ways that inform investment decisions. This is a harder task for air quality than it has been for climate, given the various issues set out in Section 1.

For these reasons, dedicated clean air financial instruments remain rare. A few clean air bonds have been issued, but two bond issuances backed by guarantees under the Asian Development Bank (ADB)'s Greater Beijing–Tianjin–Hebei green finance facility are still the main example, and they have yet to be replicated in other markets. The proposed Breathe Better Bond (Climate Policy Initiative 2019) did not progress to issuance, highlighting constraints in municipal finance, technical preparation, investor confidence, and the underlying project pipeline. More general policy-based lending in Mongolia (Cardascia et al. 2022) illustrates how finance can support regulatory and institutional measures addressing household coal use and outdoor air pollution, even when the intervention itself does not generate a commercial revenue stream. These examples show the importance of matching the financing instrument to the type of clean air intervention, rather than expecting all interventions to generate commercial returns.

3 WHAT COUNTS AS CLEAN AIR FINANCE? A WORKING TAXONOMY

An **“air quality project”** is an intervention that reduces emissions, concentrations, or exposure; **“clean air finance”** is the funding or financing that enables it; and a **“clean air outcome”** is the measurable change that results from it. The three do not always align. A project may deliver an air quality outcome without ever being labelled clean air finance, while a labelled instrument may produce little air quality impact if its eligible assets or performance indicators are weak.

This guide proposes a working taxonomy of clean air interventions built on two questions. First, is air quality the primary purpose of the intervention or a co-benefit of something else? Second, who pays: a donor (through a grant or concessional lending), a public budget (publicly financed), a market-priced user charge or cash flow (commercially financed), or a combination of these sources (hybrid)? Together, the answers help narrow down the financing instruments that are most suitable, and the paragraphs that follow take each question in turn.

Primary-purpose interventions are designed explicitly to improve air quality: monitoring networks, emissions inventories, regulatory systems, source apportionment studies, inspection and maintenance regimes, open burning controls, and city or regional clean air plans. These interventions provide widely shared public benefits and generate little or no revenue of their own. As such,

they are typically financed through grants, technical assistance, and public expenditure, with policy-based or results-based lending possible where clear reform milestones can be defined.

In contrast, co-benefit interventions are designed to achieve objectives beyond reducing air pollution, such as improving transport options or energy efficiency. Their ability to attract and repay financing depends on the underlying sector and project. For example, an electric bus transport project may rely on fare revenue and a municipal service contract; an industrial retrofit may rely on energy savings and improved cash flow; and a waste facility may rely on tipping fees or municipal payments. While these interventions also bring air quality benefits that strengthen the public case (and this may influence the terms of concessional finance and how results should be measured), the air quality component itself does not usually generate the revenue used to repay the financing.

The proposed taxonomy below sits alongside the sectoral sources introduced in Section 1 and follows a similar logic to the Air Quality Toolkit for Development Finance Institutions (Day et al. 2025). Table 1 shows one example intervention for each of the four categories, showing how the expected outcome, source of payment, and revenue potential help determine suitable financing.

Table 1: One Example Intervention For Each Financing Category

Financing category		Air quality outcome	Main value created	Who pays	Revenue or saving	Suitable instruments
Grant financed	Monitoring network	Better measurement and enforcement	Improved public decision-making	Government/public	No direct revenue	Grant ^a , technical assistance, concessionary loan ^b
Publicly financed	Open burning controls	Reduced local and regional exposure	Health and agricultural benefits	Diffuse public beneficiaries	Normally no direct revenue	PES ^c , grants, budgets, results-based public lending, policy-based loans ^d
Commercially financed	Industrial retrofit	Reduced stack emissions	Compliance and energy savings	Industrial operator	Firm cash flow and avoided energy costs	Corporate debt ^e , intermediary finance, guarantee
Hybrid	Electric bus fleet	Lower PM and NO _x emissions	Lower fuel and maintenance costs; public-health benefit	Operator, municipality, passengers	Fares, service payments, avoided fuel costs	Debt ^f , grant ^g , guarantee, blended finance ^h

NO_x = nitrogen oxides; PES = payments for ecosystem services; PM = particulate matter

^a Energy Policy Institute at the University of Chicago (EPIC). [Air Quality Fund: The Case for the Fund](#).

^b World Bank. 2025. [Pakistan: World Bank Supports Punjab's Smog Mitigation Action Plan with \\$300 million Concessional Loan](#). Press Release. 27 March.

^c Yale Inclusion Economics. [Farmer Payments to Reduce Crop Burning in India](#).

^d Asian Infrastructure Investment Bank (AIIB). 2025. [AIIB Approves USD1 Billion Climate-Focused Policy-Based Loan to Support Brazil's Ecological Transformation Plan](#). News Release. 10 November.

^e B. Peng, W. Yan, E. Elahi, and A. Wan. 2022. Does the Green Credit Policy Affect the Scale of Corporate Debt Financing? Evidence From Listed Companies in Heavy Pollution Industries in China. *Environmental Science and Pollution Research*. 29(1). pp.755–767.

^f Emerging Africa & Asia Infrastructure Fund. [€AIF Extends E46 Million to Establish Africa's First Fully Electric Bus System in Senegal. The Next Generation of Urban Mobility in Africa](#).

^g ADB. [Kyrgyz Republic: Urban Transport Electrification Project](#).

^h ADB. 2022. E-buses Drive Lower Emissions. [Partnership Report](#).

Source: Compiled by authors.

4 VALUE CREATION AND REVENUE

The health case for cleaner air is compelling but does not automatically create a financing case. Avoided mortality, lower health expenditure, and higher productivity are economic benefits but do not generally generate cash flows that can repay financing. The central financing question is therefore which entity receives a cash flow benefit, has a budget obligation, or can impose a charge. The value of clean air alone does not answer this.

4.1 Pollution pricing as a revenue-creation route

Pollution pricing measures are a useful way to raise revenue for action on air pollution. These measures, which include fuel and vehicle taxes, congestion charges, dirty fuel surcharges, industrial emissions fees, and low-emission-zone charges, serve two purposes: they raise the cost of polluting activity, which can encourage changes in behaviour, and they generate local currency revenues that can fund public expenditure, repay municipal debt, capitalize a trust fund, or support a bond (Table 2). However, pollution pricing is underused in clean air finance because of a few drawbacks, which can sometimes be mitigated.

Pollution pricing often faces political economy constraints, particularly in developing countries, where charges may fall disproportionately on households and small enterprises. Affected sectors may organize against the measures, and weak local collection capacity can limit the revenue raised.¹ Pollution pricing measures are therefore more durable when they are phased in, paired with support for affected groups, and accompanied by affordable clean alternatives.

Another drawback is that pollution pricing, if successfully implemented, can shrink its own revenue base for action on air pollution as transport fleets and fuels become cleaner. Finance for such actions should therefore not depend solely on a growing or even stable pollution tax (Table 2). Revenues from such taxes may be better suited to time-limited purposes: transition funding, credit enhancement, or capital programmes with a defined end date. Longer-term financing may need to shift towards broader taxes, fares, or service payments.

4.2 The co-benefit financing route

In a constrained development finance environment, a scalable pathway is to integrate clean air outcomes into existing climate, health, transport, energy, and urban investment pipelines. This does not mean that air quality should remain an incidental benefit. Multilateral development banks (MDBs) and governments can require projects in high pollution areas to assess local air pollution impacts, compare technology alternatives, include air quality indicators in results frameworks, and report changes in exposure or emissions. This makes air quality a financing-relevant design criterion as the Santiago fleet programme (Case study 1), the Hebei programme (Case study 2), and the Beijing-Tianjin-Hebei (BTH) facility (Section 2) illustrate.

¹ For example, Chile's green tax (2017); China's Environmental Protection Tax (2018); Delhi's Environment Compensation Charge

Table 2: Revenue and cost-saving models

Revenue model	How value is captured	Clean air applications	Limitations
User fees and tariffs (Dole and Bartlett, 2004)	Payment for a service	Public transport fares, electricity tariffs, waste-treatment fees	Affordability and cost- recovery constraints
Municipal or sovereign revenues (Farvacque-Vitkovic and Kopanyi, 2014)	Taxes and general revenues support debt service	Transit, monitoring, waste, enforcement	Fiscal space and creditworthiness
Budget-backed service or availability payments (World Bank, 2017)	Public authority pays for service availability or performance	Bus concessions, inspection services, pollution-control operations	Requires credible multi-year budget commitments; exposed to annual appropriation and fiscal-capacity risk
Avoided operating costs (Brooks et al., 2025)	Reduced fuel, energy, maintenance, or input costs	Industrial efficiency, electric fleets, clean energy	Savings may be uncertain or captured by another entity
Pollution charges, taxes, ETS (Greenstone et al., 2025)	Polluter-pays charges create local-currency revenue	Fuel surcharges, congestion charging, tyre or vehicle fees, emissions fees	Political resistance; revenue may decline as pollution falls
Environmental or air pollution market revenue	Sale of verified credits or allowances	Carbon-linked clean cooking, emissions trading, potential air quality credits	MRV, additionality and price volatility
Outcome payments	A third party pays for a verified output or result	Fleet conversion, clean cooking, emission reductions	Difficulty attributing results and the need for financing upfront

ETS = emissions trading scheme; MRV = monitoring, reporting, and verification

Source: Compiled by authors.

Table 3: Co-benefit financing: where it has worked, and what it suggests for clean air

Channel	Where it has worked	What it suggests for clean air
Transport	Public transport investment, fleet renewal, policy-based lending and guarantees can support air quality gains alongside mobility objectives.	Air quality indicators should be built into transport lending, fleet procurement and city mobility plans.
Energy transition	Clean power, electrification and efficiency investments are often financed through climate and energy mandates, with air quality treated as a co-benefit.	Clean air benefits should be made explicit through air pollution baselines, technology comparisons and reporting.
Industry	Industrial emission reduction and efficiency can be financed through sovereign lending, intermediary finance, guarantees, and blended finance.	Use compliance needs and operating cost savings as the financing anchor, with air quality outcomes tracked as part of project results.
Regulation and procurement	Standards, vehicle regulations and public procurement can mobilise private capital without creating a new financial product.	Public action can create the market signal that encourages finance to follow the standard or procurement commitment.

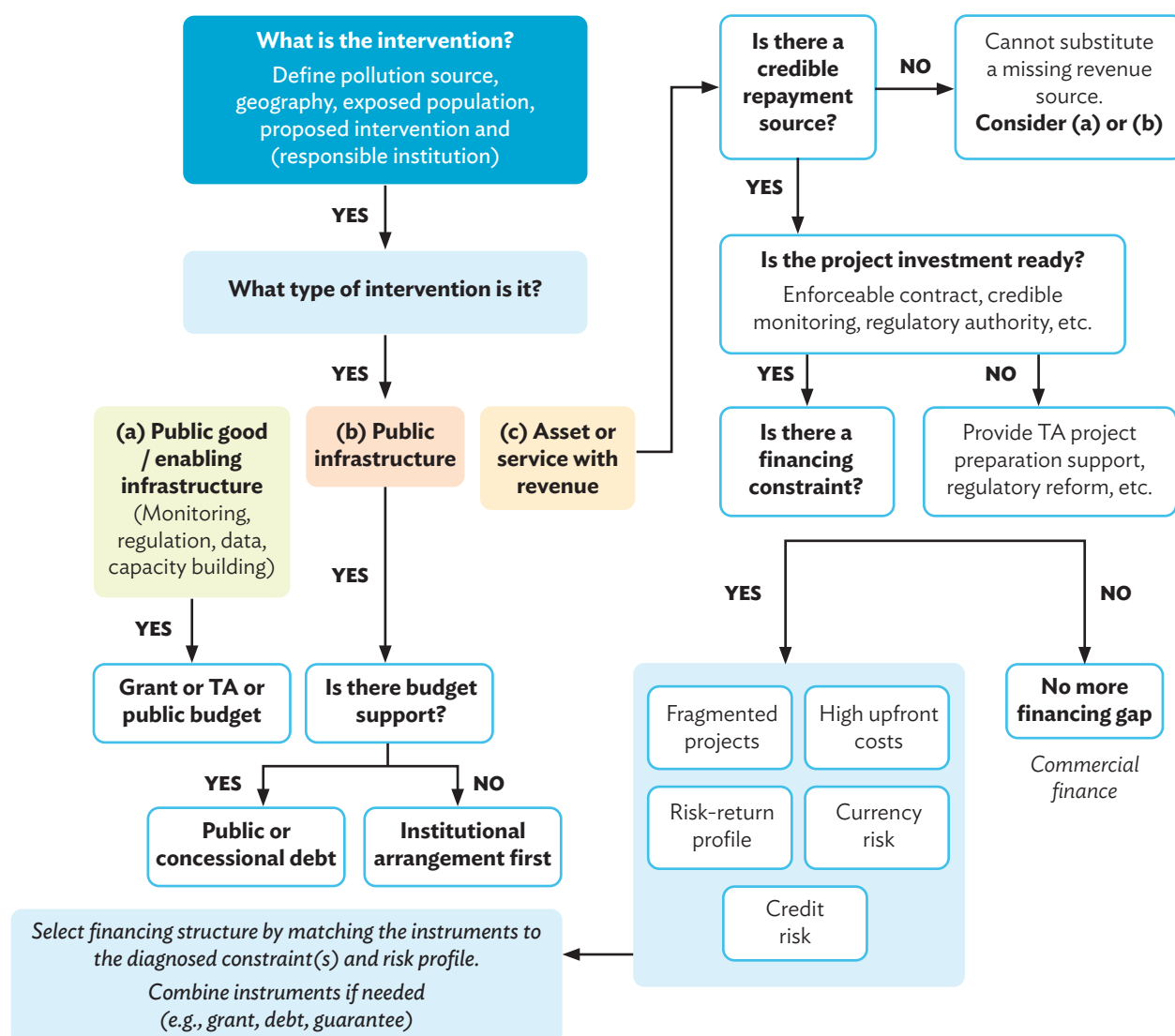
Source: Compiled by authors.

5 FINANCIAL INSTRUMENTS

Selecting an appropriate financial instrument should follow a structured diagnostic approach. As Figure 1 shows, the process starts with the type of intervention and its economic characteristics (public good, public infrastructure, or revenue-generating asset), then considers the repayment or budget source, investment readiness, and the specific financing constraint.

Because it tests for a credible repayment source before considering readiness or ways to reduce risk, it directs practitioners to debt, guarantees, or blended finance only where a business model can support them, and to grants, technical assistance, or capacity building where no revenue source exists.

Figure 1: Decision Tree for Choosing a Financial Instrument



TA = technical assistance

Source: Authors.

Building on this, Table 4 summarizes the key financial instruments for clean air, which are discussed in

Sections 5.1 to 5.6. Section 8 applies three cases to the decision tree.

Table 4: Financial instruments for clean air: indicative use cases and limitations

Instrument	Financing category	Purpose	Use in clean air	Best-fit clean air project phases	Limitations
Grants or TA	Grant financed	Fund public goods and early-stage capacity	Project readiness, data, MRV, regulation	Monitoring systems, emissions inventories, enforcement capacity, policy reform	No repayment source, limited scale
Concessional, non-concessional debt	Publicly financed or commercially financed ^a	Finance assets with repayment capacity	Capital-intensive public investment	BRT, rail electrification, waste facilities, clean energy, industrial controls	Needs a budget line or revenue stream
Guarantees	Commercially financed (revenue stream already exists)	Reduce investor and lender risk	Bankable or near-bankable projects with political, credit, or currency risk	Urban transport, utility upgrades, pollution-control infrastructure	Does not solve weak revenue
Blended finance	Hybrid	Combine public and private capital to improve the balance between risk and return	Projects in the middle: strong social benefits but not yet attractive to private finance alone	Clean transport, industrial efficiency, clean cooking scale-up	Complex structuring, still needs a viable project
Thematic bonds or SLBs	Publicly financed or commercially financed*	Raise market capital for creditworthy issuers	Larger issuers with reporting and monitoring capacity	Green transport, clean energy, industrial efficiency, citywide air targets	Weak fit where issuer or MRV capacity is limited
Results-based finance	Any (payer varies by the outcome being financed)	Pay for verified outputs or outcomes	Where attribution and verification are feasible	Fleet conversion, selected emission reduction disbursements	Ambient outdoor air outcomes are hard to attribute.

BRT = bus rapid transit; MRV = monitoring, reporting, and verification; SLB = sustainability-linked bond; TA = technical assistance

^a Depending on whether repayment comes from budget or revenue.

Source: Compiled by authors.

5.1 Grants and technical assistance

Grants are an appropriate instrument for activities that build public capacity and help prepare a project. ADB's US\$4.13 million regional technical assistance (TA) project (ADB 2025) illustrates how a TA grant can support clean air policies, institutional capacity, and the design of clean air investments, all of which can make downstream investment viable. The grant itself is a catalyst and does not generate direct revenue (Table 4). Instead, the grant pays for credible data, enforceable standards, and prepared project pipelines, without which later debt or private investment may be difficult to price.

5.2 Concessional debt and thematic bonds

Debt accounts for most international public finance for air quality. It is associated mainly with capital-intensive interventions delivered through transport, energy, urban infrastructure, industrial pollution control, waste management, and household energy transitions. Debt finance for clean air falls into two categories. Concessional loans carry below-market interest rates, longer maturities, and grace periods. Non-concessional loans suit borrowers with stronger repayment capacity or projects with clearer revenue streams.

Policy-based lending can support reforms such as fuel quality standards, emissions standards, inspection systems, and subsidy reform. Municipal and sub-sovereign loans can support city-level clean air plans where local governments have fiscal autonomy and creditworthiness (Qi et al. 2022). Financial intermediary lending can support cleaner technologies for firms and households.

Debt has limits. Many low- and middle-income countries and cities, many of which are heavily affected by air pollution, have limited fiscal space and debt sustainability concerns (World Bank 2025a). Where debt distress is acute, additional market-rate borrowing is neither viable nor sustainable, and concessional debt, grant blending and local currency financing may be needed to bridge affordability gaps and avoid adding to the strain on sub-sovereign and national balance sheets.

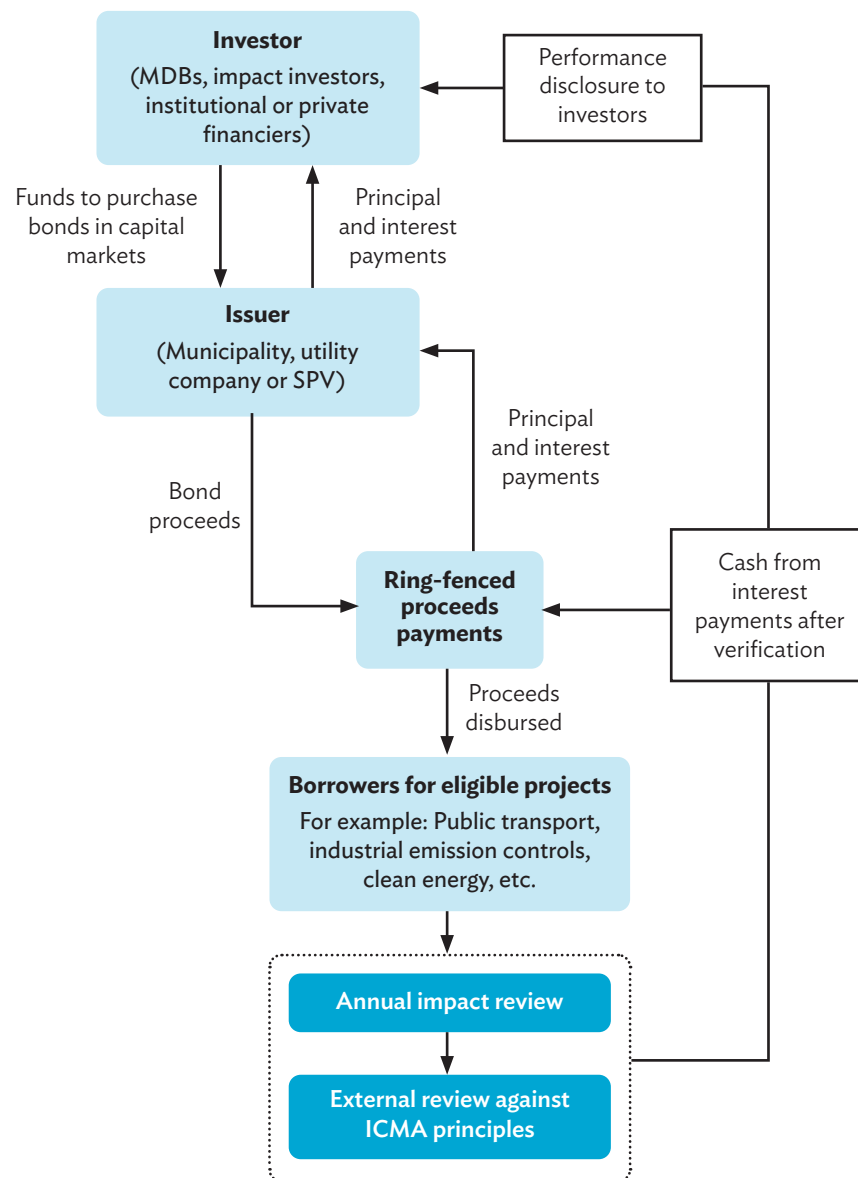
Bonds are a form of debt and therefore face the same fundamental requirements: a creditworthy issuer, a manageable balance-sheet impact, and a repayment source. Use-of-proceeds bonds (Figure 2) add transparency by ring-fencing eligible categories and requiring impact reporting. Sustainability-linked bonds (Figure 3) link financial terms to issuer-level key performance indicators (KPIs), but air quality KPIs such as fine particulate matter ($PM_{2.5}$) concentrations can be difficult to attribute and verify. For most issuers, the near-term opportunity is to include relevant clean air investments and indicators in broader green, sustainability or transition frameworks rather than launch a stand-alone clean air bond. Finance guided by such frameworks is particularly relevant for industry, where air pollution reductions come through modernisation, fuel switching, and efficiency. Embedding air quality indicators in transition frameworks captures these outcomes without a stand-alone instrument.

A thin line of smog hovers above the ger district in Ulaanbaatar, Mongolia. During winter, when temperatures drop below -30 degrees Celcius, the air quality also drops to hazardous levels because of over-dependence on burning cheap raw coal for heating and cooking (photo by ADB).



Figure 2: Financial Structure of a Use-of-Proceeds Bond for Clean Air

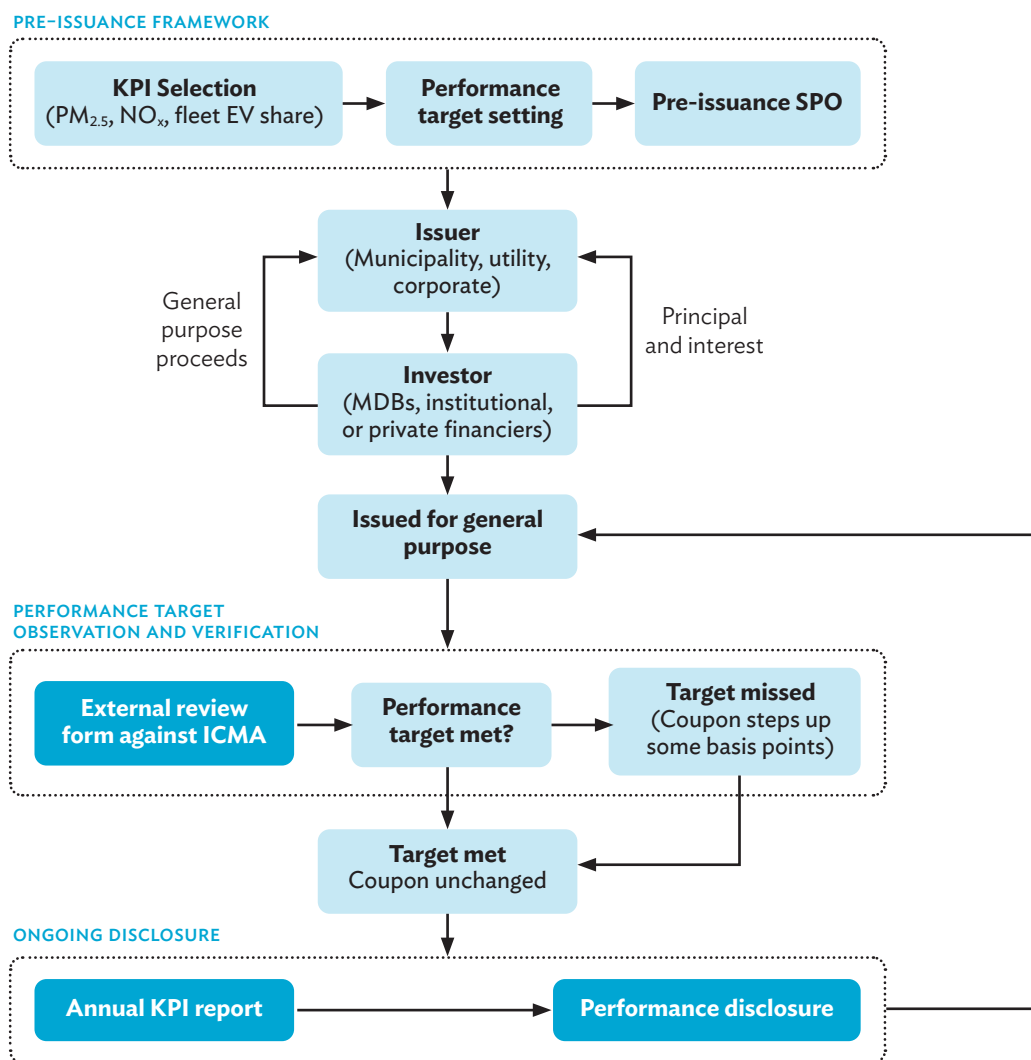
Proceeds are held in a ring-fenced account and disbursed only to eligible projects. Annual impact reporting and external review in accordance with the International Capital Market Association (ICMA) Green Bond Principles are disclosed to investors.



ICMA = International Capital Market Association; MDB = multilateral development bank; SPV = special purpose vehicle
Source: Authors.

Figure 3: Financial and Governance Structure of a Sustainability-Linked Bond

Proceeds are for general purposes. The coupon is linked to issuer-level targets such as reductions in PM_{2.5} or nitrogen oxides (NO_x) or increase in the share of the fleet that is electric, verified through monitoring and external review. Missing a target may trigger a coupon step-up, raising borrowing costs.



EV = electric vehicle; ICMA = International Capital Market Association; KPI = key performance indicator; MDB = multilateral development bank; NO_x = nitrogen oxides; PM_{2.5} = fine particulate matter; SPO = second-party opinion

Source: Authors.

A bond is attractive when it aggregates a sufficiently large pipeline, supports repeat issuance, and can build a market. A small, one-off transaction may face disproportionate legal, verification, and transaction costs. Municipal issuers

may also lack legal authority, audited accounts, credit ratings or predictable revenues. Credit enhancement can address some of these constraints, but not the underlying absence of fiscal autonomy or repayment capacity.

5.3 Guarantees and risk sharing

Guarantees transfer a defined risk and are suitable where the project already has a credible revenue stream, but commercial lenders remain concerned about political, regulatory, currency, credit, or performance risk. The Dakar Bus Rapid Transit project illustrates how political risk coverage can support urban infrastructure with air quality co-benefits (MIGA 2023). The World Bank Group Guarantee Platform and Multilateral Investment Guarantee Agency (MIGA)'s clean air commitment create a potential institutional base, but deployment should be assessed based on actual transactions rather than forward-looking pledged volumes.

5.4 Blended finance

Blended finance is appropriate where an intervention has a credible path to commercial sustainability, but its risk-return profile prevents private capital from participating on fully commercial terms. Blended finance can absorb or rebalance defined risks, but it cannot transform a poorly conceived or unviable project into a sound investment. It should therefore be targeted at identified market failures, use the minimum concessionality required, and be reduced as the market matures (International Finance Corporation, 2025). A blended structure may combine a preparation grant, concessional debt, a first-loss tranche, a guarantee, and commercial senior capital.

Blended finance is relevant for small and medium-sized enterprise (SME) pollution control equipment (Bambe and Tamasiga 2026), clean cooking, fleet conversion (Convergence Blended Finance 2018) and distributed energy (GOGLA and Dalberg Advisors 2025).

However, blended finance should not become a euphemism for using scarce public capital to compensate investors for non-commercial projects.

ADB's Innovative Finance Facility for Climate in Asia and the Pacific (IF-CAP) (Aboneaaj and Landers 2023) illustrates a balance-sheet leverage model. Donor partners guarantee a portion of ADB's existing sovereign loan portfolio, enabling each dollar of guarantee to support five dollars of intended new lending. The approach could

benefit clean air outcomes where eligible pipelines include transport, energy, and industrial pollution abatement. The practical opportunity is to recognize and measure air quality outcomes in the projects unlocked by such facilities.

Blended finance also operates through concessional trust funds and co-financing arrangements involving the Urban Resilience Trust Fund, the Japan Fund for the Joint Crediting Mechanism, and other regional facilities. These can extend concessional support and risk sharing to clean air projects that would otherwise be unattractive to commercial investors. Blended finance is therefore appropriate when an intervention has a partial but insufficient commercial return and requires a combination of financial instruments.

5.5 Results-based finance

Results-based finance (RBF) links disbursement to verified outputs or outcomes. It is promising where attribution is clear, such as scrapping and replacing a diesel bus, installing and operating a pollution control unit, connecting a household to clean energy, or achieving a regulatory milestone. Ambient air pollutant concentration is closer to the health objective but harder to attribute because weather, economic activity, and multiple sources affect measured pollution. The practical rule is to pay for verifiable intermediate outputs where the causal chain is strong and use concentration-linked payments only where baseline data, counterfactual design, and monitoring data are robust.

The literature on RBF for outdoor air quality specifically remains limited, but two applications stand out.

The first is emission reduction-linked disbursement, in which a public funder or development bank releases tranches against measured falls in a defined pollutant across a city or industrial cluster. The appeal is that payment attaches to an outcome more closely linked to health impacts, the concentration of pollution in the air people breathe, rather than to inputs or activity counts. Accurate attribution of the improvement, a difficulty for any air quality intervention, matters here because payment depends on it. A measured fall in PM_{2.5} can

reflect weather, economic activity, and other policy measures, as well as the funded intervention. Weak attribution also creates an incentive to game the measurement. An implementer may site monitors favourably, claim ambient improvements driven by factors outside the intervention, as has happened in carbon markets (Wong et al. 2016), or optimise the metric rather than the health outcome it represents.

The last of these has a precedent in health, where pay-for-performance can change simple, discrete behaviours in the short term while long-term, system-wide change is less certain (Oxman and Fretheim 2009). Credible RBF for air quality therefore needs a baseline, a counterfactual, and monitoring to a standard that many low- and middle-income cities do not yet have. Without that measurement base the payment trigger is contestable, and the instrument cannot reliably link payments to results.

The second is vehicle fleet conversion, where disbursements reward the verified replacement of older, higher-emitting vehicles, most often diesel buses or two- and three-wheelers, with cleaner or electric vehicles. Attribution is more tractable here than for ambient concentrations, because the result is a counted, registrable event: a scrapped vehicle and a commissioned replacement can be logged, inspected, and tied to a payment with relatively modest monitoring. That makes fleet conversion one of the more practical near-term candidates for outdoor-air RBF. Conversion counts are an output rather than an air quality outcome. A programme that pays only per vehicle may register strong delivery while local exposure changes little if the new fleet is small relative to the source mix or if scrapped vehicles return to service elsewhere.

The two applications expose the same tension. Outputs are easy to verify but may be weak proxies for exposure, while changes in exposure can be difficult to attribute to

an intervention, a challenge also observed in agri-environmental payments (Sidemo-Holm et al. 2018; Stritzke et al. 2021).

ADB's results-based lending modality can also support government programmes by disbursing against agreed programme results and institutional actions (ADB 2012). For clean air, this may be more realistic than a stand-alone impact bond because it can connect financing to government systems, regulatory reform, and implementation capacity.

5.6 Public procurement as a financing lever

Procurement is not usually classified as a financial instrument, but practitioner consultations suggest it is one of the most powerful levers governments already hold. Public bodies routinely purchase vehicles, equipment, and services. Specifying low-emission requirements in tenders for municipal bus fleets, government vehicles or waste-collection contracts creates a guaranteed demand volume that manufacturers and their financiers can plan around. Unlike blended finance or guarantees, procurement requires no new financial product. It reallocates existing public spending towards cleaner technology and, at sufficient scale, can shift private capital and market pricing without a subsidy. Its main limitation is institutional and legal rather than financial. It depends on public bodies' capacity and willingness to specify and enforce standards in their own contracting. Mandated standards can extend the same logic beyond government purchasing. Thailand's requirement that imported maize for animal feed be certified free of open-field burning creates demand for burn-free crops without a separate financing instrument (The Nation 2026).

6 MOBILISING PRIVATE FINANCE

Framed against the four financing categories in Section 3, this section is about movement between them. Private capital enters directly only at the commercially financed end, or at the hybrid end where risk is partially absorbed by public capital and is generally not suited to grant-financed or purely publicly financed projects. Private capital can finance clean air assets, but it will not finance diffuse public benefits in the absence of a payer. The relevant question is therefore how to create investable assets, credible contracts, and acceptable risk allocation.

6.1 Barriers

Mobilising private capital requires addressing institutional and financial barriers simultaneously. The absence of a viable revenue stream or contract is often the first bottleneck. However, high capital costs, foreign exchange mismatches, and macro-fiscal constraints in developing markets mean that policy clarity alone will not automatically attract commercial investment without targeted concessionality or risk sharing. This is especially true for monitoring, enforcement and other public good functions, where benefits are spread out and any cash flow is usually provided through a public budget or donor contribution. Even where a repayment source exists, municipal credit constraints, limited fiscal autonomy, and weak legal authority to borrow or pledge revenues can prevent projects from reaching the market (World Bank 2025b). Similar barriers are documented in nature projects where small and fragmented pipelines, uncertain regulation, weak enforcement, foreign exchange mismatches between hard-currency debt and local-currency revenues, limited MRV and high attribution costs can further weaken bankability (Sheikh et al. 2025). As a result, clean air projects are most financeable when they are backed by credible public commitments, concessional support, guarantees, or results-based payments.

6.2 Conditions for investment

Private investment becomes realistic when six conditions align: a clearly defined asset or service; a capable sponsor; an enforceable contract; a predictable revenue or payment source; proportionate monitoring; and a policy environment that supports the project over its financing horizon. Clean air benefits can strengthen the social case, eligibility for concessional support, and investor impact reporting, but they do not replace these conditions.

Aggregation is especially important. Financial intermediary structures can provide credit lines to local banks or specialized facilities that on-lend to SMEs for boilers, kilns, filters, energy efficiency, or cleaner fuels. Standardised eligibility criteria, equipment lists, technical assistance and partial guarantees can reduce transaction costs. Similar aggregation can be used for municipal bus fleets, distributed energy, or waste projects.

6.3 What private investors and financial institutions can do

Private capital has generally been treated as the last mover in clean air finance, brought in once an MDB, development finance institution (DFI), or donor has already structured the deal. However, private capital providers can apply their own screening criteria, set out in Section 3, Table 1, to establish which interventions have a revenue model and are therefore commercially financeable without public financial support.

Private capital providers should ask what the concessional layer in a transaction intends to achieve. Where it closes a pricing gap for a viable project whose risk-adjusted return does not yet meet commercial requirements, the underlying revenue model is intact, and the investment



A Steel Mill in Termitau, Kazakhstan (photo by ADB).

case can remain viable after the subsidy. Where it substitutes for a missing revenue model (Section 5.4), returns depend on the concessional support continuing, and adding more support does not change that. The intervention needs a revenue source, or a different instrument that does not require one.

Where the revenue base comes from public sources, the associated risk should be priced accordingly. If repayment depends on a pollution charge or ring-fenced public revenue (see Table 2), that revenue can shrink as the intervention succeeds.

Many individually strong clean air interventions are too small to justify standalone transaction costs. Where that is the main constraint, engaging MDB or DFI counterparts on financial intermediary lending or pooled procurement structures (Section 6.2) may offer a faster route to deployment than waiting for larger single transactions to emerge.

6.4 What MDBs can do

Multilateral development banks can choose between structuring an operation around an air quality-specific instrument and embedding clean air outcomes in an existing pipeline. In many developing countries, lack of

projects ready for finance is a greater constraint than the choice of instrument, so project preparation is key. Possible actions by MDBs include:

- Fund project preparation, transaction design, legal structuring and MRV before seeking mobilisation targets.
- Use policy dialogue and policy-based lending to establish standards, pricing, enforcement and municipal authority.
- Offer local-currency lending, hedging or guarantees where currency risk is the main constraint and provide partial credit or political-risk guarantees for near-bankable assets.
- Support financial intermediary programmes for SMEs and households, with verified technical standards and outcome reporting.
- Develop repeatable programme structures and a replicable pipeline of transactions.
- Work with the technical knowledge that already sits within government: ministries of climate change, environment and health already understand local pollution sources.
- Support regional or airshed-level coordination and financing mechanisms where air pollution and its sources cross national or sub-national boundaries. This can complement interventions designed at the single-project or single-country level.

7 LESSONS FROM ADJACENT PUBLIC GOOD SECTORS

Renewable energy, public transport, water and sanitation, and roads show that private finance can scale only when public institutions first define service obligations, tariffs, subsidies, contracts and regulation (Fabre and Straub 2023).

For example, renewable energy has scaled through long-term offtake agreements, standardized procurement, grid rules, and policy support (Miller 2020). Public transport concessions rely on fares, availability payments, municipal support, and fleet contracts. Water and sanitation projects often combine tariffs with public subsidies and guarantees.

A comparable dynamic is visible in adjacent circular economy markets. Recycled aggregate for road-base construction has become a commercial market in jurisdictions such as the Netherlands, where demolition-derived aggregate now covers effectively all domestic road-base demand (Zhang et al. 2020), driven by certification standards and procurement specifications rather than grant funding. For many clean air-adjacent projects, the main constraint is the absence of demand-side rules that make the cleaner input the default procurement choice, rather than fiscal space.

Clean air initiatives can apply these structures where the intervention is asset-based, but not where the core function is monitoring or enforcement. Those functions remain public responsibilities even if private contractors provide parts of the service.

Results-based financing in the health sector has improved discrete and measurable behaviours, but system-wide outcomes proved harder to attribute and sustain. The same attribution problem applies to air quality, where outcomes may need to be measured across a wider area. A payment for installed equipment is easy to verify but may be a weak proxy for exposure reduction; an ambient PM_{2.5} target is meaningful but influenced by many sources and external factors. Instrument design has to trade off what can be measured against what matters.

The lesson across these sectors is that a public benefit becomes financeable when an accountable entity commits to pay for a service, permits a user charge, or creates a regulated market.

8 PRACTICE VALIDATION: WHAT WORKS, WHAT FAILS AND WHY

The evidence and practitioner experience converge on several conclusions.

First, the health narrative alone does not close the financing gap. Financiers require a repayment source, risk allocation, and a credible delivery mechanism. Health benefits justify public support and can guide project selection, but they are not normally monetisable at project level. Attempts to build a structure around future health savings should be treated cautiously unless a health payer makes an enforceable outcome commitment.

Second, finance works best when attached to regulation or an existing service market. Fuel standards, emissions limits, vehicle policies, industrial permitting, and municipal transport plans create demand for cleaner assets. Without enforcement, concessional finance may subsidise investments that firms or households have little incentive to maintain. Practitioners add that the causal direction usually runs from regulation and procurement to private capital. A tightened standard forces reallocation of capital towards compliance. Public procurement of vehicles, equipment, and services is itself a demand-side lever that can move private capital and pricing without a new financial product.

Third, institutional and legal readiness are often more constraining than the availability of capital. Municipalities may lack authority to borrow, levy charges, enter into long-term offtake agreements or ring-fence revenues. Investors may face small projects, weak accounts, and uncertain procurement. Early-stage legal, technical, and financial preparation is, therefore, an investment in bankability.

Fourth, co-benefit financing is an important near-term route. Clean air outcomes should be built into the design of climate, transport, energy, industrial and urban programmes. This requires practical changes: source-sensitive project appraisal, clean air KPIs, emissions

and exposure baselines, technology comparisons, and reporting that is proportionate to the transaction.

Fifth, replication matters more than labels. A dedicated clean air bond may attract attention, but an instrument that cannot be repeated, aggregated, or serviced will not create a market. Labels do not alter the underlying financing economics, such as the repayment source, the risk allocation and the counterfactual. Bond proceeds are also fungible at the issuer level. Standardised programmes for electric buses, industrial retrofits, brick kilns, clean cooking, waste burning, and monitoring can create more durable financing channels than a single bespoke issuance.

Sixth, air quality credit mechanisms and pollution markets warrant experimentation as the evidence is thin. Their prospects depend on regulatory caps, reliable measurement, additionality, enforcement and demand. Pollution pricing through taxes, fees and charges, or cap-and-trade markets is currently more mature as a revenue-creation route than a voluntary clean air credit market.

Seventh, a persistent misconception is that private capital or new technology, on their own, can substitute for public action. Core government functions include regulation and monitoring, and most of the capital already in the system is private. The practical task is to make private capital respond to clear rules and demand signals. MDBs and financiers often already have access to the relevant technical knowledge within government agencies they are trying to support, and a durable approach is to work with and strengthen that existing capacity rather than design new instruments or institutions around it.

Eighth, air pollution does not respect administrative boundaries. An intervention in one jurisdiction can change air quality in a neighbouring one, which strengthens the case for regional, airshed-level coordination and financing

alongside single-project or single-country design approaches. The World Bank's 2024 loan of \$416 million to Türkiye for its Industrial Emissions Reduction Project, which targets a 40% cut in particulate matter and 30% in nitrogen oxides from beneficiary manufacturers (World Bank 2024), and its 2026 agreements with the Government of India and the state governments of Haryana (World Bank 2026a) and Uttar Pradesh (World Bank 2026b), totalling around \$600 million to strengthen air quality monitoring and management in both states, illustrate the scale of sovereign lending MDBs can bring to country or state-level programmes. MIGA's separate pledge of up to \$1 billion to de-risk air quality investments points to the scale of guarantee capacity available (Clean Air

Fund 2024). The pledge has not yet been matched by comparable disbursed guarantee volumes labelled for air quality, and its success should be assessed against actual transactions. These examples highlight the potential for pairing sovereign lending and guarantees with the regional and procurement-based levers described above.

Three cases worked through the sequence set out in Sections 4 and 5 show the structure in practice. Santiago succeeded by unbundling the asset from its operation, Hebei by results-based sovereign lending, and the Breathe Better Bond encountered constraints related to both payer and issuer. Table 5 summarizes the operational lessons.

Case study 1: Transit Capital: The Santiago Public Transport Electrification Model

1. **Intervention and Economic Archetype:** Electrification of Santiago's public bus fleet and conversion of depots to zero-emission infrastructure (Catalyst Mobility, 2026). Classified as a hybrid infrastructure asset combining municipal public transit services with revenue-generating vehicle assets.
2. **Value and Co-Benefit Identification:** Direct elimination of urban tailpipe emissions ($PM_{2.5}$, NO_x , black carbon) in dense corridors, leading to reduced urban air pollution, lower operational/fuel costs, and improved passenger experience.
3. **Primary Payer and Revenue Diagnosis: Payer:** Metropolitan transit users and municipal transit budgets via tariff collections (farebox revenue) and public transport subsidies.

Revenue Stream: Long-term fleet lease payments structured as operational expenditure (Opex) rather than capital expenditure (Capex).
4. **Instrument Structuring and Risk Allocation:** Private utility Enel X purchased e-buses (from manufacturer BYD) and built smart depot charging infrastructure. Enel X leased the fleet to private bus operator Metbus via a 10-year contract. This decoupled vehicle ownership and technology risk from bus operation: Enel X managed battery lifecycle and charging risks while Metbus focused on route operation. Concessional financing and commercial debt supported the underlying capital purchase.
5. **Outcome:** Successfully scaled to over 1,000 electric buses in Santiago, making it one of the largest zero-emission fleets outside the PRC. Key takeaway: Unbundling high upfront capital assets from daily operations can transform a prohibitive Capex burden into a predictable, serviceable lease payment backed by transit fares.

Source: Compiled by authors.

Case study 2: Results-Based Public Finance: World Bank Hebei Air Pollution Prevention Programme

- 1. Intervention and Economic Archetype:** Multisector air pollution reduction in Hebei Province, PRC, targeting industrial emissions monitoring, diesel fleet phase-out, and household coal-stove conversion. Classified as a pure public good intervention at sovereign or sub-sovereign scale.
- 2. Value and Co-benefit Identification:** Rapid reduction in regional ambient PM_{2.5} exposure across the Beijing–Tianjin–Hebei airshed, reducing respiratory mortality, healthcare expenses, and regional industrial carbon intensity.
- 3. Primary Payer and Revenue Diagnosis:** Payer: Provincial and national government fiscal budgets. Revenue Source: Sovereign tax revenues and central government transfers designated for environmental protection.
- 4. Instrument Structuring and Risk Allocation:** The World Bank deployed a \$500 million Program-for-Results (PforR) sovereign loan (World Bank, 2016), alongside parallel loans from the Asian Development Bank (\$300 million policy-based loan approved in 2015) (ADB 2015) and KfW. Disbursements were explicitly linked to verified disbursement-linked indicators (DLIs), such as continuous industrial emissions monitoring compliance, retirement of over 4,000 diesel buses, and clean stove transitions for 1.2 million rural households. The government absorbed execution risk, receiving capital reimbursement only upon independent verification of policy and physical milestones.
- 5. Outcome:** Ambient PM_{2.5} concentrations in Hebei dropped by nearly 40% over the initial programme period; results-based public finance helped ensure multilateral capital was tied directly to verified environmental outcomes.

Source: Compiled by authors.



A worker walks around a solar panel system on the rooftop of Istiqlal Mosque area (photo by Aji Styawan / Climate Visuals).

Case study 3: Lessons on Results-Based Payment: The Breathe Better Bond Initiative

- 1. Intervention and Economic Archetype:** Municipal-level clean air and climate interventions (spanning urban transit, waste management, and energy efficiency) across urban centres in low- and middle-income countries. Classified as a hybrid municipal infrastructure asset and public good intervention (Climate Policy Initiative, 2019).
- 2. Value and Co-benefit Identification:** Dual reduction in local air pollutants ($PM_{2.5}$, NO_x) and and greenhouse gas (GHG) emissions, resulting in urban public health savings, reduced mortality, and carbon mitigation.
- 3. Primary Payer and Revenue Diagnosis:** Payer: Dual-tier structure relying on municipal budget revenues for core debt service, paired with philanthropic, concessional, or bilateral donor pools to fund results-based 'outcome payments'. Revenue Stream: Local tax revenues supplemented by conditional donor grant disbursements.
- 4. Instrument Structuring and Risk Allocation:** The Breathe Better Bond (BBB) was conceived as an outcome-based financial vehicle designed to bundle municipal clean air projects. It aimed to allow cities to issue debt where interest rates or principal repayments were effectively lowered via grant subsidies paid by donor 'outcome payments' upon independent verification of air quality improvements.
- 5. Outcome:** The concept did not progress to widespread commercial deployment due to two primary structural barriers:
 - (i) Outcome Payer Deficit:** Difficulty in convincing philanthropic organizations or bilateral donors to commit long-term capital as «outcome payers».
 - (ii) Subnational Market Constraints:** The target municipal issuers, particularly Tier 2 cities in lower-income settings where air pollution was most severe, lacked the credit ratings, debt-servicing capacity, or legal authority required to issue municipal bonds in capital markets.

Key takeaway: Blended results-based debt instruments cannot by themselves overcome fundamental subnational credit constraints.

Source: Compiled by authors.



Table 5: Comparative Operational Precedents in Clean Air Finance

Financing Mechanism	Real-world precedent	Lesson	Key Structural Risk or Failure
Ring-fenced airshed fund	Mexico City Fideicomiso 1490 (BANOBRAS, CAME, Federal/State Govts)	Demonstrates how a dedicated pollution charge (gasoline surcharge, vehicle verification fees) can be ring-fenced for local-currency airshed investment across multiple jurisdictions over 30 years.	Revenue Base Erosion: the fund transitioned from fuel surcharges to mandatory vehicle verification fees as vehicle efficiency altered the underlying tax base.
Cross-border airshed platform	South Asia IGP Platform (World Bank: UP and Haryana air pollution programme [India], Punjab \$300 million programme [Pakistan])	Answers the institutional boundary question by using a purpose-built Special Purpose Vehicle authority to receive multi-sovereign funds and implement regional reduction plans.	High political friction: Inter-jurisdictional coordination costs can delay disbursements without legally binding emission targets.
Performance-based subnational transfers	India 15th Finance Commission Grants (Ministry of Finance, Urban Local Bodies)	Deploys one of the largest results-based air quality transfer systems to million-plus cities based on ambient PM ₁₀ targets.	KPI Distortion: Disproportionate concentration of expenditure on dust control measures, which are easy to verify.
Recurrent Operating Subsidy Facility	Ulaanbaatar Household Heating Transition (Government of Mongolia, World Bank, ADB)	Highlights that capital grants for clean technologies fail unless continuous winter operating subsidies (briquette, power tariffs) are guaranteed long-term.	Upfront Equipment Barriers: Households avoided subsidized tariffs because they could not afford electric heater upgrades and feared tariff expiration.
Fiscal Architecture	PRC Industrial Clean Air Architecture (Ministry of Finance, State Banks, Provincial Govts)	Combines central to provincial performance transfers with mandatory green credit policy to fund ultra-low emission retrofits at scale.	Subnational Fiscal Strain: Uneven provincial revenue capacity created execution delays in heavy-industrial regions.

ADB = Asian Development Bank; BANOBRAS = Banco Nacional de Obras y Servicios Públicos; CAME = Comisión Ambiental de la Megalópolis; IGP = Indo-Gangetic Plains; KPI = key performance indicator; PM = particulate matter; UP = Uttar Pradesh.

Source: Compiled by authors.

9 NEXT STEPS

9.1 Immediate actions

The actions below use the instruments and evidence available today.

Table 6: Priority Actions by Stakeholder

Stakeholder	Priority actions
MDBs and DFIs	Develop and apply a clean air financing diagnostic before structuring any operation, covering the intervention, the value created, who captures it, the repayment source, and only then the instrument. Embed material air quality outcomes in climate and infrastructure operations, with local air pollutant assessment and results indicators in high-burden locations. Section 6.4 sets out the operational toolkit: project preparation, policy-based lending, guarantees, local-currency instruments, aggregation platforms, and working through existing government capacity.
Governments and ministries of finance	Treat clean air as a cross-government investment agenda. Create predictable domestic revenue through pollution charges, fuel and vehicle taxation, congestion pricing and ring-fenced budgets, paired with support for affected groups and clean transport alternatives. Strengthen enforcement so that finance supports compliance rather than substituting for it. Use procurement specifications for vehicle fleets, equipment and municipal contracts as a demand-side lever alongside regulation.
Cities and implementing agencies	Start with source apportionment and institutional mapping, then prioritise interventions that are both material and deliverable. Separate capital expenditure, operating expenditure and public good functions. Use service contracts, availability payments, pooled procurement, and standardized concessions to create predictable payment structures.
Private investors and financial institutions	Focus on sectors where the assets are bankable and air quality is a measurable impact dimension: transport, energy, industry, buildings, and waste. Develop local-currency lending and leasing products for cleaner equipment and fleet conversion, backed by technical standards and partial guarantees. Build internal capacity to appraise clean technology risks and opportunities.
Philanthropies and donors	Fund the early-stage public goods that commercial finance will not: data, policy design, institutional capacity and project preparation. Provide catalytic grants for transaction development and for independent evaluation, including of structures that have failed. Support pilots of pollution pricing, air quality credits and results-based mechanisms and capex-reducing business models, alongside rigorous learning agendas.

DFI = development finance institution; MDB = multilateral development bank.

Source: Compiled by authors.

9.2 A development agenda

Several constraints limit the role of clean air development finance, and these need to be addressed before individual financing instruments are considered. Lenders often lack the information needed to determine how borrowers contribute to air pollution within an airshed. Transition plans also provide limited information on how

decarbonization pathways will affect local air quality. The relationship between air pollution and sovereign financing costs remains poorly understood, while supervisory frameworks do not consider air pollution. As a result, sustainability-linked finance rarely uses air quality indicators. This guide proposes six priorities to address these gaps.

Table 7. Development priorities for the next phase

Priority	What it would establish	Lead actors
Next-generation geospatial and asset-level data (Near term)	An open registry linking polluting assets to their owners, lenders and investors. Similar data are available for coal and power but not for the wider set of polluting assets, and pollutant release registers are absent or unreliable in many key airsheds. A further priority is the first documented use of satellite-derived pollutant data in a covenant, an eligibility test or payment trigger. Geostationary satellites over Asia can now provide hourly observations rather than once a day. Climate TRACE^a and APAD^b have also published asset-level estimates for particulate matter since November 2024, although their methodology is at an early stage.	Research institutions, MDBs, data coalitions, supervisors
Air quality in transition plans (Near term)	Air pollutant baselines and trajectories would be disclosed alongside greenhouse gases by companies in pollution-intensive sectors and by national and sub-national governments responsible for high-burden airsheds. Plans would also identify cases where a decarbonisation pathway does not reduce air pollution or may increase it, as can occur with biomass combustion, waste-to-energy and hydrogen combustion. The aim is to develop air pollution guidance aligned with the TPT framework and IFRS S2, so that local pollutants are included in the disclosure frameworks companies already use rather than separate reporting. Transition plans already disclose asset retirement schedules, technology choices and capital allocation, so similar disclosure logic could be applied to air pollutants.	ISSB and the IFRS Foundation, ITPN, national transition plan regimes, EU standard setters reconciling ESRS E1 and E2
Financial materiality and risk premia (Scale and integration)	Evidence on whether air pollution raises the cost of borrowing. This has not been tested sufficiently in relation to sovereign borrowing and evidence for cities and companies comes almost entirely from the PRC, so findings may not apply elsewhere. Changes in air quality regulations provide opportunities to examine this relationship. If investors price the risk, borrowing costs should move when air quality rules tighten or loosen. If investors demand higher returns where air pollution is worse, supervisors may need to consider air quality as a financial risk, and finance ministries would have a fiscal reason to act on air pollution, as well as a health one.	Research institutions, central banks and supervisors, NGFS, rating agencies
Air quality-linked financial instruments (Demonstration)	Sustainability-linked loans and bonds, where interest rate rises if the borrower misses an air quality target. The target should be something the borrower controls, such as its own emissions, the make-up of its vehicle fleet or the date it retires a polluting plant, rather than ambient air quality, which depends on many other sources. Linking the target to the borrower's own transition plan would connect the financial instrument to a commitment the borrower has already made. Public lenders can help develop and test these instruments.	MDBs and national development banks, sovereign and utility issuers, ICMA

continued on next page

Table 7 continued

Priority	What it would establish	Lead actors
Artificial intelligence applied to appraisal, verification and enforcement (Scale and integration)	More affordable ways to assess a project, verify its results and enforce standards. Automated assessment could reduce the cost of appraising small projects, such as a single kiln or bus depot, that are too costly to review individually. Automated verification can help separate the effect of weather from that of an intervention, so that results-based payments better reflect the project's own contribution. It can also work out which sources are responsible for air pollution in an area. Satellite detection can help enforcement officials identify plants that may not be complying with emission standards.	Regulators, MDBs, research institutions, technology providers
Public financial institutions as enablers (Near term)	The technical assistance, capacity building, facilities, first-of-a-kind transaction support and convening activities needed to advance the above five priorities.	MDBs, national and regional development banks, bilateral agencies

APAD = Air Pollution Asset-Level Detection; ESRS = European Sustainability Reporting Standards; ESRS E1 = Climate Change standard; ESRS E2 = Pollution standard; EU = European Union; ICMA = International Capital Market Association; IFRS = International Financial Reporting Standards Foundation; ISSB = International Sustainability Standards Board; ITPN = International Transition Plan Network; MDB = multilateral development bank; NGFS = Network for Greening the Financial System; S2 = Climate-related Disclosures; TPT = Transition Plan Taskforce

^a Climate TRACE. <https://climatetrace.org>

^b APAD. <https://apad.world>

Source: Compiled by authors.

These priorities reinforce one another, but none depends on any other starting first. Asset-level data make air pollutant disclosure verifiable, and disclosed trajectories make financial impacts easier to test. Evidence of financial impacts could, in turn, support the development of sustainability-linked instruments, while automated appraisal could reduce the costs across the process.

Public financial institutions could focus on five areas that the market is unlikely to provide adequately:

1. Technical assistance, so that issuers, regulators, cities and finance ministries can act without having to develop new methods.
2. Capacity building in monitoring and enforcement, without which no market, indicator or payment trigger can be verified. The PRC's ultra-low emissions programme relied on continuous monitoring across almost the whole thermal power fleet (Tang et al. 2019), and the Surat emissions market (Greenstone et al. 2025) required plant-level monitoring as a condition of trading.
3. New facilities for project preparation, pooled procurement, aggregation, and concessional incentives to support the use of air quality indicators in financing decisions.
4. Support for first-of-a-kind issuance, where structuring and verification costs can be high for an initial transaction but fall substantially with replication. Success should therefore be measured by the potential for replication, not only for the initial volume of finance mobilised.
5. Convening to address market failures, of which the absence of asset-level air pollutant data is a clear example. Many parties could benefit from these data, but individual organizations may have little incentive to fund them alone.



Morning commuters on a train at Manggarai station, Jakarta, Indonesia
(photo by Aji Styawan / Climate Visuals).

10 CONCLUSION AND FUTURE OUTLOOK

Financing cleaner air begins with a local diagnosis: the air pollution sources, the people exposed, the relevant airshed, and the institutions responsible for action. This diagnosis separates the public functions that must be paid for—such as monitoring, regulation, enforcement, and institutional coordination—from the investments that can attract private finance.

The choice of financing instruments depends on the risk and return characteristics of the intervention. Grants and technical assistance are appropriate for project preparation and monitoring, where there is no revenue for repayment. Concessional and policy-based lending can support reforms and public investments that governments can accommodate in their budgets. Guarantees, blended finance, thematic instruments, and results-based finance can support projects with a credible revenue source or repayment source. They can lower the cost of capital where a repayment source already exists but cannot create a repayment source where none exists. Regulation and public procurement remain central throughout because they redirect existing private investment toward cleaner technologies and services without requiring a new financing instrument.

In the near term, the most practical approach is to integrate air quality outcomes into existing financial programmes in climate, transport, energy, industrial, waste, and urban development. Assessment of local air pollutants, clean air indicators, and results frameworks should inform project selection, design, and implementation rather than being treated as narrative co-benefits.

Beyond that, four operational gaps limit the wider use of the financing instruments described in this guide. A lack of capital is not in itself one of these gaps. The macro-fiscal constraints discussed in Section 5.2 are also important, but not specific to clean air.

The first gap is asset identification. A lender cannot easily establish which of its borrowers own the air polluting assets that contribute to population exposure in an airshed. Attributing emissions to a facility is already possible in some jurisdictions through air pollutant registers and satellite observation. What is missing is the link between the air polluting asset and the companies or financial institutions that own or finance it, especially where air pollutant registers are weak or absent.

The second gap is identifying who pays. The health benefits are widely shared rather than captured by a single beneficiary. The conditions under which a health system, an employer, or a treasury could be contracted to pay for reductions in air pollution exposure remain underdeveloped.

The third gap is understanding how financial markets value air pollution risk. The relationship between air pollution and sovereign borrowing costs remains poorly understood. Evidence for municipal and corporate borrowing comes almost entirely from the PRC and has not yet been shown to apply widely. Financial supervisory scenario frameworks also rarely consider air pollution.

The fourth gap is the limited use of air pollutant indicators in financial instruments. The tracked sustainability-linked bond (SLB) and sustainability-linked loan (SLL) market shows no air quality KPI in use to date (Climate Bonds Initiative 2023), while evidence from compliance markets is increasingly strong (Greenstone et al. 2025). Further work is needed to determine how this experience could inform wider replication.

The next phase should therefore focus on these four gaps, supported by the six priorities in Table 7. Establishing an asset registry, specifying the conditions under which a payer can be contracted, testing whether air pollution risk is priced, and designing and supporting a first air quality-linked issuance could be achievable within a normal project cycle. Progress in one area could reduce the cost of action in others. This work would benefit from a partnership among development banks, which can support transactions and convene stakeholders, research institutions, which can manage open data independently, and philanthropic funders, which can support public goods and early-stage innovation that may not attract commercial finance.

Clean air has traditionally been treated as a health issue that finance can occasionally support. The evidence set out here suggests that financing cleaner air also requires better measurement, clearer links between air pollution sources and finance, and mechanisms for translating benefits into viable payment structures. Addressing these gaps could substantially expand the role of development finance in delivering cleaner air.

Buildings in Ulaanbaatar, Mongolia obscured by smog (photo by ADB).



REFERENCES

- Aboneaaj, R. and C. Landers. 2023. *IF-CAP Recap: The Asian Development Bank's Big Climate Finance Bet*. Center for Global Development.
- Asian Development Bank. 2012. [Piloting A Results-Based Financing For Programs Modality](#).
- Asian Development Bank. 2018. [People's Republic of China: Beijing-Tianjin-Hebei Air Quality Improvement-Hebei Policy Reforms Program](#). Completion Report. Project No. 49232-001.
- Asian Development Bank. 2025. *Scaling Up Clean Air Actions for Better Health and Resilience, Project 58076-001*.
- Bambe, B. and P. Tamasiga. 2026. *Scaling Green Investment for SMEs in Low- and Middle-Income Countries Through Guarantees and Blended Finance*. German Institute of Development and Sustainability.
- Bowe, B., Y. Xie, T. Li, Y. Yan, H. Xian, and Z. Al-Aly. 2018. The 2016 Global and National Burden of Diabetes Mellitus Attributable to PM_{2.5} Air Pollution. *Lancet Planetary Health*. 2(7). pp. e301–e312.
- Brooks, N., D. Biswas, S. Maithel, G. Miller, A. Mahajan, M.R. Uddin, S. Ahmed, M. Mahzab, M. Rahman, and S.P. Luby. 2025. Reducing Emissions and Air Pollution From Informal Brick Kilns: Evidence from Bangladesh. *Science*. 388(6747), p. eadr7394.
- Cardascia, S., S.C. Cowlin, D. Schwede, and W. Derbyshire. 2022. *Improving Air Quality in Ulaanbaatar*. ADB Briefs No. 229.
- Catalyst Mobility. 2026. [Accelerating Change: How Chile Became a Global E-Bus Leader](#).
- Center for Global Development (CGD). 2018. [Development Impact Bonds Targeting Health Outcomes](#).
- Clean Air Fund. 2024. [Air Pollution Climbs World Bank's Agenda, As \\$1 Billion in Financial Guarantees Pledged](#). News release. 25 April.
- Clean Air Fund and Climate Policy Initiative. 2026. *State of Global Air Quality Funding 2026*. Clean Air Fund.
- Climate Bonds Initiative. 2023. *Sustainability-Linked Bonds: Building a High-Quality Market*. CBI.
- Climate Policy Initiative. 2019. [Breathe Better Bond Initiative](#).
- Committee on the Medical Effects of Air Pollutants. 2022. [Cognitive Decline, Dementia and Air Pollution](#).
- Convergence Blended Finance. 2018. [Blended Finance Accelerator Grant Portfolio](#).
- Day, C., et al. 2025. *Air Quality Toolkit for Development Finance Institutions*. Clean Air Fund.
- Dole, D. and I. Bartlett. 2004. *Beyond Cost Recovery: Setting User Charges for Financial, Economic, and Social Goals*. ERD Technical Note No. 10. Manila: Asian Development Bank.
- Fabre, A. and S. Straub. 2023. The Impact of Public-Private Partnerships (PPPs) in Infrastructure, Health, and Education. *Journal of Economic Literature*. 61(2). pp. 655–715.
- Farvacque-Vitkovic, C.D. and M. Kopanyi, eds. 2014. *Municipal Finances: A Handbook for Local Governments*. World Bank.

- GOGLA (with Dalberg Advisors), 'Blended Finance for Off-Grid Solar: Unlocking Capital to Accelerate Energy Access', published 10 July 2025.
- Greenstone, M., R. Pande, N. Ryan, and A. Sudarshan. 2025. Can Pollution Markets Work in Developing Countries? Experimental Evidence from India. *The Quarterly Journal of Economics*. 140(2), pp. 1003–1060.
- Greenstone, M. and P. Schwarz. 2018. *Is China Winning its War on Pollution?* Energy Policy Institute at the University of Chicago.
- International Capital Market Association. 2024. *Sustainability-Linked Bond Principles*. ICMA.
- International Finance Corporation. 2025. *The Role of Blended Finance in an Evolving Global Context: Technical Note for the International Financial Architecture Working Group of the G20*. IFC.
- Kampa, M. and E. Castanas. 2008. Human Health Effects of Air Pollution. *Environmental Pollution*. 151. pp. 362–367.
- MIGA. 2023. BRT Dakar. Multilateral Investment Guarantee Agency.
- Miller, G. 2020. Beyond 100% Renewable: Policy and Practical Pathways to 24/7 Renewable Energy Procurement. *The Electricity Journal*. 33(2). Article No. 106695.
- The Nation. 2026. [Thailand Imposes 'Burn-Free' Mandate on Corn Imports to Combat PM2.5 Crisis](#). 6 January.
- Oxman, A. and A. Fretheim. 2009. Can Paying for Results Help to Achieve the Millennium Development Goals? *Journal of Evidence-Based Medicine*. 2(3). pp. 184–195.
- Qi, Z., S. Yang, D. Feng, and W. Wang. 2022. The Impact of Local Government Debt on Urban Environmental Pollution and Its Mechanism: Evidence from China. *PLoS ONE*. 17(3). e0263796.
- Reynaert, M. 2021. Abatement Strategies and the Cost of Environmental Regulation: Emission Standards on the European Car Market. *The Review of Economic Studies*. 88(1). pp. 454–488.
- Sheikh, H.A., D. Narain, C. Bartlett, and C. Christiaen. 2025. Unlocking Private Finance for Nature: Addressing Barriers and Reframing Risk-Return Dynamics. *iScience*. 28(11).
- Sidemo-Holm, W., H. Smith, and M. Brady. 2018. Improving Agricultural Pollution Abatement Through Result-based Payment Schemes. *Land Use Policy*. Vol. 77. pp. 209–219.
- Stritzke, S., C. Sakyi-Nyarko, I. Bisaga, M. Bricknell, J. Leary, and E. Brown. 2021. Results-Based Financing for Modern Energy Cooking Solutions. *Energies*. 14(15). 4559.
- Tang, L., et al. 2019. Substantial Emission Reductions from Chinese Power Plants After the Introduction of Ultra-Low Emissions Standards. *Nature Energy*. 4(11). pp. 929–938.
- WHO. 2026. [New SDG Data Shows Stalled Progress on Air Pollution and Health](#). News Release. 29 June.
- Wong, G. et al. 2016. *Results-Based Payments for REDD+: Lessons on Finance, Performance, and Non-carbon Benefits*. CIFOR.
- World Bank. 2016. [China - Hebei Air Pollution Prevention and Control Program Project](#). Washington, D.C.: World Bank Group.

World Bank. 2017. *Public–Private Partnerships: Reference Guide, Version 3*.

World Bank. 2024. [World Bank to Support Women, Youth Owned Small Businesses and Industry Adapt to Green Transition in Türkiye](#). Press release. 1 April.

World Bank. 2025a. [International Debt Statistics](#).

World Bank. 2025b. *Unlocking Subnational Finance: Overcoming Barriers to Finance for Municipalities in Low- and Middle-Income Countries*.

World Bank. 2026a. [World Bank, Government of India Sign Agreement to Improve Air Quality in Haryana State and National Capital Region](#). Press Release. 13 March.

World Bank. 2026b. [World Bank, Government of India Sign Agreement to Improve Air Quality in Uttar Pradesh State](#). Press release. 16 March.

Zhang, C., et al. 2020. Upgrading Construction and Demolition Waste Management from Downcycling to Recycling in the Netherlands. *Journal of Cleaner Production*. Vol. 266. Article No. 121718.

