AIR QUALITY TOOLKIT FOR DFIs:

Practical guide to integrate clean air into multi-sectoral investments

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FOREWORD

Polluted air is one of the most urgent environmental health issues that we face today. 8.1 million premature deaths annually are attributed to air pollution, which ranks as the second largest risk factor for all deaths globally. Air pollution now kills more people than tobacco worldwide. Countries in South Asia and Africa faced the highest burden of disease because of poor air quality.[i] Economic losses from air pollution totaled $8.1 trillion globally in 2019 or 6.1% of global GDP. In regions such as South Asia the loss was as high as 10.3% of GDP.[ii]

Despite the urgency of the issue, the most recent figures show that international development finance for improving outdoor air quality was dismally low at only 1% of total ODA.[iii] The limited funding is not distributed equitably across global geographies while some of the countries with the poorest air quality receiving the least.

Development Finance Institutions (DFIs) provide the largest share of international air quality funding, but there is more room for multilateral and bilateral funders to contribute. This includes increasing funding for outdoor air quality; expanding grant funding; improving equity in funding across regions and providing air quality financing where it is needed the most; integrating air quality across portfolios and developing and enhancing monitoring and tracking systems that fully account for air quality.

DFIs are well placed to scale up financing for air quality, given their mandates for advancing development projects and addressing complex challenges in an integrated and holistic manner. With targeted efforts, we can maximize air quality benefits from investments across sectors.

This toolkit is intended to serve exactly this purpose- to equip project officers and portfolio managers with information to design projects that generate air quality benefits. It features a wealth of information on why air quality is important, and on opportunities or entry points for integrating air quality in cross-sectoral investments. Let us widely use this toolkit and respond to the call for multilateral and bilateral financers to increase the volume and type of financing for air quality.

Bruno Carrasco

Director General, Climate Change and Sustainable Development Department

Asian Development Bank

Juan Pablo Bonilla

Manager, Climate Change and Sustainable Development Sector

Inter-American Development Bank

The toolkit has been endorsed by the following organizations:

[i] 2024. Special report. https://www.stateofglobalair.org/resources/report/state-global-air-report-2024

[ii] World Bank. 2022. The Global Health Cost of PM2.5 Air Pollution: A Case for Action Beyond 2021. Washington, DC.

[iii] Clean Air Fund. 2024. The State of Global Air Quality Funding 2024. https://www.cleanairfund.org/resource/air-quality-funding-2024/

ENDORSEMENTS

“Transport systems that are well planned, implemented and operated have large co-benefits that can reduce air pollution, reduce congestion, reduce climate emissions all while improving access and mobility for all. This Toolkit is a helpful resource for project officers to design transport projects that meet multiple development objectives.”

James Leather, Asian Development Bank (ADB)

"Breathing clean air need not be a pipe dream. While AQIP has identified areas where ASEAN Member States would benefit from interventions, seeking support to realise them is a challenge. This is where the Toolkit would potentially guide them to take the first steps towards opening the taps."

Catherine Frances Corpuz, Project Coordinator, Expertise France, Air Quality Improvement Program in ASEAN (AQIP)

“While air pollution causes serious problems worldwide, few people have effectively addressed it. This Toolkit expands the range of stakeholders by involving officers working on various sectoral projects, thereby maximizing air quality benefits. As a bilateral agency, we will fully leverage the Toolkit’s potential.”

Senior Staff of Development Aid Agency

“The Clean Air Toolkit is a go-to resource for project officers working on projects with indirect air quality benefits. It breaks down how to integrate air quality considerations step by step, making it easy to follow and apply at every stage of the project.”

Pauline Bogey, MobiliseYourCity

“The Clean Air Toolkit is a game-changer for project officers, making it easier to incorporate air quality measures into sectoral projects. Its guidance on tracking co-benefits offers a practical approach to demonstrating the added value of cleaner air in development initiatives. Clean air is everyone’s right - let’s make it our goal."

Representative, GIZ Thailand SFF Air Quality Management and Climate Change

"The Project Officers at DFIs already have their hands full with multiple development objectives. I am very optimistic that this Toolkit, co-developed in consultation with the officers, will make the task of adding one more objective, i.e. integrating air quality into the funding process, significantly easier for them. This should ultimately help improve air quality while simultaneously also supporting their key economic growth, equity, health, and climate-related objectives."

Amit Mehra, Founder, Reuters Market Light/RML AgTech and former Managing Director, Global Sustainability, Accenture

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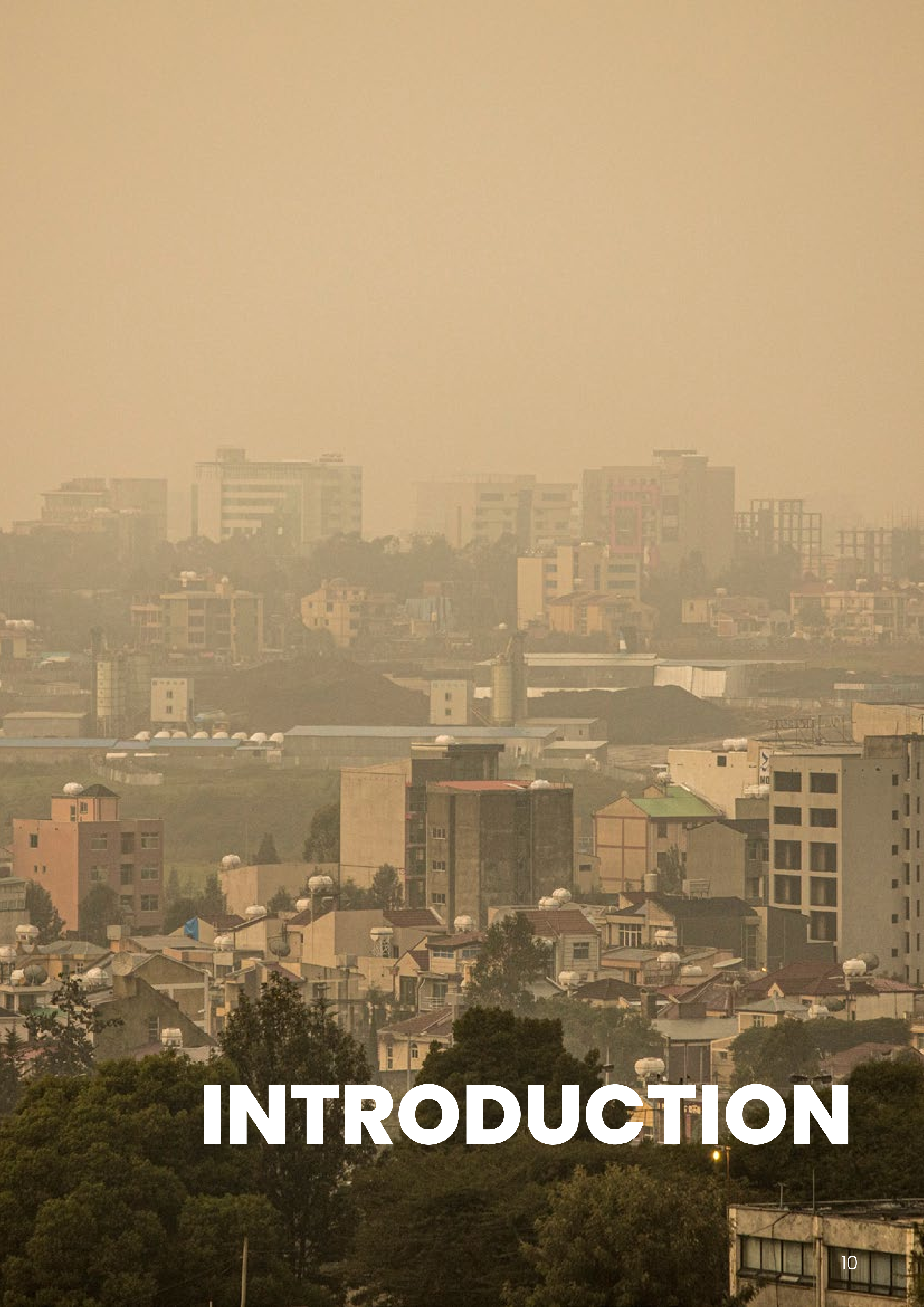
ABBREVIATIONS

AATHP	ASEAN Agreement on Transboundary Haze Pollution
ADB	Asian Development Bank
AIIB	Asian Infrastructure Investment Bank
AQ	Air quality
AQUA	Air Quality through Urban Actions
AQMx	Air Quality Management Exchange Platform
ASEAN	Association of South East Asian Nations
BC	Black carbon
BD	Bilateral Donor
BECCS	Bioenergy with carbon capture and storage
BenMAP-CE	Benefits Mapping and Analysis Program - Community Edition
CAAP	Clean Air Action Plans
CC	Climate change
CCAC	Climate and Clean Air Coalition
CEDAR	Centre for Diet and Activity Research
CH_4	Methane
CLIMAQ-H	Climate Change Mitigation, Air Quality and Health
CLRTAP	UN Convention on Long-Range Transboundary Air Pollution
CO_2	Carbon dioxide
DFI	Development Finance Institution
EU	European Union
FIT	Feed-in Tariff
GDP	Gross Domestic Product
GFMR	Global Flaring and Methane Reduction Partnership
GHG	Greenhouse gases
HEI	Health Effects Institute
HFC	Hydrofluorocarbon

IAQM	Institute of Air Quality Management
IBAQ	Integrated Programme for Better Air Quality
IHME	Institute for Health Metrics and Evaluation
ITHIM	Integrated Transport and Health Impact Modelling Tool
iSThAT	Integrated Sustainable Transport and Health Assessment Tool
JICA	Japan International Cooperation Agency
LEAP-IBC	Long-range Energy Alternatives Planning Integrated Benefits Calculator
LEZ	Low Emission Zone
LPG	Liquified petroleum gas
MDB	Multilateral Development Bank
MER	Monitoring, evaluation and reporting
NECD	National Emission reduction Commitments Directive
NCAP	National Clean Air Programme
NMVOCs	Non-methane volatile organic compounds
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
NRMM	Non-Road Mobile Machinery
OECD	Organisation for Economic Co-operation and Development
O_3	Ozone
PM	Particulate matter
$PM_{2.5}$	Fine particulate matter (particles with a diameter of 2.5 micrometers or less)
PM_{10}	Coarse particulate matter (particles with a diameter of 10 micrometers or less)
POP	Persistent organic pollutant
RAPAP	Asia-Pacific Regional Action Programme on Air Pollution
SLCPs	Short-Lived Climate Pollutants
SO_2	Sulfur dioxide

SWEET	Solid Waste Emissions Estimation Tool
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UN	United Nations
USEPA	United States Environmental Protection Agency
VOC	Volatile organic compound
WHO	World Health Organization
WRI	World Resources Institute



INTRODUCTION

Poor air quality (AQ) is now the second leading cause of premature death worldwide, behind cardiovascular disease[1]. It is estimated to result in the deaths of nearly 2,000 children under the age of 5 every day, and in many areas of the world the problem is worsening[2]. Ninety-nine percent of the global population is living in areas that exceed the WHO's Air Quality Guidelines[3] (hereafter referred to as the 'WHO Guidelines') – the benchmark for levels of air quality that do not represent a substantial risk to human health. The 2022 UN Resolution A/RES/76/300 determines a "human right to a clean, healthy and sustainable environment" and recognizes that "the pollution of air, land and water…. interferes with the enjoyment of a clean, healthy and sustainable environment and that environmental damage has negative implications, both direct and indirect, for the effective enjoyment of all human rights".

Global funding organizations and national governments are critical to reversing this trend. To uphold the UN resolution, all grants and loans provided to a sovereign government should seek, where relevant, to mandate air quality improvements as a fundamental consideration of any lending. Through the effective implementation of legislation, policies, measures, and actions which support the phasing out of harmful emission sources and promote a shift to more sustainable and equitable environments, significant strides can be achieved in bringing down harmful pollution levels and improving the lives of communities around the world. In support of such a shift, Our Common Air Commission, an independent high-level commission of global leaders, has advocated for clean air to be properly valued. It urges governments, businesses, investors, multilateral development banks, and others, to see clean air as an asset that improves health and productivity, drives sustainable development, and more prominently makes the case for clean air projects[4].

This Toolkit has been developed to support Development Finance Institutions (DFIs), primarily multilateral development banks (MDBs) and bilateral donors (BDs), to better understand air pollution and how their development projects can lead to air quality improvement. The guidance is designed for project officers and managers working across different sectoral development projects with little or no knowledge of air quality. It provides background information on air pollution and how working on air quality issues can help drive development, improve health, deliver economic benefits, and achieve climate change mitigation and adaptation. It also demonstrates some simple steps to support the inclusion of air quality in projects. Figure 1 shows how the Toolkit is envisaged to trigger change and advancement in the assessment of air quality in sectoral development projects. It also looks forward to the positive outcomes and impacts that this could achieve.

1 State of Global Air 2024, HEI and IHME, 2024, https://www.stateofglobalair.org/resources/report/state-global-air-report-2024
2 Air pollution and child health: prescribing clean air, 2018. https://www.who.int/publications/i/item/air-pollution-and-child-health
3 WHO Air Pollution Portal. https://www.who.int/health-topics/air-pollution#tab=tab_1
4 Clean Air: A Call to Action, Our Common Air. https://ourcommonair.org/clean-air-a-call-to-action/752/

FIGURE 1. FROM INTERVENTION TO IMPACTS: THE THEORY OF CHANGE MODEL

Impact
Long-term goals

- Reduced number of deaths / illnesses from ambient ai pollution
- Impactful progress made towards meeting WHO Air Quality Guidelines
- Quantification of AQ co-benefits of climate mitigation projects and vice versa
- Reduction in inequitable impacts of air pollution
- Air quality is seen as an asset benefiting society and the economy

Short- & Long-term Outcomes
Measurable benefits

- Requirement for recipients and donors to consider AQ during project identification and preparation of sectoral projects
- Annual AQ investments increases with the goal to equal climate investments
- Corporate air quality indicators are adopted by donors, initially in sectoral projects
- Grants or loans to sovereign governments for sectoral projects, where relevant, mandate air quality as a key consideration
- AQ funding for countries disproportionately affected by air pollution increases
- Total impact of development funding for sectoral projects, on emissions and/or air pollution, can be quantified

Output
The change we want to see

- Positive and negative impacts of sectoral projects on air quality are tracked
- Air quality actions, especially those requiring minimal, incremental cost, are added to sectoral projects
- Increased inclusion of air pollution quantification activities in project implementation
- Air quality and climate action are integrated, to mutual benefit
- Increased inclusion of air quality related indicators in M&E frameworks

Intervention
Resources provided

AQ Toolkit supports inclusion of air quality actions and tracking of air quality co-benefits in sectoral grants and loans

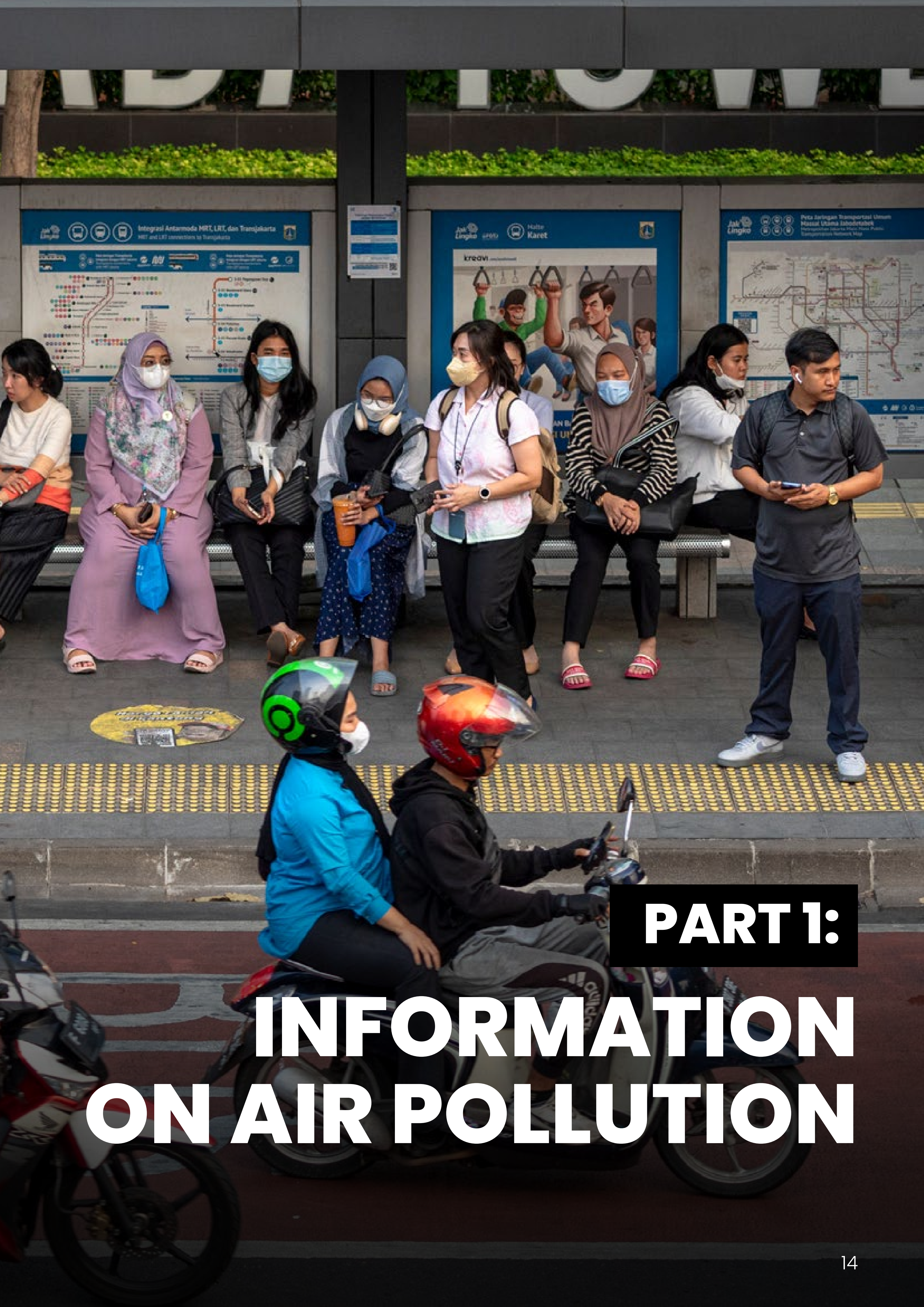
The Toolkit comprises two parts:

Part 1: Information on air pollution sets out critical information on air quality, explaining why it is important, how it can be better understood and what actions can be taken to improve it. Part 1 is designed to act as a signpost for relevant resources on air quality and includes various links to supporting information and examples of good practice from around the world. This information is designed to provide the "why?" for the inclusion of air quality into projects.

Part 2: Clean Air Guide for Project Officers is a practical guide on how air quality can be better integrated into project development, discussing each stage of the project development lifecycle, with the aim of maximizing air quality benefits at each step and improving the tracking and reporting of air quality impacts. Two appendices are also included, providing a repository of actions known to be effective in tackling air pollution, and a comprehensive list of air quality indicators.

Throughout the Toolkit, 'Air Quality Toolboxes' provide additional resources of information relevant to the preceding chapter. They include supporting information, guidance, and tools that may be useful for further reading and use. The Toolboxes provide a link to the resource and a summary of its content and how it may be helpful to the reader. For more specific technical information and case studies, the Air Quality Management Exchange Platform (AQMx) is a large and continually expanding platform for technical tools, models, data, and knowledge on air quality management.[5] A component of the Climate and Clean Air Coalition (CCAC)'s Clean Air Flagship, the AQMx Platform aims to increase collaboration and consolidation of global efforts around air quality management guidance, and improve and expand the delivery of guidance to address critical gaps. Many of the resources in the Air Quality Toolboxes can also be found within the curated guidance on the AQMx Platform, which covers eight key areas of air quality management: air quality monitoring, emissions inventories, source attribution, health impact assessments, sustainable development benefits assessments, decision support, public engagement and communication, and legal frameworks, policy design and implementation.

[5] Air Quality Management Exchange Platform (AQMx). https://aqmx.org/about



PART 1:

INFORMATION ON AIR POLLUTION

Part 1 of this Toolkit sets out critical information on air quality, including the main pollutants of concern and their associated sources. It explains how these emissions affect our health and the world around us, and the relationship between air quality and climate change. It also describes the policies and programs being implemented to address the issues and provides examples of where this has resulted in real-world improvements.

1.1 UNDERSTANDING AIR POLLUTION

1.1.1 Key air pollutants and sources

Air pollutants are a complex mixture of gaseous compounds and particles, with each having different effects on human health and the environment. The most important pollutants from a health impact perspective include particulate matter (including $PM_{2.5}$ and PM_{10} (particulates which have diameters less than 2.5 and 10 micrometers respectively)) and nitrogen dioxide (NO_2; a component of NO_x – see Figure 2), which are often the focus of air quality studies as they are typically the causes of poor air quality in urban and industrial areas.

Air pollutants can arise from a range of sources and are often associated with combustion (e.g., fuel or waste burning, wildfires). They can also arise from other human activities (e.g., mining, vehicle brake and tire wear, fugitive emissions from industrial processes, etc.) as well as from natural processes (e.g., emissions from vegetation or wind-blown dust).

The following Figure 2 shows some of the most commonly mentioned air pollutants and the main categories of emissions sources. Despite all of these pollutants having negative impacts on human health, $PM_{2.5}$ is often considered the most globally significant air pollutant due to its widespread impacts on health and its ability to penetrate deep into the lungs and bloodstream, affecting multiple organ systems. Globally, $PM_{2.5}$ accounts for approximately 7.8 million deaths annually and is considered the most consistent predictor of negative health outcomes from air pollution[6].

[6] State of Global Air 2024, HEI and IHME, 2024, https://www.stateofglobalair.org/resources/report/state-global-air-report-2024

FIGURE 2: COMMON AIR POLLUTANTS AND EMISSIONS SOURCES

Particulate matter (PM)

Complex mixture of solid and liquid particles. Some emitted directly, some formed in the atmosphere as secondary PM. Grouped by particle size, the composition of PM tends to vary by source.

Sulfur dioxide (SO_2)

A gas produced due to the burning of sulfur containing fuels. Irritant effect on nose, throat and airways. Also contributes to the formation of secondary PM.

Non-methane volatile organic compounds (NMVOCs)

Consists of a large variety of compounds, from both natural and man-made sources such as industrial processes, domestic, and agriculture. React with NO_x in the atmosphere, in the presence of sunlight, to form tropospheric O_3. Also, a key source of indoor air pollution.

Ammonia (NH_3)

A gas released from natural and man-made sources, such as fertilizer, manure and wastewater. Once in the atmosphere, contributes to habitat damage through acidification and eutrophication. Also contributes to the formation of secondary PM.

Nitrogen oxides (NO_x)

A group of highly reactive gases comprising nitrogen dioxide (NO_2) and nitric oxide (NO). Mainly formed by combustion processes and largely associated with transport and energy sector emissions. A respiratory irritant that causes inflammation of the airways and may cause reduced lung development. Contributes to the formation of ground-level ozone (O_3) in the presence of heat and sunlight.

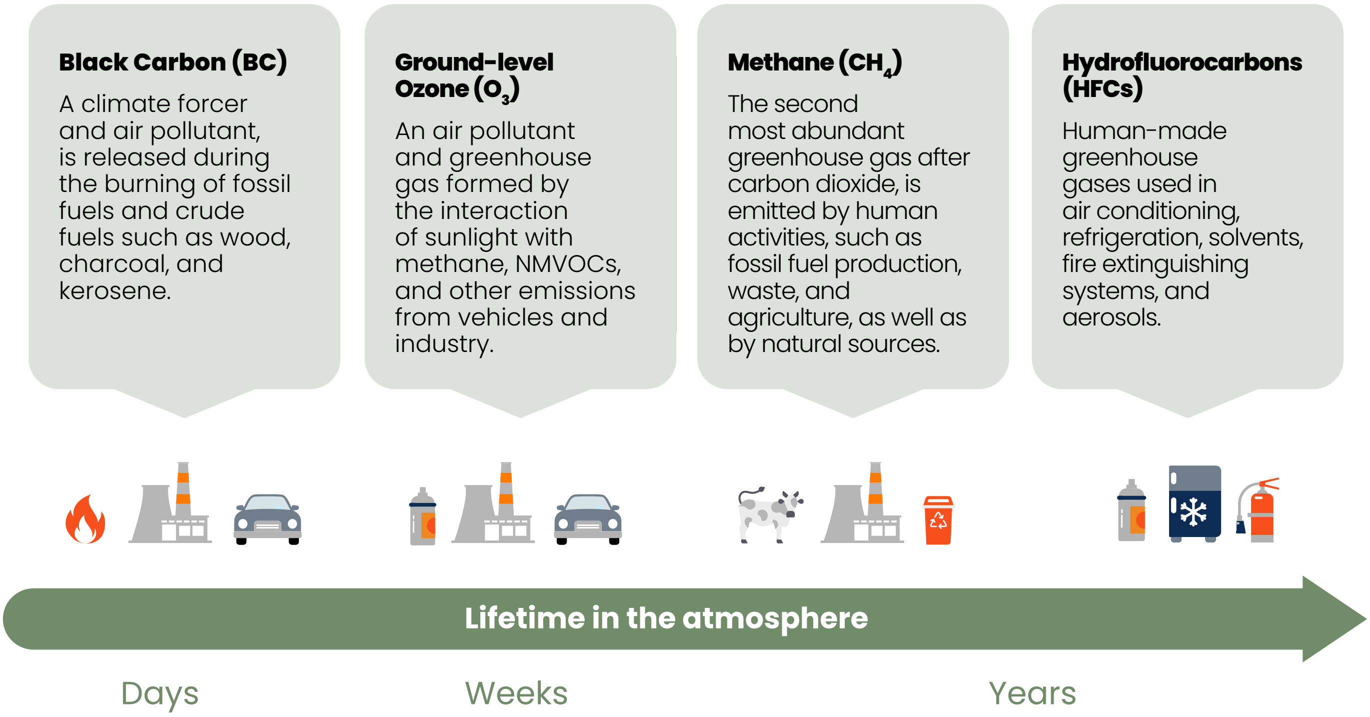
Carbon monoxide (CO)

A gas produced through the incomplete burning of fuel e.g., from the domestic and transport sectors. The highest concentrations typically present in the air can be detrimental to health.

1. Manufacturing & construction
2. Energy industries
3. Industrial processes
4. Residential and small-scale commercial combustion
5. Waste
6. Non-road transport
7. Road transport
8. Agriculture

In addition to these health impacting pollutants, short-lived climate pollutants (SLCPs) - increasingly referred to as "super pollutants" - are a group of greenhouse gases (GHGs) and air pollutants that have both a near-term warming impact on climate and an impact on health. SLCPs include black carbon (a major component of $PM_{2.5}$), methane, ground-level ozone (O_3), and hydrofluorocarbons (HFCs). SLCPs have a significant impact on human health, ecosystems, and agricultural productivity. Black carbon also contributes to accelerating ice melting and disrupts monsoon and water cycles. Figure 3 further describes these SLCPs. For more information please see Section 1.3.2.

FIGURE 3: SHORT-LIVED CLIMATE POLLUTANTS, THEIR SOURCES AND LIFETIMES



1.1.2 Health and economic impacts of air pollution

Air quality and health

Exposure to air pollution causes millions of deaths every year. According to the State of Global Air 2024[7], air pollution contributed to 8.1 million deaths in 2021 which is more than 1 in 8 deaths worldwide. There is a strong body of evidence to show how air pollution negatively affects human health, even at very low concentrations, and the burden of disease at the population level puts major strains on health care systems, which can lead to detrimental social and economic effects.

Figure 4 summarizes the primary known impacts of air pollution on human health, including the estimated proportion of global deaths from specific causes attributable to total air pollution in 2021[8].

[7] State of Global Air 2024, HEI and IHME, 2024, https://www.stateofglobalair.org/resources/report/state-global-air-report-2024
[8] Pie chart data extracted from Figure 22: Percentage of global deaths from specific causes attributable to total air pollution in 2021. State of Global Air 2024, HEI and IHME, 2024, https://www.stateofglobalair.org/resources/report/state-global-air-report-2024

FIGURE 4: SHORT- AND LONG-TERM EFFECTS OF AIR POLLUTION ON HUMAN HEALTH

Short-term effects

Air pollutants can affect the eyes, nose, throat, respiratory system and the heart.

In the short-term this can cause breathing problems and exacerbate asthma symptoms.

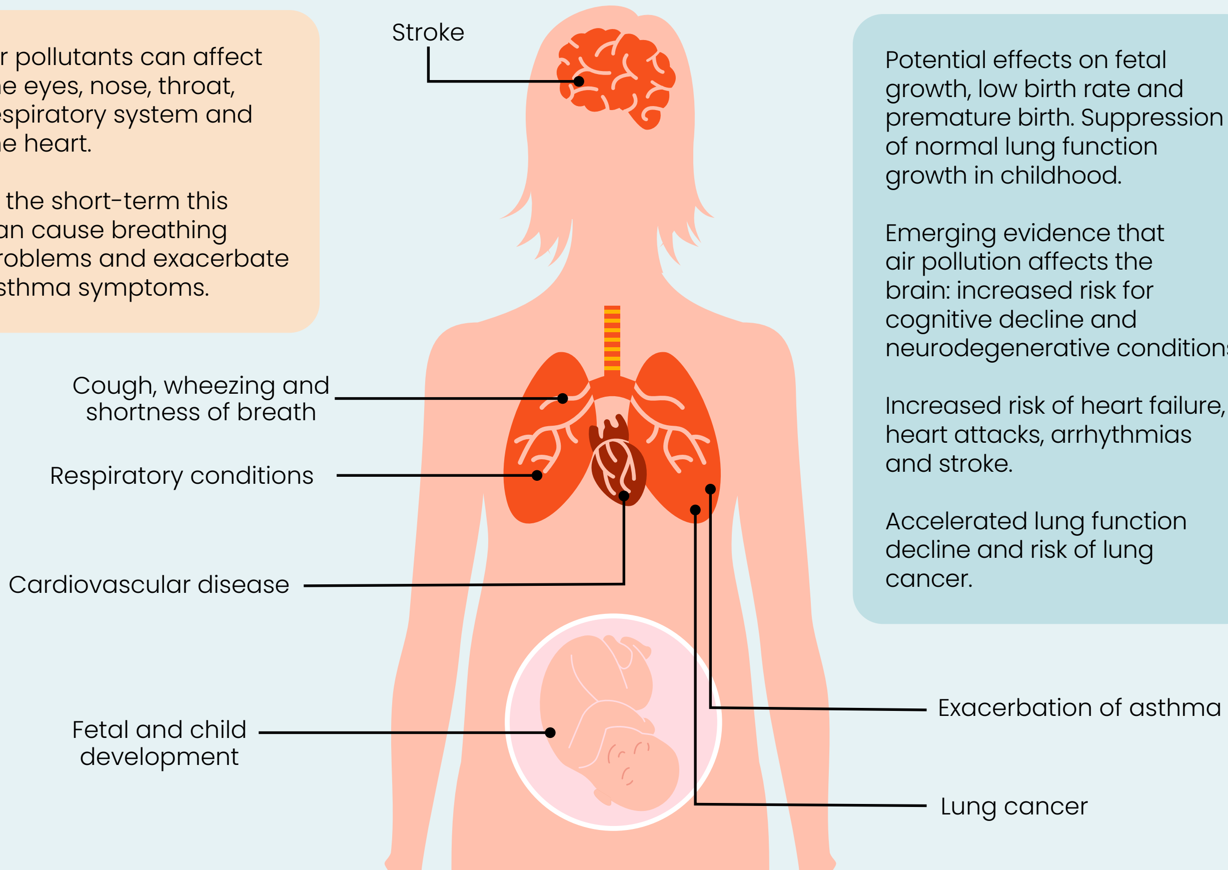
Long-term effects

Potential effects on fetal growth, low birth rate and premature birth. Suppression of normal lung function growth in childhood.

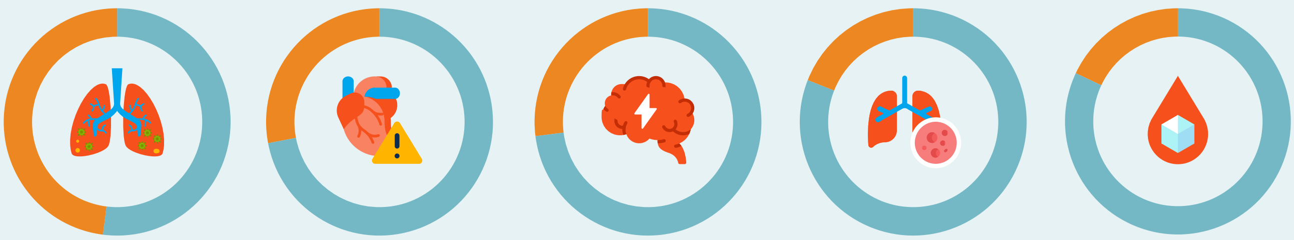
Emerging evidence that air pollution affects the brain: increased risk for cognitive decline and neurodegenerative conditions.

Increased risk of heart failure, heart attacks, arrhythmias and stroke.

Accelerated lung function decline and risk of lung cancer.



In 2021, air pollution was globally responsible for...



48% Chronic Obstructive Pulmonary Disease

28% Ischemic Heart Disease

27% Stroke

19% Lung Cancer

18% Type II Diabetes

The body of evidence to support our understanding of the negative impacts of air pollution on human health is constantly evolving, and poor air quality is being linked with a wider range of health effects. Breathing polluted air during pregnancy, for example, increases the likelihood of adverse birth outcomes, including preterm births, stillbirths, and miscarriages[9].

[9] Health Effects Institute. 2024. State of Global Air 2024. Special Report. Boston, MA:Health Effects Institute. Available at: https://www.stateofglobalair.org/resources/report/state-global-air-report-2024

Air quality and the economy

The global health cost of exposure to $PM_{2.5}$ air pollution was estimated at USD$8.1 trillion (equivalent to 6.1% of global gross domestic product (GDP)) in 2019, according to analysis by the World Bank[10]. At a local scale, air quality can influence economies in several ways, including increased burden on healthcare systems, reduced productivity, lost working days and by discouraging tourism and investment.

An effective way of contextualizing the impact of air quality is by applying a monetary value to emissions and changes in air quality, and their associated health effects (i.e., mortality and morbidity rates). This enables a more representative assessment of the costs and benefits of proposed developments. More information on this is provided in Section 2.2.4.

Clean air is increasingly being reframed as an asset with an inherent value. This has been drawn out explicitly by the Our Common Air Commission. They advocate that this value should be recognized as improved health, improved crop yields, increased productivity, and sustainable economic growth[11].

Health inequalities

While air pollution affects all of us, the impacts are felt disproportionately. Depending on where you live and work, your stage in life, health, and socioeconomic status, you may experience greater air pollution exposure or more severe health impacts. Groups worst affected include children and the elderly, those with underlying health conditions, pregnant women, and low-income communities.

Figure 5 represents the societal factors influencing air quality impacts.

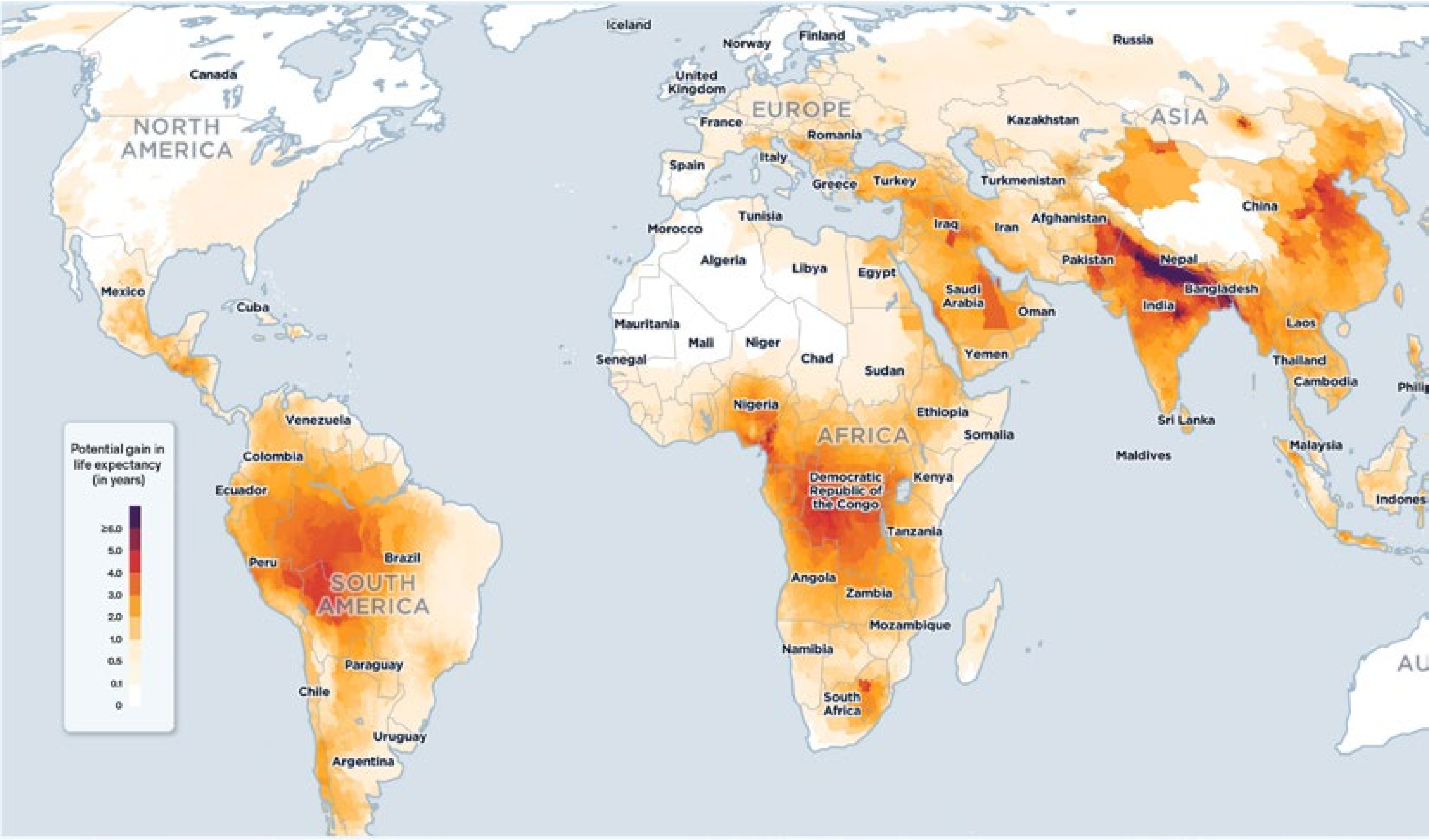
[10]The Global Health Cost of PM2.5 Air Pollution; A Case for Action Beyond 2021, World Bank, 2022, https://openknowledge.worldbank.org/server/api/core/bitstreams/550b7a9b-4d1f-5d2f-a439-40692d4eedf3/content
[11]Clean Air: A Call to Action, Our Common Air. https://ourcommonair.org/clean-air-a-call-to-action/752/

FIGURE 5: SOCIETAL FACTORS INFLUENCING AIR QUALITY IMPACTS

1.1.3 Global air pollution trends

Increasing availability of air quality monitoring data and associated air quality studies is providing ever greater transparency on the extent of air pollution around the world. Although 99% of the world's population live in areas that exceed the WHO Guidelines, the impacts of poor air quality are uneven. Most countries in the Global North have seen reductions in $PM_{2.5}$ emission levels and exposures since 2000, whilst many areas in the Global South have experienced worsening conditions. Figure 6 presents the potential gain in life expectancy (in

FIGURE 6: GLOBAL MAP OF POTENTIAL GAIN IN LIFE EXPECTANCY IF FINE PARTICULATE POLLUTION WERE REDUCED TO MEET THE WHO GUIDELINE LEVEL (μg/m³) (BASED ON 2022 DATA); SEE FOOTNOTE FOR LINK TO THE INTERACTIVE DATA[13]



SOURCE: Air Quality Life Index 2024 Annual Update

years) if concentrations of $PM_{2.5}$ were reduced to meet the WHO Guidelines[12]. From this, it is clear that the greatest potential gains in life expectancy are in Asia, Africa, and South America, as well as parts of the Middle East.

The sources of $PM_{2.5}$ in areas of high potential gain from the reduction of $PM_{2.5}$, as shown in Figure 6, are likely to come from a range of origins, the characteristics of which will differ by country, region and city. There will be differences in the AQ issues being faced in each area, for example, agricultural burning is a significant contributor to air pollution episodes in some areas of South and Southeast Asia, however this is a less common problem in the Middle East. In all areas there is need for a holistic, evidence-based approach to implementing improvements to tackle the primary sources of air pollution within specific areas.

1.1.4 Financing air quality improvement

Examining the economic impacts of financing air quality policy demonstrates the potential for significant benefits to be achieved globally. A United States Environmental Protection Agency study

[12] Air Quality Life Index, Annual Update 2024, https://aqli.epic.uchicago.edu/wp-content/uploads/2024/08/AQLI-2024-Report_English.pdf
[13] The interactive data for 1998-2022 is available online at https://aqli.epic.uchicago.edu/the-index/

estimates that every $1 spent on air pollution control returns an estimated $30 in economic benefits[14], while within the EU, the implementation of clean air measures has been estimated to boost annual economic growth by up to €60 billion since 2014[15]. Despite the economic benefits and potential benefits for health, climate, and biodiversity, outdoor air quality is still significantly underfunded. The Clean Air Fund's latest analysis shows that only 0.8% of international development aid ($15.8 billion) went towards outdoor air quality management between 2018-2022[16]. In addition to outdoor air quality funding, a larger pool of funding has been provided for projects with air quality co-benefits ($96.2 billion from 2018-2022), including $27 billion in 2022 (85% of total air quality funding that year). These projects do not have air quality improvement as a specific objective, and are often focused on development or climate action in the transport and energy generation sectors, which are significant contributors to air pollution.

While it is important that funding for both air quality projects and air quality co-benefit projects should increase, it should also be recognized that the true volume of funding going to projects that result in an air quality benefit is likely to be higher than the estimates provided. The figures are estimates based on the information available, and there may be many other projects delivering air quality co-benefits that have not been included in the analysis due to a lack of standardization of methodologies to track and report air quality finance. Implementing robust tracking and reporting of air quality co-benefits will allow project impacts to be assessed in order to improve the business case for future air quality projects. This Toolkit aims to kickstart this process by guiding sectoral project officers to consider air quality throughout their project's identification, preparation, and appraisal stages, and enabling them to include indicators for tracking air quality outcomes (which they may already be achieving). Going forward, frameworks such as the Common Principles for Climate Finance Tracking,[17,18] could be used as templates for implementing a similar framework for air quality outcomes.

Another characteristic of air quality funding to consider is the instrument by which it is administered. Air quality funding, both for air quality projects and air quality co-benefit projects, is dominated by loans (over 90% of total funding, as shown in Table 1), with two-thirds of that funding being offered at market-rate over the five year period from 2018-2022. Only 6% of overall air quality funding over that same period came in the form of grants, in comparison to 63% for total Official Development Assistance in 2022[16]. As air pollution disproportionately affects individuals in lower-income countries, where debt vulnerabilities have increased significantly in recent years, governments have less money for domestic spending in areas such as air quality. Therefore, increasing the provision of low-cost loans and grants for projects with air quality co-benefits is vital to aid countries at risk of debt distress and with high exposure to air pollution.

[14] The Benefits and Costs of the Clean Air Act from 1990 to 2020, Final Report – Rev. A, U.S. Environmental Protection Agency, Office of Air and Radiation, April 2011. Available at: https://www.epa.gov/sites/default/files/2015-07/documents/fullreport_rev_a.pdf

[15] Miquel Oliu-Barton, Bruegel, How much does Europe pay for clean air (2024), WP 15 2024.pdf (bruegel.org)

[16] Clean Air Fund. (2024) The State of Global Air Quality Funding 2024. Available at: https://s40026.pcdn.co/wp-content/uploads/State-of-Global-Air-Quality-Funding-2024-UPDATE.pdf

[17] Common Principles for Climate Mitigation Finance Tracking, Joint Climate Finance Tracking Group of Multilateral Development Banks and International Development Finance Club, Revision version, December 2023. Available at: https://www.idfc.org/wp-content/uploads/2023/12/revised-common-principles-2023-12-05.pdf

[18] Common Principles for Climate Change Adaptation Finance Tracking, International Development Finance Club and Multilateral Development Banks, November 2023. Available at: https://www.idfc.org/wp-content/uploads/2023/11/idfc-2023-common-principles-adaptation-1.pdf

TABLE 1: AIR QUALITY FUNDING BY INSTRUMENT, 2018-2022[19]

Funding	Funding provided as loans	Loan total (US$ bn)	Funding provided as grants	Grant total (US$ bn)	Concessional funding	Concessional funding total (US$ bn)	2018-2022 total (US$ bn)
Overall air quality funding	92%	103.5	6%	6.3	36%	40.4	112.0
Outdoor air quality funding	91%	14.7	8%	1.3	70%	11.2	15.8
Funding with air quality co-benefits	92%	88.8	5%	5.0	30%	29.2	96.2

Note: Funding totals include very small amounts of funding delivered through instruments other than grants and loans, such as risk management instruments and project-level equity. This means that together, grant funding and loan funding will make up slightly less than 100% of the total.

The use of cross-sectoral and innovative mechanisms by international development funders, private investors, and governments can drive efficiencies and mobilize long-term private capital into air quality projects, whilst providing an array of co-benefits. One example is using climate investment to catalyze air quality improvements, as climate-focused projects tend to lead to emission reductions in both GHGs and air pollutants. By quantifying GHG emissions reductions in air pollution-focused project proposals, additional funding opportunities can be realized, enabling the delivery of multiple co-benefits.

[19] Table 2.3: Air quality funding by instrument, 2018-2022, reproduced from Clean Air Fund's The State of Global Air Quality Funding 2024. Available at: https://s40026.pcdn.co/wp-content/uploads/State-of-Global-Air-Quality-Funding-2024-UPDATE.pdf

Air Quality Toolbox: Understanding air pollution

Supporting information

Clean Air Fund – The State of Global Air Quality Funding 2024	Highlights trends and gaps in international air and public climate finance spending from 2018 to 2022. Additionally, gives recommendations for governments, bilateral donors and MDBs to tackle air pollution and climate change together.
Climate and Clean Air Coalition – 25 Clean Air Measures for Asia and the Pacific	An overview of philanthropic climate funding trends based on 2015 – 2022 data, including identifying financing across different geographies, sectors, and strategies. Key findings illustrated that philanthropic funding to address climate change remains at under 2% of all giving.
European Commission – Clean Air Tracking	Overview of EU spending and funding mechanisms available to support air quality policies.
Green Climate Fund - Annual Report 2023	Provides an overview of annual climate finance funding (2023) and action to mobilize private climate finance and improve climate finance accessibility.
HEI & IHME – State of Global Air 2024	This report provides a comprehensive analysis of data for air quality and health impacts for countries around the world in 2021.
OECD – Finance and investment for climate targets	Provides an overview of current climate finance spending per sector and amount mobilized for developing countries. Database of environmental taxes per country as a % of GDP.

Supporting information

OECD – The Economic Consequences of Outdoor Air Pollution	Provides a comprehensive assessment of the economic consequences of outdoor air pollution in the coming decades, focusing on the impacts on mortality, morbidity and changes in crop yields as caused by high concentrations of pollutants.
UNEP – Pollution Action Note - Data you need to know	Summary note on the global state of air pollution, major sources, the impact on human health, and national efforts to tackle the issue.
WHO Air Quality Guidelines (2021 update)	Globally established guidelines on ideal ambient air pollution levels to avoid impacts on human health. Often used by policymakers to set standards and goals for air quality management.
World Bank & UNEP – Cooler Finance	Quantifies sustainable investment needs and financing gaps to support sustainable cooling needs in the developing world. This includes highlighting opportunities for private investment and identifying existing barriers scaling up private finance.
World Bank – The Global Health Cost of $PM_{2.5}$	This study calculates the economic costs of premature mortality from air pollution. This aims to help strengthen the case for increased investment in air quality improvements in low and middle income countries.

Guidance

Clean Air Asia – Integrated Programme for Better Air Quality (IBAQ Programme) City Solutions Toolkit	Offers concise guidance on specific aspects of the different air quality management areas and covers elements needed for the effective design and successful implementation of clean air action plans (CAAPs). Guidance on operationalizing CAAPs including prioritizing solutions, adopting technologies and financing are also provided.

1.2 AIR QUALITY AGREEMENTS, LEGISLATION AND POLICY

The hazards that air pollution poses to human health and the environment have led to the introduction of various forms of agreements, legislative controls and policies. These are designed to restrict the release of harmful emissions and manage the impact of emitted substances on local populations and the environment. They also aim to improve the ways in which air quality data is collected, interpreted, and used to inform decision making.

Examples of agreements and controls to improve air quality range from the global to the local level, reflecting the scale at which coordination is needed. Globally, the United Nations Environment Programme (UNEP)'s Guide on Ambient Air Quality Legislation provides a foundation for effective national air quality governance. At the national level, numerous countries have implemented clean air legislation which will impact how development projects are planned. Often this dictates standards for air quality and includes restrictions for key polluting sectors, such as emission standards for industrial processes or vehicles. There may also be requirements for national / sub-national agencies to monitor and manage air quality, for example through establishing air quality monitoring networks and developing Clean Air Action Plans. In addition to localized action, an airshed approach (management of air quality across a geographic area that, because of topography, meteorology, and/or climate, frequently shares the same air) is a commonly used approach. Air quality management within an airshed can help to address transboundary air pollution challenges, especially for $PM_{2.5}$. A number of regional agreements are provided in the Toolbox in the next page.

Increasingly, finance and donor organizations are playing a central role in tackling air quality problems through the implementation of targeted funding and capacity building initiatives. Therefore, an awareness of the existing air quality legislation and policy within the target country and/or city is vital for any project that will have an air quality impact. By understanding the goals and any legally binding targets that may apply, these can be considered in the design of the project and its monitoring, evaluation and reporting (MER) framework so that air quality benefits can be realized and tracked.

Supporting information

UNEP – Guide on Ambient Air Quality Legislation

The Guide assists national lawmakers and policymakers to develop or improve ambient air quality legislation. It promotes robust national systems of air quality governance that prioritize public health outcomes and provides a legal resource for developing robust national legislation that supports public access to scientifically evidenced levels of clean air.

UNEP – Regulating Air Quality: the First Global Assessment of Air Pollution Legislation

This global study assesses national air quality legislation in 194 States and the European Union (EU) against a model of robust air quality governance developed as part of the research.

Agreements, legislation and policies

Association of South East Asian Nations – Agreement on Transboundary Haze Pollution (AATHP)

Regional initiative (transboundary). Following severe land and forest fires in 1997-1998, Association of South East Asian Nations (ASEAN) Member States signed the ASEAN Agreement on Transboundary Haze Pollution (AATHP) in 2002. The AATHP aims to prevent, monitor, and mitigate land and forest fires to control transboundary haze pollution through concerted national efforts, regional and international cooperation.

Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe

Regional initiative. The Ambient Air Quality Directives define common methods to monitor, assess and inform on ambient air quality in the European Union, and establish objectives for ambient air quality to avoid, prevent or reduce harmful effects on human health and the environment. In 2022, as part of the European Green Deal, the European Commission proposed to revise the Ambient Air Quality Directives, aligning the air quality standards more closely with the latest recommendations of the WHO's 2021 Guidelines. **In October 2024, the Council of the European Union voted to formally adopt the revised Ambient Air Quality Directive which will come into force imminently.**

Agreements, legislation and policies

Environment and Climate Change Canada and United States Environmental Protection Agency – Canada-US Air Quality Agreement

Regional initiative (transboundary). The Canada-U.S. Air Quality Agreement was signed in 1991 and was originally designed to address transboundary contributions to acid rain caused by emissions of SO_2 and NO_x. In 2000, the Agreement was amended to address transboundary ground-level O_3 with the addition of commitments on VOCs and additional measures on NO_x. By 2007, both countries met their respective commitments under the Agreement, and comprehensive review and assessment of the Agreement and its implementation now takes place every five years.

European Union – Industrial and Livestock Rearing Emissions Directive 2024/1785

Regional initiative (sectoral). The new Industrial and Livestock Rearing Emissions Directive 2024/1785 (IED 2.0) is the main EU instrument to reduce emissions from industrial production processes into air, water, and land, and to prevent waste generation from large industrial installations and intensive livestock farms (pig and poultry). It amends Directive 2010/75/EU and requires "Best Available Techniques" for control of industrial emissions supported with guidance (BREF) documents.

European Environment Agency – National Emission reduction Commitments Directive

Regional initiative. The National Emission Reduction Commitments Directive (NECD) sets 2020 and 2030 emissions reduction commitments for Member States and the EU for five main air pollutants: NO_x, NMVOCs, SO_2, NH_3 and $PM_{2.5}$. The National Emissions Reduction Commitments Directive (2016/2284/EU) entered into force on 31 December 2016, replacing earlier legislation (Directive 2001/81/EC).

Agreements, legislation and policies

Intergovernmental Network on Atmospheric Pollution for Latin America and the Caribbean and UNEP – Regional Action Plan on Air Quality

Regional initiative. The Regional Air Quality Action Plan 2022-2025 is an update to the regional plan previously developed in 2014. It aims to establish a cooperation framework to support the strengthening of comprehensive air quality management in the Latin American and Caribbean region, at national and subnational levels. The plan considers particulate matter (PM_{10} and $PM_{2.5}$), ground-level O_3 and its precursors (VOCs and NO_x), SO_2, carbon monoxide, black carbon, and methane.

South Asia Co-operative Environment Programme – Malé Declaration on Control and Prevention of Air Pollution

Regional initiative (transboundary). The Malé Declaration was the first regional environmental agreement in South Asia to tackle transboundary air pollution. The Declaration states the need for the countries of South Asia to carry forward, or initiate, studies and programs on air pollution. It outlines a process where current knowledge and information and institutional capacity are documented and baseline studies developed, followed by development of action plans to fill in gaps in current knowledge and create a solid scientific basis for the policy process.

Stockholm Convention on Persistent Organic Pollutants (POPs)

Global initiative. The objective of this Convention is to protect human health and the environment from persistent organic pollutants (POPs). It sets out measures to reduce the total releases derived from anthropogenic sources of the chemicals listed in Annex C, with the goal of their continuing minimization and, where feasible, ultimate elimination.

Agreements, legislation and policies

United Nations Economic and Social Commission for Asia and the Pacific – Regional Action Plan on Air Pollution (RAPAP)

Regional initiative (transboundary). The Asia-Pacific Regional Action Programme on Air Pollution (RAPAP) aims to improve air quality management, facilitate air quality monitoring and open data sharing, enhance monitoring best practice exchange, support capacity building, and mobilize multilateral cooperation. The program includes six virtual dialogues and a knowledge sharing workshop to determine opportunities for improvement and collaboration.

United Nations Economic Commission for Europe – Convention on Long-range Transboundary Air Pollution for Europe

Regional initiative (transboundary). The Convention entered into force in 1983 and lays down the general principles of international cooperation for air pollution abatement as well as an institutional framework. The number of substances covered by the Convention and its protocols has been gradually extended over the years to include ground-level O_3, persistent organic pollutants, heavy metals, and particulate matter.

US EPA – MARPOL (International Convention for the Prevention of Pollution from Ships) Annex VI

Regional initiative. MARPOL is concerned with preventing marine pollution from ships. Annex VI of MARPOL addresses air pollution from ocean-going ships. The international air pollution requirements of Annex VI establish limits on NO_x emissions and require the use of fuel with lower sulfur content. The requirements apply to vessels operating in U.S. waters and ships operating within 200 nautical miles of the coast of North America, also known as the North American Emission Control Area.

1.3 SOLUTIONS FOR IMPROVING AIR QUALITY

1.3.1 Actions to improve air quality

Emissions improvements are driven by either reducing the overall activity that generates emissions, reducing the emissions intensity of that activity, or a combination of both. This "activity-emissions framework" helps in designing policies and strategies aimed at mitigating emissions, as it highlights two distinct pathways to achieving environmental goals.

Emissions reductions can therefore be expressed using a simple equation:

Emissions = Activity Level × Emissions Intensity

A change in activity level or emissions intensity or both will result in a change to the total emissions.

- **Activity Change:** This refers to changes in the scale of the activities that generate emissions. For example, reducing energy consumption or decreasing the number of vehicle miles driven. Reducing the underlying activities directly reduces emissions.

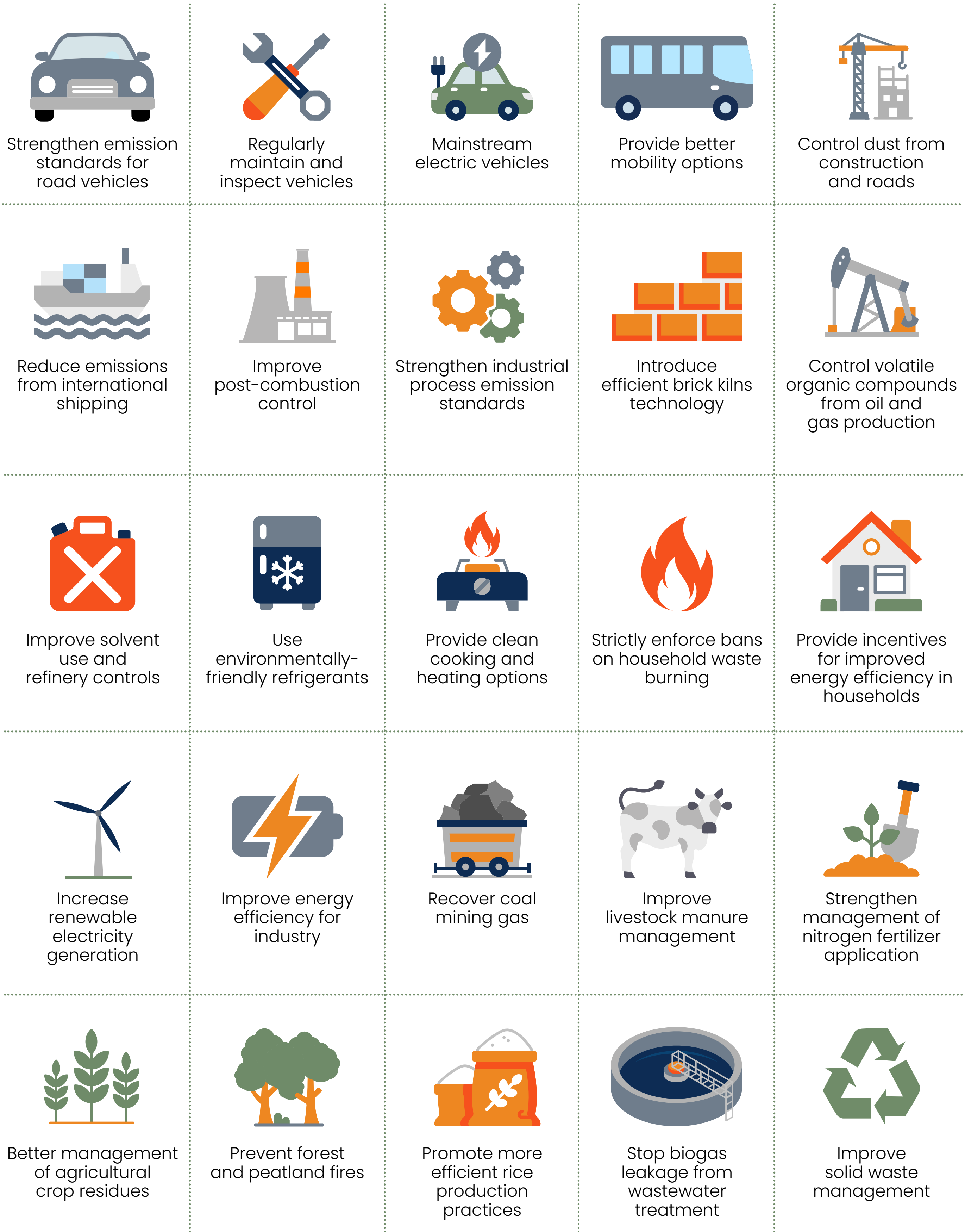
- **Emissions Intensity Change:** This refers to improvements in the efficiency or cleanliness of the activity, meaning the amount of emissions produced per unit of activity decreases. This can be achieved through cleaner technologies, fuel switching, or process improvements. For example, switching from coal-fired power plants to renewable energy sources like wind or solar reduces the emissions per kilowatt-hour of electricity produced.

- **Combination of both:** Often, emissions reductions are the result of both reduced activity and improved emissions intensity. For example, a country might reduce energy consumption through efficiency measures while simultaneously transitioning to cleaner energy sources. These changes are often either directly or indirectly involved with the reduction in use of fossil fuels, which is the overarching main source of air pollutant emissions.

There are a huge number of solutions for improving air quality available across the major polluting sectors, and much work has already been done to determine which actions are the most effective to reduce transport, energy, industry, waste, domestic, and agricultural emissions (Figure 7). Other similar resources are provided in the chapter Toolbox.

Even where projects do not have a primary goal to reduce air pollutant emissions, projects are often developed with unrealized co-benefits for air quality. For example, projects that concentrate on the development of waste collection, recycling, recovery, and advanced disposal systems can help improve air quality in urban areas as effective waste management systems reduce the likelihood of waste burning. Additionally, if waste processing facilities, such as material recovery facilities, composters, anaerobic digesters, and energy-from-waste systems, are fitted with appropriate pollution control technologies, this will help to minimize air pollution impacts on communities. Appendix 1 of this guidance provides an extensive, but not exhaustive, list of measures to improve air quality across key sectors, including the pollutants the measures target, and the estimated timeframe for implementation.

FIGURE 7: TWENTY-FIVE OF THE MOST IMPACTFUL MEASURES TO IMPROVE AIR QUALITY



Source: Climate and Clean Air Coalition – 25 Clean Air Measures for Asia and the Pacific

1.3.2 Integrating air quality and climate change policy

Air pollution and climate change are inextricably linked. Many air pollutants and GHGs share the same sources, the most notable being energy production, transport, agriculture, and manufacturing. In addition, the effects of climate change (such as droughts, wildfires, dust storms, and higher temperatures) are worsening air pollution levels.

Furthermore, some air pollutants are categorized as short-lived climate pollutants (SLCPs), including black carbon, ground-level (or tropospheric) ozone, and methane. These SLCPs both contribute to climate change and impact human health, with black carbon being a component of particulate matter, and methane a precursor to the formation of ozone (see Section 1.1). SLCPs are the most important contributors to anthropogenic global warming after carbon dioxide, responsible for up to 45% of current global warming[20]. As SLCPs can be removed from the atmosphere in periods ranging from days, to up to 15 years, reducing their emissions can prevent four times more warming by 2050 than focusing on decarbonization alone. Reducing the emissions of SLCPs can have major benefits for climate, human health, crop yields, and economies.

Large strides have been made in reducing the emissions of methane through increased financing (such as the World Bank's Global Flaring and Methane Reduction Partnership (GFMR)) and other initiatives such as the Global Methane Pledge). However, more work has to be done on targeting black carbon and ground-level ozone to reduce their climate, environmental and human health impacts. Measures available to reduce SLCPs tend to be practical, technically feasible, and cost effective, such as improving energy efficiency, transitioning to clean cooking and heating technologies, and promoting cleaner transportation, among others[21, 22]. Targeted action on SLCPs – sometimes referred to as super pollutants – holds the key to mitigating climate change in the near-term. Therefore, projects targeting sources most relevant to methane, black carbon, and tropospheric ozone, are an important consideration for both climate and air quality finance.

Instead of tackling emissions of air pollution and GHGs separately, there are policy and technological solutions that address both concerns at the same time by targeting shared emissions sources. Cross-cutting solutions can maximize the co-benefits of addressing air pollution and climate action, ultimately improving health and quality of life. Such solutions are more resource-efficient and cost-effective by capitalizing on both air quality and climate finance. Stakeholder engagement is also increased, since more benefits are highlighted, increasing support at all levels.

In terms of implementation, integrated air quality and climate change policies and projects provide an opportunity to achieve both local and international goals and targets. However, it is

20 Primer on Short-Lived Climate Pollutants, Institute for Governance and Sustainable Development, April 2013. Available at: PrimeronShort-LivedClimatePollutants23april2013EV.pdf
21 The Case for Action on Black Carbon, Clean Air Fund, December 2023. Available at: https://www.cleanairfund.org/resource/black-carbon/
22 The Case for Action on Tropospheric Ozone, Clean Air Fund, November 2024. Available at: https://www.cleanairfund.org/resource/action-on-tropospheric-ozone/

important to be aware that, as well as air pollution and climate co-benefits, there can also be conflicts and trade-offs. For example, a shift to the use of biofuels to realize carbon benefits may lead to increased emissions of air pollutants as shown in Figure 8, whilst conversely the installation of advanced air pollution control technologies to reduce industrial emissions can require additional energy, leading to higher overall carbon emissions. Instead of a siloed approach that may lead to such trade-offs, a combined strategy reduces the risk of redundant or even indirectly harmful efforts.

FIGURE 8: BENEFITS OF INTEGRATED AIR QUALITY AND CLIMATE CHANGE POLICY

Air Quality Toolbox: Understanding air pollution

Supporting information

Asian Development Bank (ADB) – Air Quality in Asia: Why is it important and what can we do?	The appendix 'Measures to improve air quality' provides a list of solutions to address sources of air pollution from the domestic, transport, waste, agriculture, industrial, and energy sectors.
Climate and Clean Air Coalition – 25 Clean Air Measures for Asia and the Pacific	This report outlines 25 clean air measures that could achieve safe air quality levels for 1 billion people by 2030.
Global Alliance on Health and Pollution, Air Quality Asia and Boston College – Air Pollution Interventions: Seeking the Intersection between Climate and Health	This report is intended to help governments and policymakers understand the impact of more than 20 identified practical interventions for addressing air pollution and to determine which of those interventions may be most feasible and effective for their particular communities.
Institute of Air Quality Management (IAQM) – Guidance on the assessment of dust from demolition and construction	Chapter 8 of this guidance provides mitigation measures for dust and other air pollution from construction sites, including measures applicable specifically to demolition, earthworks, construction and trackout.
Ministry of Environment, Forest, and Climate Change, Government of India – Compendium of Viable Technologies and Practices: Lessons from NCAP Cities	The National Clean Air Programme (NCAP) of India, launched in 2019, aims to improve air quality across the country by implementing various measures to address sources of air pollution. Since its inception, significant initiatives have been undertaken in the 131 'NCAP' cities to reduce particulate matter levels. This compendium presents 25 case study examples of initiatives undertaken by NCAP cities to enhance air quality, tailored to local contexts and requirements.

Supporting information

UNEP – Actions on Air Quality: A Global Summary of Policies and Programmes to Reduce Air Pollution

This global report provides a review of policy actions of Member States, building on the UNEP 2016 report 'Actions on Air Quality' which provided an overview of actions undertaken by countries around the world, focusing on a set of measures that, if adopted, would significantly improve air quality. The full report splits out solutions by sector, and executive summaries are also available for different geographies.

World Economic Forum & Global Future Council on Clean Air 2023-24 – Clean Air Actions in Cities

This paper explores nine categories of actions to improve air quality in urban areas, across the transport, energy, industry, urban planning, buildings, residential, and waste sectors. It outlines the co-benefits of these actions for health, the economy, and equity, and presents case study examples of successful actions employed in cities around the world.

Guidance

Climate & Clean Air Coalition (CCAC) – Opportunities for increasing ambition of NDCs through integrated air pollution and climate change planning: A practical guidance document

Provides a practical framework to identify, evaluate and prioritize these actions, and details four opportunities for how climate change mitigation ambition can be increased by taking actions that reduce air pollution, and short-lived climate pollutants, and improve human health.

CCAC and UNEP – Leveraging the Benefits of non-CO_2 Pollutants and Air Quality in NDC 3.0

This guidance provides practical and strategic recommendations for experts and teams involved in preparing their upcoming round of Nationally Determined Contributions (NDCs) 3.0, informing them how to set goals and identify specific measures suitable to the national context. The Guidance describes the role that non-CO_2 pollutants play in ensuring the progressive strengthening of NDCs.

Supporting information

C40 – Clean air, healthy planet: A framework for integrating air quality management and climate action planning

This presents an integrated planning framework to help cities simultaneously meet their climate change, air quality and health goals. The approach identifies major strategies for reducing air pollutants, identifies opportunities for co-benefits, identifies actions that can mitigate or reduce climate change and improve municipal efficiency.

The Institution of Environmental Sciences – Integrating Action on Air Quality & Climate Change: A Guide for Local Authorities

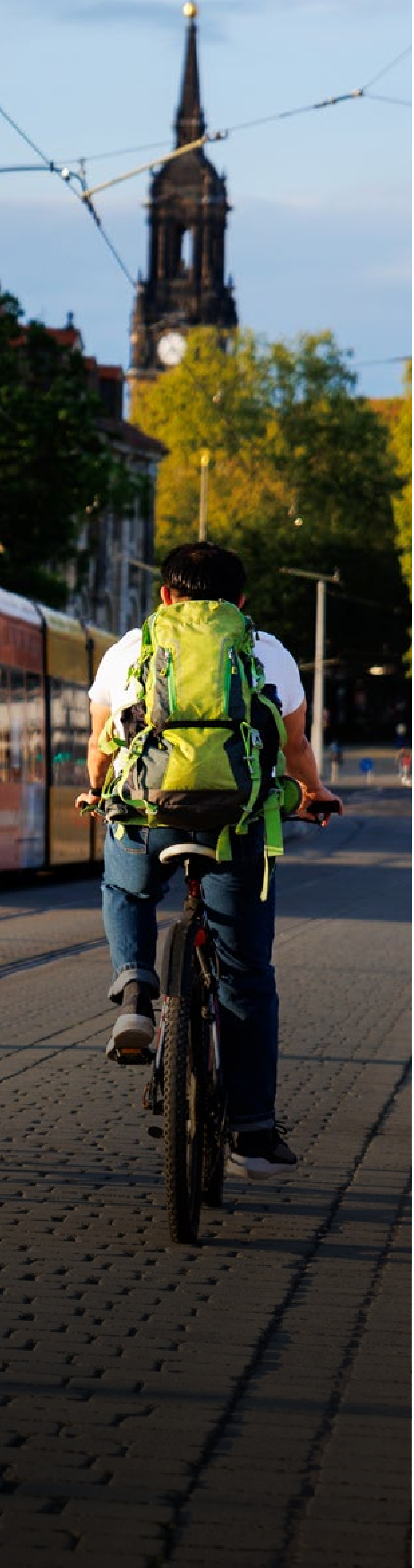
This guidance document, aimed at local authorities in the UK, identifies opportunities for combining local measures on air quality and climate change. It maps out a range of possible measures, their potential impacts on air pollutant and GHG emissions, as well wider impacts on health, safety, and the economy, and outlines support mechanisms for local authorities to make use of. Case study examples of success stories are presented. The document also provides useful guidance on how an integrated approach to air quality and climate change can be developed.

World Bank – Integrating Air Quality Management and Climate Change Mitigation: Achieving Ambitious Climate Action by Cleaning the Air We Breathe

Chapter 5: Designing Interventions to Mitigate SLCPs and their Linkages with Air Quality Management provides a cost-benefit analysis of combined local air pollution and global climate change mitigation, which shows a net welfare gain in comparison to each policy being carried out alone.

PART 2:

CLEAN AIR GUIDE FOR PROJECT OFFICERS



This Toolkit is designed for project officers and managers working across different sectoral development projects with little or no knowledge of air quality. Projects where there is a clear objective of air quality improvements, such as technical assistance projects focusing on developing an air quality evidence base, or policy-based lending establishing or strengthening national and local air quality management frameworks, will already be considering the likely impacts on air quality and setting appropriate indicators.

Part 2 of the Toolkit has been designed as a practical guide for those involved in scoping, designing, and implementing projects that are not focused on air quality improvements but that have the potential to do so. Understanding how to identify and, even more importantly, enhance the potential air pollution impacts of projects is crucial. Even if the impact on air quality of a single project seems small it should still not be overlooked as it will be contributing to a likely wider effort on emissions reduction.

Figure 9 presents an example of a typical project life cycle and demonstrates where air quality considerations could be embedded. It is likely that different DFIs have differing processes depending on the type of investment, but the fundamentals can be universally applied. This section of the Toolkit focuses on guidance for the project identification, preparation and appraisal stages when air quality considerations need to be incorporated. In this section the guidance offered relates to projects with an indirect air quality benefit. The reader should refer back to Part 1 and also the Appendices for supporting information.

FIGURE 9. OPPORTUNITIES TO MAINSTREAM AIR QUALITY THROUGHOUT A PROJECT LIFE CYCLE

Step 1

The DFI (and the borrower where they work together) identify specific projects that are suitable for support. This will be aligned with the country strategy (if prepared) and DFI priorities. Where a Country Partnership Framework/Strategy document is prepared this will identify the country's main investment priorities and needs.

- Inclusion of air quality improvement in country partnership documents (where prepared) alongside other benefits
- Explore (with borrower) if the project will have an air quality positive outcome
- Identify projects specifically designed to deliver air quality improvements
- Inclusion of air quality in the intended project concept alongside other benefits

Step 2

Proposed project has preliminary approval. The borrower and DFI conduct a detailed technical study of the plans. The design and preparation may ultimately be the borrower's responsibility, though the DFI may support contracts for technical support.

- Borrower to include air quality in environmental assessments ideally establishing baseline data and likely health and economic benefits of air quality improvements
- Lender to enable inclusion of air quality and optimisation of air quality benefits in the project preparation
- Include air quality improvement metrics in the proposed M&E framework

Step 5

After the project is complete and all funds have been disbursed, the project is assessed by the MDB in detail so that any improvements can be identified and implemented.

- Assessment/validation of project air quality benefits
- Lessons learned from inclusion of air quality
- Seek improvement of policies and procedures to improve delivery and tracking of air quality benefits

Step 4

Implementing the project may be the responsibility of the lender or the borrower. Where it is done with minimal lender involvement, the DFI will regulate and oversee all major procurement decisions made by the borrower.

- Collect baseline data if not collected in the preparation phase
- Ensure air quality benefits are realised in practice, so far as possible
- Collection of data and assessment of project against air quality related project outcome indicators

Step 3

DFI staff conduct an in-depth assessment of the technical and financial elements of the project and work with the borrower to finalise the project plan. This may be an iterative process.

- Confirmation of project benefits in the context of air quality
- Embed in project outcome indicators

2.1 IDENTIFICATION

2.1.1 Will my project have an air quality positive outcome?

At the concept development stage, it is important to establish if the project will have an air quality positive impact. This will lay the ground work for subsequent steps as the project is developed with the inclusion of air quality as an outcome in the initial inception document. This may already have been identified through a previously agreed country working document produced in collaboration between the lender and the borrower.

Figure 10 on the succeeding pages presents suggestions of how different sectoral projects may have the potential for air quality improvement, including examples of the types of projects that would be expected to reduce air pollutant emissions. This is not an exhaustive list of examples, and there will be opportunities available to reduce emissions from other sectoral projects not listed.

FIGURE 10. EQUATING SECTORAL PROJECTS TO AIR QUALITY IMPROVEMENT OPPORTUNITIES

Residential sector projects

- Projects that **reduce fossil fuel usage and/or replace it with cleaner technologies** in residential areas will reduce air pollutant and greenhouse gas emissions. This could include reducing the overall energy needs for residential activities such as cooking, heating or cooling, or retrofitting / upgrading household devices with cleaner technologies.
- Projects that **increase the energy efficiency** of residential buildings will reduce air pollution as less energy is required and less fuel (of any type) is needed. These types of projects can also improve building resilience to climate change. For example, buildings can be insulated to reduce heating or cooling requirements.

Energy generation and industrial sector projects

- Projects that **replace energy generation via fossil fuels, with energy generation via renewable sources** (such as wind, solar, hydro, geothermal, and green hydrogen) will reduce air pollutant emissions. It is important that this is a transition away from fossil fuels, rather than just increasing energy generation capacity with renewable energy, otherwise there will not be an air quality or climate improvement.
- Projects that **increase energy efficiency in transmission and distribution** will reduce air pollutant and greenhouse gas emissions, as less energy (from any source) is required overall. Projects improving the energy transmission and distribution network can also improve resilience to climate change.
- Projects that **reduce fossil fuel usage in industrial processes** will reduce air pollutant and greenhouse gas emissions. This could be achieved via **increasing energy efficiency in industrial processes** or replacing fossil fuel usage with alternative, renewable fuels.

Transport sector projects

- Projects that **reduce the total number of vehicles** operating, or **reduce the total number of vehicle kilometres travelled**, will reduce air pollutant and greenhouse gas emissions. Examples include projects that facilitate mode shift away from private vehicles to public transport or active travel, or limiting vehicle usage.

- Note that **any vehicle movement** is likely to generate pollution from tire wear, brake wear, and by resuspending dust on the road.

- Projects that **upgrade to a cleaner technology** for a fleet of vehicles will reduce air pollutant emissions. Examples could include switching vehicles from internal combustion engines to electric vehicles (especially where the electricity is from renewable sources), or upgrading vehicles to a newer, less polluting model (e.g., newer Euro Standard).

- Projects that **reduce congestion** will reduce air pollutant emissions, as smoother flows of traffic with less stop-start activity, and less idling of vehicles, produce fewer tailpipe emissions. This encompasses various types of urban mobility projects.

- **Sustainable Urban Transport Plans** (e.g. Low Emission Zones, public transport improvements, active transport, etc.) can be an effective way to progressively and holistically reduce vehicle emissions and improve air quality in a managed and cost-effective program.

Agriculture sector projects

- Projects that **reduce the amount of agricultural waste generated, or provide an alternative use for this waste**, will reduce air pollutant emissions as this generally leads to a reduction in the open burning of residues. Examples include efficient removal of crop residues from fields, avoiding locking farmers into contracts which require unsustainable waste management practices, and developing a value chain that transforms agricultural waste into sustainable economic opportunities.
- Projects that **reduce the need for fertilizers** will reduce air pollutant emissions. Examples include manure management techniques, precision application of fertilizers, and alternative fertilizers.
- Projects that **increase efficiency in agricultural processes** will reduce air pollutant emissions. This could include various modern farming techniques such as housing climatization systems, feeding and grazing strategies, animal nutrition management, planning for livestock genetics, and breeding improvement programs. Such projects can also improve agricultural resilience to climate change.

Waste sector projects

- Projects that **increase coverage of waste collection processes** will reduce air pollutant and greenhouse gas emissions, as affordable / free waste collection services reduce the need for uncontrolled open burning of waste.
- Projects that **improve the efficiency of waste collection services** further reduce air pollutant emissions. This could include streamlining collections / collection routes, and upgrading collection vehicles (e.g. to newer and/or less polluting vehicles).
- Projects that **increase the proportion of waste that is reused or recycled** will reduce air pollutant and greenhouse gas emissions, as this is likely to reduce the amount of open waste burning.
- Projects that **increase energy efficiency in waste management processes** will reduce air pollutant and greenhouse gas emissions, as less energy (from any source) is required overall.

2.1.2 Will my project have financial or economic returns?

Financial returns refer to direct monetary benefits generated by an investment or activity, for example revenues, cost savings, or profits that are measurable in financial terms. Economic returns consider the broader societal benefits of an investment or activity, often including non-monetary gains such as environmental improvement, health benefits, and increased productivity.

Projects which realize reductions in air pollutant emissions will provide a common set of economic returns when successfully implemented. These will include reductions in costs such as those related to health outcomes and fossil fuel usage as well as improvements in social, economic and ecological resilience. However, not all air quality improvement projects result in financial returns as this depends on the nature, scale, and the incentives or savings a project generates. Projects which see financial returns include those that result in savings in energy usage and/or maintenance costs; provide excess power that can be sold to the grid; produce a revenue stream from charges (such as transport schemes); and reductions in heating/cooling costs. Figure 11 provides an overview of some of the different financial and economic returns that can be expected from air quality improvement components of sectoral projects.

FIGURE 11. EXAMPLES OF FINANCIAL AND ECONOMIC RETURNS THAT AIR QUALITY IMPROVEMENTS CAN YIELD

2.2 PREPARATION AND APPRAISAL

2.2.1 What are the key sources of air pollution from my project and the key pollutants of concern?

For projects that offer indirect air quality benefits, the key air pollutants and pollution sources will be dependent on the nature of the technologies and activities involved in the project. The proximity of air quality emissions sources to points of potential impact will also be important. One critical point to keep in mind is that any changes in combustion activity will contribute to changes in air pollution; for example, shifts to renewable energy production from coal or improvements in vehicle technology. Other activities can also contribute to emissions of air pollutants, such as construction, demolition, mining, waste management, and brake and tire wear. Finally, it may be possible to realize indirect benefits, such as the adoption of air quality positive initiatives, through legislation and regulations reform, in particular for transport, energy, and climate.

The pollutant emissions of most concern will primarily be those pollutants that have impacts on human health. In most cities, the top pollutants of concern for human health are NO_2 and $PM_{2.5}$. Depending on the dominant source(s) of air pollution in the area, pollutants such as PM_{10}, SO_2, volatile organic compounds, and NH_3 may also be prevalent; other specific sources such as industrial processes and energy-from-waste may have less-common pollutants that need to be considered. There is also increasing focus on reducing emissions of SLCPs (methane, ground-level ozone precursors and black carbon) co-emitted alongside $PM_{2.5}$ and other gases, due to their relevance to both air quality and near-term climate change (see Sections 1.1.1 and 1.3.2 for more detail). Ideally, the key pollutants of concern will be evident from air quality monitoring data or emissions inventories. This can then be compared with relevant national (e.g., National Ambient Air Quality Standards) or international (e.g., EU Limit Values, WHO Guidelines and Interim Targets) standards to determine whether the relevant standards are being exceeded, and to what extent. However, monitoring data may not always be available, in which case consideration should be given to the potential for baseline monitoring and/or modelling studies to improve the characterization of the air quality issue.

2.2.2 Understanding the current air quality landscape

All air quality positive projects should be influenced by air quality legislation, policies and regulations, as they will have an impact on how DFIs develop projects (including co-benefit projects) with their country partners. Air quality frameworks at the national level commonly dictate how the air quality impacts of a development should be assessed and managed, and therefore influence the design of the preferred option.

National air quality legislation typically describes the standards for pollution levels in ambient air and may include requirements for monitoring and assessment. They may also indicate a country's or city's commitments or targets for improving air quality. However, the specifics of air quality legislation and policy often differs between countries, and in some areas, may not yet be established. An overview of some of the key global and regional air quality agreements, legislation and policies is provided in Section 1.2.

On the following page, the Project Design Checklist can be used to support inclusion of air quality benefits at the project design stage.

At the project design stage, it's useful to undertake the following:

Project Design Checklist

Determine the existing national air quality related legislation, regulations and policies, including whether there is a Clean Air Action Plan, or similar, in place and assess the implications for project design. Relevant documentation could include:

- [ ] Regulations and policies relating to specific sectors, for example industrial or vehicle emission limits.
- [ ] National emission ceiling limits/regulations.
- [ ] Planned or in-progress sectoral actions to reduce emissions of air pollutants.
- [ ] National and/or regional agreements on air quality, including if there is an airsheds approach to air quality management.
- [ ] Clean Air Action Plans with background information on air quality, including air quality monitoring data, identification of key emission sources and a list of current and planned actions to improve air quality.
- [ ] Climate Action Plans, which often include emissions inventories and projections of greenhouse gas emissions, priority climate action plans and other information that may be relevant to air quality initiatives.
- [ ] Understand how the project may be able to support/contribute to national goals and objectives around air quality.

Be aware of transboundary pollution issues and how your project may interact with these. This may include the following considerations:

- [ ] Ensuring the project aligns with international treaties such as the UN Convention on Long-Range Transboundary Air Pollution (CLRTAP).
- [ ] Compliance with environmental regulations in both the project's location, and potentially other affected countries.
- [ ] Consider the transboundary influence of the project from an air quality perspective.
- [ ] Consider how the project might contribute to existing activities to address transboundary pollution issues.

Assess what existing data are available (see the toolbox in Section 3.2.4 for supporting information, guidance, and tools related to this). This will help to understand which pollutants may already be an issue, as well as what data may be available for setting a baseline and measuring project impacts. Data may include:

- [ ] Existing air pollution measurement infrastructure, and associated monitoring data.
- [ ] Emissions inventories and/or source apportionment studies.
- [ ] Air pollutant dispersion modelling studies.

2.2.3 What are the priority options / solutions to reduce air pollution from the identified sources and are they feasible?

Where air quality is not the primary focus, there are still likely to be opportunities to maximize air quality benefits, with minimal impact on the bottom line of the project. 'Low hanging fruits' include, for example, the establishment of a robust construction dust management plan, and consideration for the provision of low emission transport options. It is important to consider all the available options at the outset, and follow an evidence-based approach to refining those options, providing an estimation of the impacts to aid decision making. Consideration should also be given to international best practice to identify 'tried and tested' methods. Appendix 1 provides examples of measures that have positive impacts on air quality, and the toolbox in Section 1.3 contains supporting information and further guidance on actions to improve air quality, as well as integrating air quality and climate change policy.

The following should also be considered for sector-specific initiatives:

- **Transport** – Transport impacts can often be hyper-local. Transport modelling, together with a detailed air quality dispersion model, can offer insights into local hotspots, and allow the testing of various scenarios. Consideration should also be given to distributional impacts, where transport initiatives create new traffic problems in other areas.
- **Energy / Industry** – Proximity is key with energy and industry. If installations are near to residential areas, the risk to populations will be higher. Consider options for continuous emissions monitoring and the adoption of Best Available Techniques (BAT).
- **Waste** – Solid waste management poses a significant challenge, especially where the infrastructure is lacking. Bans on waste burning can be difficult to enforce. Significant improvements will likely require investment in waste management facilities and behavior change campaigns.
- **Agriculture** – Agricultural burning poses an enormous challenge for air quality, and can be difficult to address due to the diffuse nature of the sources (both on- and off-farm), and lack of funding. Technological solutions are available, but consideration needs to be given to a suitable support structure for farmers, and impacts on supply chains.
- **Construction and demolition** – Often overlooked, but a significant source of particulate emissions in urban environments. Although challenging to enforce, best practices can be established at the design stage and implemented through permits and licenses.

Once a ‘long list’ of potential options has been drawn up, an initial feasibility assessment should take place to refine this list before more in-depth assessments of the impacts of the options takes place. This rapid assessment aims to produce a ‘short list’ of solutions for further exploration and discussion. The Initial Feasibility Assessment Checklist below provides some of the main considerations.

Initial Feasibility Assessment Checklist

- [ ] Is the cost of the proposed solution feasible? For example, is the cost to implement the solution a reasonable proportion of the total budget for the project, or would it incur an excessive cost that would jeopardize the viability of the project?
- [ ] Does the timeline to implement the proposed solution align with the timeline for implementation of the project as a whole? If the proposed solution would delay the project significantly, another option may be more appropriate.
- [ ] Are there any regulatory constraints that may prevent the proposed solution from being implemented? For example, national legislation is often required to enable Low Emission Zones to be enacted in cities.
- [ ] Is there sufficient technical capacity to implement the proposed solution? This could be within the local team on the group, within the funding agency, or via academia, consultants, or other technical experts that could be brought on to the project.
- [ ] Is the proposed solution likely to lead to increases GHG emissions? If a significant trade-off between air quality and GHGs is expected, then other solutions may be more appropriate.
- [ ] What is the potential of the solution for financial and economic returns? For example, any solution that charges penalties for non-compliance can generate revenue, and most solutions would be expected to generate an economic benefit via realization of improvements to human health.

Many of the considerations above can be addressed during project planning and implementation; however, an initial feasibility assessment is a good sense check as to which solutions can be immediately ruled out, and which are likely to be most appropriate for the project’s needs as a whole.

2.2.4 What are the potential impacts of the project?

Prior to project implementation, it is important to consider how the different phases of the project could impact air quality, and to what extent these changes will be captured in the monitoring, evaluation and reporting (MER) framework.

The relationship between a development project and the surrounding air will change as it moves through the project phases. For example, during demolition and construction, key sources of air pollution will likely include Non-Road Mobile Machinery, and the dust generated by these activities. Therefore, it's important to consider how safeguards can be adopted to minimize impacts during this period as well as the operational phase.

The area of influence of the project from an air quality perspective should be determined. The project may have an impact on the immediate vicinity; across a whole city; or, where there are significant transboundary pollution issues, cross border pollution impacts may need to be understood.

Determining the impacts on the area of influence of a proposed project can be complex, as these are not limited to the total change in emissions, in the same way that GHG impacts would be determined. It is also likely that it will be necessary to source external expertise to support such assessments. Of key importance when looking to quantify the impacts of a project on air pollution metrics is to ensure that a baseline (without the project) situation is captured at the preparation and appraisal stages before the project implementation begins. In an ideal world an air quality impact assessment would consider the changes in ambient air quality that may be brought about as a result of that project, as well as throughout the project's lifecycle (i.e. implementation). There are also less-complex options for incorporating air quality into projects to ensure they are flagged as having an air quality benefit. These options are outlined below:

1. **Qualitative/semi-quantitative assessment**. This is the very minimum approach. The assessment is whether the project will lead to an increase or decrease in air pollution, or no significant change. The change could be described as Low/Medium/High and defined on the basis of project type and scale. At a minimum, this can feed into institutional reporting, e.g., "xx% of our projects delivered air quality benefits". Associated indicators would be qualitative.

2. **Emissions-based evaluation.** This approach estimates the change in emissions resulting from the project to set alongside the calculation of carbon benefits (i.e. steps 1-3 in the flow chart in Figure 12). As discussed in Section 1.3.1, emissions reductions can therefore be expressed using a simple equation: **Emissions = Activity Level × Emissions Intensity**. Some indicators would need to be defined to collect information on changes in activity and emissions intensity.

3. **Detailed assessment to determine health and economic benefits.** The full quantification of likely air pollution changes due to a project requires a number of steps as summarized previously in Figure 11. This process allows for air quality benefits of a project to be clearly understood in terms of both potential health outcomes and associated economic savings. The economic benefits can be set alongside the investment costs and benefits to give a full understanding of the financial benefits of the planned investment. It is, though, acknowledged that such an assessment has associated resource implications.

Table 2 presents the advantages and disadvantages of the three different assessment options.

Reaching for the "ideal" detailed assessment for projects with an air quality co-benefit may be a stretch until air quality becomes more strongly embedded in project design. However, project officers should at a minimum explore what is possible, to push the assessments to the most robust option.

TABLE 2. THE RELATIVE ADVANTAGES AND DISADVANTAGES OF THE ASSESSMENT APPROACHES

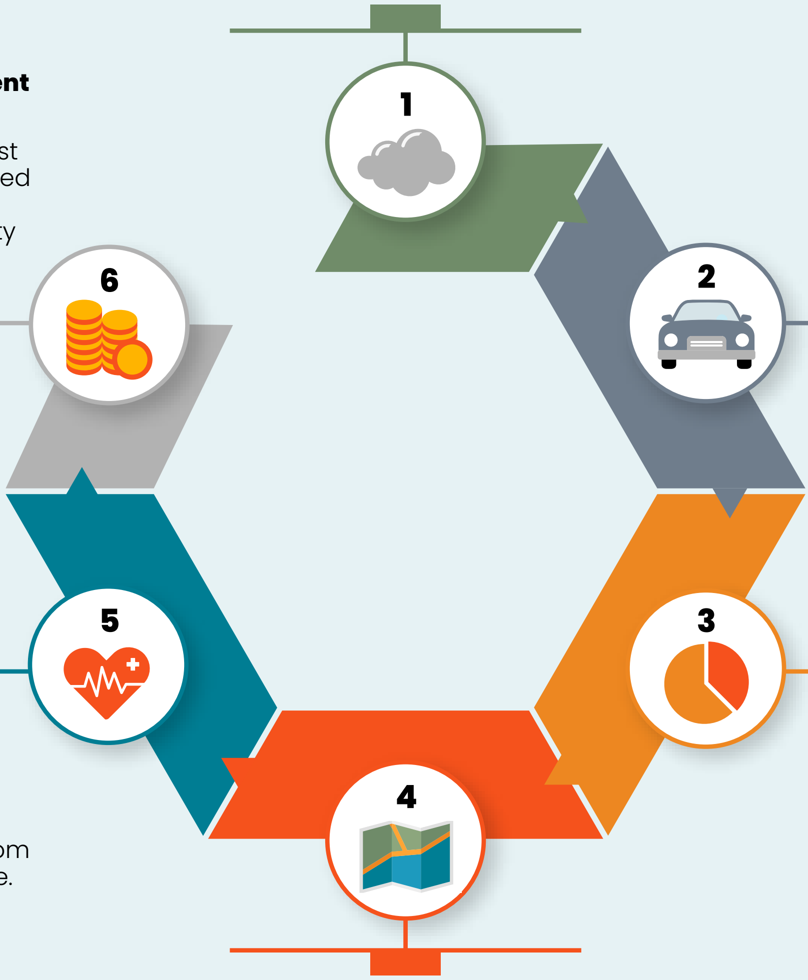
Assessment type	Pros	Cons
Qualitative assessment of the impact of a project on air quality	• Allows for the reporting of a project as air quality positive. • No expertise required. • Minimal impact on budget.	• Least robust options for assessing air quality impacts. • Limited or no quantitative impacts data. • Unable to demonstrate the contribution of the project to air quality improvements. • Unable to include air quality related benefits in the project cost-benefit assessment.

Assessment type	Pros	Cons
Assessment of emissions changes	• Allows for a simple framework of indicators to quantify air quality positive projects. • Provides an assessment as to the contribution of the project to emissions reductions. • Requires data inputs from a small number of predefined indicators. • Some expertise required but may not require external consultant support.	• Does not translate changes in emissions into changes in ambient air quality concentrations. • Insufficient insight to include air quality related benefits in the project cost-benefit assessment.
Detailed air quality assessment	• Most robust option for assessing air quality impacts. • Translates emissions changes into changes in air quality concentrations. • Provides a mechanism to test different project scenarios and their impact. • Demonstrates the likely health impacts on local populations. • Provides economic benefit information to support project justification.	• Requires detailed data inputs. • Requires specialist expertise most likely to external consultants. • Adds additional costs to the project.

FIGURE 12. STEPS IN QUANTIFYING AIR POLLUTION CHANGES AND ASSOCIATED BENEFITS

Baseline emissions

Estimate activity and emissions without the project within the selected project boundary (e.g. plant to be upgraded, road network to have improved public transport infrastructure).



Changes to emissions sources

Improvements in source activity and/or reduced emissions due to project. Projected (ex-ante) or actual (ex-post).

Emissions inventory/ emissions calculations

Translate changes in sources to changes in emissions.

Air quality modelling

Estimates of current or future pollutant concentrations accounting for emissions from project, other source emissions and weather conditions.

Health impacts

Calculate mortality (early deaths) and morbidity (increased illnesses) resulting from air pollutant exposure.

Economic assessment

Translate changes in health impacts to cost savings due to reduced healthcare costs, increased productivity and wider benefits.

Air quality concentrations - Baseline (ex-ante) and with project (ex-post)

For some projects ex-ante and ex-post measurement regimes can be devised although it can be difficult to see the effect of the project on ambient air pollution. Measurement data is useful for validation of air quality models and to support health impact assessment. Existing monitoring, satellite data and international databases may be available.

Further to Figure 12, below is a brief description of the role of the key tools used for the full quantification of air quality impacts.

Air pollution monitoring or measurements: A variety of technologies, designed to give an indication of the concentrations of pollutants in the air. These approaches vary in price, accuracy, and suitability. In a project context, monitoring data can be used to establish a 'baseline', which provides the current level of pollution in the study area. Monitoring data can then be used to measure any changes in air quality resulting from the project. Monitoring data is also useful to support validation of modelling activities. Limitations of monitoring are that it can be difficult to see changes in air pollution as a result of a project. Also there can be a need for ample financial, technical, and human resources to operate and maintain more complex equipment / networks. It is important to note that many cities have existing air quality measurement networks (these may be operated by the city itself, academic institutions, other foreign agencies), and these can be reviewed to determine if they are useful for the project under consideration.

Emissions inventories/calculations: For input into air quality modelling a database of the total emissions of pollutants is required. This can cover ambient air pollutants and/or climate pollutants such as GHGs and short-lived climate pollutants. Emission inventories identify sources of pollution, with varying complexity and accuracy depending on the data available and methods used. Their scope can be for all sources or specific key sources and cover a whole country, a city, or a single source location.

For assessing a project impact it is possible, as discussed above, to measure a few metrics to enable assessment of emission changes. Suggested indicators are provided in Appendix 2.

Air quality modelling: A range of techniques to better understand the behavior of pollutant emissions in the air, in combination with the influence of meteorological (weather), chemical reactions, and emission sources. These vary in complexity and scope and can estimate the dispersion of pollutants across entire continents, or be used for local scale assessments. Modelling provides a higher spatial resolution of estimated pollutant concentrations which can be used for health impact assessment and cost-benefit analysis. Models also enable more complex scenario testing, informing decision making on policies and project selection and prioritization.

Health impact estimation: The quantification of the health effects of pollutants on populations, which can in turn enable quantification of the economic consequences of these health outcomes. This enables the representation of air quality impacts in terms of human health (e.g., respiratory and cardiovascular diseases, premature mortality, hospital admissions, and birth outcomes) societal and economic outcomes, including lost working days. There are a number of methods available and most require ambient air pollution concentrations, local health related data and population data. Although the estimates may carry some uncertainty, they offer an effective means of estimating and communicating air quality impacts.

Supporting information

IQAir	The IQAir air quality map presents global measured air quality concentrations collated from over 100 data sources including various national- and city-level environment agencies (e.g., European Environment Agency, Singapore National Environment Agency, Beijing Environmental Protection Monitoring Centre) and US embassies.
Milken Institute School of Public Health – Urban AQ Explorer	The Urban Air Quality Explorer provides global data on concentrations for $PM_{2.5}$, NO_2, O_3 and CO_2, as well as PAF (Population Attributable Fraction) and annual cases and rates for health outcomes attributable to these pollutants.
OpenAQ – OpenAQ Explorer	OpenAQ Explorer is an interactive way to explore a global repository of open air quality measurements. It is an open-source, open-access database of real-time and historical air quality data. OpenAQ aggregates and harmonizes disparate measurements from government-measured and research-grade monitors, as well as air sensors.
US Environmental Protection Agency – AirNow Department of State	AirNow Department of State collects **Air Quality Monitoring data from U.S. embassies and consulates around the world**. It typically provides concentrations and air quality index (AQI) data for $PM_{2.5}$, but some stations also include other pollutants such as O_3.
WHO – Epidemiological repository on particulate matter and mortality	This epidemiological repository is a compilation of quantitative information on the magnitude of mortality risks related to long-term exposure to ambient particulate matter, identified through a two-stage search strategy of epidemiological studies. It aims to provide decision-makers, policymakers, and researchers with an easily accessible database of exposure-risk relationships between ambient particulate matter and mortality. It can complement the use of health impact assessment software such as AirQ+ (see Guidance).

Guidance

Clean Air Asia – Guidance Framework for Better Air Quality in Asian Cities	Relevant guidance is included on (1) Ambient Air Quality Standards and Monitoring and (2) Emissions Inventories and Modelling. Relevant key guidance for understanding air pollution health impacts is the Guidance Area 3: Health and other impacts. It includes a roadmap and a step-by-step guide on developing a health impact assessment.
United Nations Economic Commission for Europe (UNECE) – An Introduction to Emissions Inventories	This slide deck from a UNECE workshop organised provides an introduction to emissions inventories, their drivers, international and national policy needs, methodologies, and emissions inventories' outputs.
Urban Emissions.Info – Primer on Source Apportionment	This primer summarizes the purpose of source apportionment and the steps in the process in simple terms, via two different approaches.
WHO – Health impact assessment (HIA) methods	These guidelines emphasize setting air quality standards, assessing the health impacts of air pollution, and integrating air quality management into development projects. The WHO encourages Multilateral Development Banks (MDBs) to use health-based indicators and benchmarks in their projects to ensure that air quality considerations are adequately addressed.
WHO – Policy brief 1 on health impact assessments and incorporating health into environmental assessments	This policy brief provides guidance on the proportionate assessment of health impacts in environmental assessments. It contextualizes how public health, heath systems, and other sectoral actions overlap and function to protect and improve help. The guidance sets out questions that should be asked during the project planning and implementation phases in order to undertake an assessment of potential health impacts.

Tools

Centre for Diet and Activity Research (CEDAR) University of Cambridge – Integrated Transport and Health Impact Modelling Tool (ITHIM)	The Integrated Transport and Health Impact Modelling Tool (ITHIM) is a collection of related tools and models that perform integrated assessment of the health effects of transport scenarios and policies at the urban and national level. The health effects of transport policies are modelled through the changes in physical activity, road traffic injury risk, and exposure to $PM_{2.5}$ air pollution. Some versions of ITHIM also predict changes in CO_2 emissions.
Clean Air Asia – IBAQ City Solutions Toolkit: Health and other impacts	An updated guidance on (a) Inter-agency collaboration for Health Impact Assessment, (b) Health Impact Assessment Tools for Cities, and (c) Stages and Types of Health Impact Assessment for Cities.
C40 – Air Quality through Urban Actions (AQUA) Tool	An Excel spreadsheet model that city staff are able to use with minimal guidance. The model utilizes population, exposure, health and economic cost data, along with epidemiologic evidence, to help users calculate how emission changes can benefit local air quality and health. Two options for analysis are available: rapid, and advanced analysis.
Stockholm Environment Institute – Long-range Energy Alternatives Planning Integrated Benefits Calculator (LEAP-IBC)	The Long-range Energy Alternatives Planning Integrated Benefits Calculator (LEAP-IBC) is an integrated planning tool to help governments jointly assess GHGs, SLCPs, and other air pollutant emissions; build mitigation scenarios; and understand how emission reductions benefit climate and health. It combines emissions scenarios with a global atmospheric chemistry transport model and exposure-response.
US Environmental Protection Agency – Solid Waste Emissions Estimation Tool (SWEET)	The Solid Waste Emissions Estimation Tool (SWEET) is an Excel-based tool that quantifies emissions of methane, black carbon, and other pollutants from sources in the municipal solid waste sector. The tool provides emissions and emissions reduction estimates at the project-, source-, and municipality-level. Cities can use this information to establish a baseline scenario, compare scenarios, analyze projects for potential emissions reductions, estimate the contribution of activities in the waste sector to overall city emissions, and track progress over time.

Tools

USEPA – Environmental Benefits Mapping and Analysis Program - Community Edition (BenMAP-CE)	This is an open-source computer program that calculates the number and economic value of air pollution-related deaths and illnesses. The software incorporates a database that includes many of the concentration-response relationships, population files, and health and economic data needed to quantify these impacts.
WHO – Climate Change Mitigation, Air Quality and Health (CLIMAQ-H)	Using methodologies based on evidence from epidemiological studies, CLIMAQ-H calculates the annual benefit of averted long-term mortality and morbidity from exposure to ambient air pollution. The tool estimates the health and related economic gains by implementing actions and measures aimed at mitigating climate change and considers primary emissions reductions of $PM_{2.5}$ as well as changes in the secondary PM aerosols from reductions of emissions of SO_2, NO_x and NH_3.
WHO – Integrated Sustainable Transport and Health Assessment Tool (iSThAT)	The Integrated Sustainable Transport and Health Assessment Tool (iSThAT) is a user-friendly, interactive Excel-based tool for evaluating carbon mitigation alternatives in transportation by calculating health risks using an 'impact pathway' analysis. It is intended for use by local authorities, including their advisers and technical staff, as well as regulators, urban planners, private/public enterprises, non-governmental organizations, and educators.

2.2.5 Which agencies need to be engaged in air quality policy / regulation?

As outlined in Section 2.2.2, relevant air quality rules and regulations will impact how projects are developed with in-country partners, and it is important to engage with the right agencies. While national governments and/or international bodies (such as the European Commission) set air quality standards, it is often local and regional governments that are responsible for achieving those standards by implementing solutions to manage and improve air quality. In many cases, the local government department responsible for environmental protection will be responsible for the air quality management in a city, and the extent to which there are dedicated officers for air quality management varies a lot between cities. Where transboundary air pollution is an issue, it is vital that regional collaboration takes place in order to align actions and tackle the problem effectively.

Within national and local governments, it is likely that departments outside the environmental protection (or equivalent) team will need to be engaged in order to successfully implement the solution. This is generally dependent on the sector the project falls within; e.g., transport, waste, energy, or industry, but may also involve departments such as planning, legal, finance, public health, and procurement. Where Clean Air Action Plans (or equivalent) are in place, they are often key to ensure coordination and collaboration among these different departments.

Other organizations can be engaged with to support governments with initiatives to improve air quality, for example: development organizations, the private sector, non-governmental organizations and other civil society groups, the media, and academia.

Air Quality Toolbox: Engaging with stakeholders on air quality management

Supporting information

C40 Cities – Air Quality Communications Toolkit	The Air Quality Communications Toolkit is a comprehensive resource designed to assist cities in effectively communicating their efforts and progress in addressing air quality challenges. However, the toolkit is relevant for project officers as it provides guidance on understanding the existing air quality management situation in a city or region, the relevant stakeholders, and how to engage with them.
Integrated Programme for Better Air Quality in Asia (IBAQ) – City Solutions Toolkit: Communications Planning for Cities	Though primarily aimed at wider air quality communications, this toolkit provides useful guidance on effective stakeholder mapping and planning for engagement. It identifies the relevant stakeholder groups for engagement on air quality management issues and provides a template of questions and considerations for engaging with them.
World Resources Institute (WRI) – Clean air action: applications of citizen science to identify and address air pollution emission sources	The paper presents reflections emerging from a purposive literature review of 33 case studies of citizen science initiatives addressing air pollution sources. It provides insights into how citizen science methodologies can be used to address air pollution sources, and considers what is needed to achieve positive outcomes from this type of engagement.

2.2.6 Development of a Monitoring, Evaluation and Reporting Framework

A framework for Monitoring, Evaluation, and Reporting (MER) will be developed and approved as part of the project preparation and appraisal phase. For ensuring air quality positive projects are tracked, it is important to include air quality within this framework. The Monitoring, Evaluation and Reporting Checklist on the next page provides some of the key factors to consider:

Monitoring, Evaluation and Reporting Checklist

- Which air pollutants will be impacted by the project?

☐ $PM_{2.5}$ ☐ PM_{10} ☐ NO_x/NO_2 ☐ SOx/SO_2 ☐ NH_3 ☐ VOCs ☐ BC

Other (specify) ______________________________

- What impact is the project expected to have on:

  Reducing overall activity that generates emissions?

  ____

  Reducing the emissions intensity of that activity?

  ____

  Reducing both overall activity and emissions intensity of the activity?

  ____

- What data are currently available external to the project to support MER?

  ☐ Air quality monitoring data ______________________________

  ☐ Emissions measurements ______________________________

  ☐ Activity Measurements (e.g., indicators in bold in Appendix 2) ______________________________

  ☐ Other secondary indicators (see Appendix 2) ______________________________

- Has the option for detailed assessment of air quality benefits been explored and discussed with the borrower?

  ____

  What level of assessment was agreed upon?

  ____

- What data are required to define a baseline?

  ____

- What data are required during implementation to allow for tracking of air quality impacts?

  ____

- Who will collect the data?

  ____

- How often will the data be collected?

  ____

- Who will analyze and report the data?

  ____

Answering the questions in the Monitoring, Evaluation and Reporting Checklist will allow a set of project indicators and a data collection plan to be developed specifically for air quality, to slot into the MER framework. Appendix 2 provides example indicators that can be used to track projects where there is good potential for the project to result in an air quality benefit or co-benefit.

Air Quality Toolbox: Case studies

Case study	Description	Link
Bangkok, Thailand	The Japan International Cooperation Agency (JICA) has funded a technical co-operation project in Thailand, aiming to strengthen Bangkok's capacity for air quality management by improving its PM emissions inventory, developing a simulation model , assessing the pollution structure, formulating effective pollution control measures, and sharing knowledge.	Signing of Record of Discussions on Technical Cooperation Project with Thailand: Support for prevention and reduction of air pollution caused by PM2.5 | News and Publication - JICA
Dhaka, Bangladesh	In 2017/18, the main sources of air pollution in Dhaka were industry (largely brick kilns), construction, and vehicles. It was also estimated that air and water pollution cost $6.52 billion in urban areas; yet only $2.4 billion of air quality finance was committed to Bangladesh in from 2015-2021. In response, the Bangladesh Environmental Sustainability and Transformation (BEST) project was implemented, investing in pollution reduction activities focusing around brick kiln sector, municipal waste management and rooftop solar systems. The project was funded by a $170 million Green Credit Guarantee Fund (CGF), financed by the World Bank, AFD, and the private sector.	Case studies: innovative finance for air quality - Clean Air Fund

Air Quality Toolbox: Case studies

Case study	Description	Link
Hebei, China	The Hebei Air Pollution Prevention and Control Program was funded by the World Bank via Program-for-Results (PforR) finance. The Hebei Pollution Prevention and Control Implementation Action Plan (HAP) 2013–2017 had a goal of reducing $PM_{2.5}$ concentrations by 25% by 2017, compared to 2012. Specific indicators related to the funding included targets for reductions in NO_x and SO_2 emissions from industry, reductions in $PM_{2.5}$ from area and dust sources, and reductions in NO_x from mobile sources.	World Bank – China - Hebei Air Pollution Prevention and Control Project Implementation Completion and Results Report
Indore, India	In January 2023, USAID funded the installation of three new air quality monitoring stations. The results from these have provided an understanding of the timing of air pollution, suggesting that transportation is a significant contributor of air pollution.	Six Takeaways from Indore's New Air Quality Monitoring Stations - Urban Links
Malé, the Maldives	The Greater Malé capital region and its 32 outer islands suffer from severe environmental pollution, mainly due to the 10-hectare dumpsite on Thilafushi island where 830 tons of solid waste are dumped or burned every day. In 2019, the Government of Maldives launched the $151 million Greater Malé Waste-To-Energy Project, aiming at establishing a sustainable regional solid waste management system. Financing was approved in 2020 and largely provided by ADB, through a $38 million concessional loan and a $35 million grant. The Asian Infrastructure Investment Bank (AIIB) also co-financed a $40 million loan. Other financial support came from Japan Fund for the Joint Crediting Mechanism (JFJCM) (grant of $10 million) and the Government of Maldives ($28 million), demonstrating close collaboration between international development funders.	Case studies: innovative finance for air quality - Clean Air Fund

Air Quality Toolbox: Case studies

Case study	Description	Link
Nairobi, Kenya	The Green Climate Fund invested \$9.3million to develop a GHG and SLCP monitoring network in Nairobi for improved compliance and stricter enforcement of emissions standards.	Green Climate Fund – Concept Note: Developing a GHG and SLCP monitoring network for enhanced compliance & enforcement of emission standards and improved climate change reporting
Pune, India	In order to reduce PM and CO_2 emissions, as well as reducing the amount of noise pollution, Pune are electrifying 25% of its public bus fleet by 2031. The project, launched in 2019, was funded by Pune Municipal Corporation (PMC), Pimpri Chinchwad Municipal Corporation (PCMC), Pune Smart City Development Corporation Ltd. (PSCDCL), and the FAME II Central Government Scheme.	Ministry of Environment, Forest, and Climate Change, Government of India – Compendium of Viable Technologies and Practices: Lessons from NCAP Cities

APPENDICES

APPENDIX 1: MEASURES TO IMPROVE AIR QUALITY

Tables A.1 - A.5 present an overview of potential measures for air pollution reduction, organized by sector: transport, residential sector/buildings, energy generation and industrial, agriculture, and waste. The tables provide a short description of what each measure entails, the pollutants it targets, and an estimated timeline for implementation referring to how long it would take to implement the action. Short-term indicates less than a year to implement, medium-term indicates around 1-3 years, and long-term indicates 3-5+ years. The list is intended to be extensive, but not exhaustive, especially as new technologies are developing all the time.

The majority of these actions will have additional carbon co-benefits that can lead to a reduction in GHG emissions.

However, the relationship between air quality and climate change is complex, and some actions may have unintended consequences for one or both. For example, implementing NO_x emission reduction technologies in vehicle exhaust systems can significantly decrease NO_x levels, improving air quality. However, this process can reduce fuel efficiency, leading to increased fuel consumption and therefore GHG emissions. Similarly, while renewable energy sources like biomass are considered carbon-neutral and do not contribute to greenhouse gas accumulation, burning biomass still releases air pollutants, which can negatively impact on air quality. These trade-offs highlight the need for a balanced approach to addressing both air quality and climate change.

TABLE A.1: MEASURES TO ADDRESS AIR POLLUTION FROM THE TRANSPORT SECTOR

Measure	Description	Pollutants targeted	Timeline for implementation
Emissions standards, testing and inspections for road vehicles	Establish emissions testing centers, conduct roadside emissions tests, run awareness or promotional campaigns (e.g. discounted tests) to promote testing benefits.	PM, NO_x, SO_2	Short-term
Promote the use of low emission vehicles	Upgrade vehicles, promote renewable and alternative fuels.	PM, NO_x, SO_2	Medium/Long-term
Improved public transport	Enhance public transport, for example by upgrading vehicles, adding additional routes and stops, providing discounts and offers to encourage ridership.	PM, NO_x, SO_2	Medium/Long-term

Measure	Description	Pollutants targeted	Timeline for implementation
Encourage active travel	Improve active travel infrastructure to provide safe routes for travel and convenient facilities for e.g. bicycle storage, host promotional events (e.g., Car Free Day, cycle to work day).	PM, NO_x, SO_2	Medium-term
Optimize traffic network	Optimize urban planning, improve junctions, build bypasses, and implement intelligent traffic systems to reduce congestion.	PM, NO_x, SO_2	Medium/Long-term
Fugitive road dust control	Implement street sweeping, pave roads, use dust sprays, and enforce dust management plants at construction sites.	PM	Short-term
Electric transport	Develop charging infrastructure, ensure reliable power supply, and consider offsets from electricity generation; provide grants and subsidies for public transport providers, taxis, and the general public to encourage uptake.	PM, NO_x, SO_2	Short-term
Eliminate 2-stroke engines	Introduce technology to reduce emissions, enforce regulations, and provide financial incentives to phase out 2-stroke engines.	PM, NO_x, SO_2	Medium-term
Integrate land use and transport planning	Promote mixed-use development, discourage urban sprawl, encourage smart growth, and develop mass transit initiatives.	PM, NO_x, SO_2	Long-term
Improve fuel quality	Upgrade to higher quality fuels, couple clean fuels with clean engine technologies and encourage investment from the fuel and auto industries.	PM, NO_x, SO_2	Short-term
Alternative fuels	Explore and support the use of alternative fuels, for example, ethanol, Compressed Natural Gas, hydrogen, and electricity.	PM, NO_x, SO_2, CO_2	Medium-term
Secondhand vehicles and engines	Monitor secondhand vehicle imports, ensure they meet emission and safety standards.	PM, NO_x, SO_2	Medium-term
Low Emission Zones	Restrict vehicle entry to specific areas, improve vehicle emission legislation and use technology for enforcement.	PM, NOx, SO_2	Medium-term
Central area congestion charging zones	Implement congestion charges in targeted zones, enforce with technology, provide alternative transport options.	PM, NO_x, SO_2	Medium-term

Measure	Description	Pollutants targeted	Timeline for implementation
Landscaping and planting	Plan urban planting projects carefully to avoid adverse effects, creating climate and liveability co-benefits.	PM, NO_x, SO_2, CO_2	Long-term
Transit-oriented development	Encourage smart urban growth, develop mass transit systems, and integrate feeder routes, emphasizing mixed-use development.	PM, NO_x, SO_2, CO_2	Long-term
Park & Ride	Establish secure parking areas linked to public transport, with strong central area parking controls to encourage usage.	PM, NO_x, SO_2, CO_2	Short/Medium-term
Parking controls	Implement parking controls to encourage alternative transport use, with clear signage and enforcement, reducing congestion.	PM, NO_x, SO_2,	Short-term

TABLE A.2: MEASURES TO ADDRESS AIR POLLUTION FROM THE RESIDENTIAL SECTOR/BUILDINGS

Measure	Description	Pollutants targeted	Timeline for implementation
Improvements in household fuel quality	Regulate coal use in households, and establish a supply chain to allow phase out of coal usage.	PM, SO_x	Medium-term
Switching to cleaner fuels	Eliminate use of solid fuel (biomass and coal), diesel, heavy fuel use etc. Introduce natural gas, liquified petroleum gas (LPG), renewables, and electric stoves.	PM, NO_x, SO_x	Medium-term
Improvements in energy efficiency	Replace old energy devices, improve building insulation, install efficient devices, and promote good energy practices.	PM, NO_x, SO_x	Medium-term
Promotion of clean operation and energy efficient behavior	Engage in communication, provide tools for energy efficiency, and promote energy-saving behaviors like turning off lights.	PM, NO_x, SO_x	Short-term
Extraction/indoor air quality	Install chimneys, hoods for stoves, ensure ventilation standards in buildings to improve indoor air quality and safety.	PM, NO_x, SO_x	Long-term
Clean cooking and heating	Regulate coal and solid fuels, introduce cleaner stoves and heating, improve building insulation, and promote energy efficiency practices and devices.	PM, NO_x, SO_x	Long-term

TABLE A.3: MEASURES TO ADDRESS AIR POLLUTION FROM THE ENERGY GENERATION AND INDUSTRIAL SECTORS

Measure	Description	Pollutants targeted	Timeline for implementation
Renewables and low-carbon power generation	Transition to renewable and low-carbon technologies like wind, solar, hydro, and bioenergy with carbon capture and storage (BECCS). Could also include implementation of a Feed-in Tariff (FIT) as an incentive. Also has large carbon co-benefit.	PM, NO_x, SO_x	Short/Medium/Long-term
Upgrading existing plant	Upgrade existing plants with advanced, cleaner units or improve emissions control systems.	PM, NO_x, SO_x	Medium/Long-term
Demand-side energy efficiency improvements	Promote energy audits, certifications, and encourage the use of energy-efficient appliances among all users.	PM, NO_x, SO_x	Medium-term
Active load management	Implement time-of-use pricing, interruptible tariffs, and provide smart electricity readers to customers.	PM, NO_x, SO_x	Medium-term
Active network management	Develop network innovation projects to support the integration of distributed renewable energy at the distribution level.	PM, NO_x, SO_x	Medium/Long-term
Industrial process emissions standards and post-combustion controls	A number of options available including flue gas treatments, VOC management, coal handling best practices, energy efficiency, fuel switching, and emissions standards.	PM, NO_x, SO_x, VOCs	Medium-term
Improve efficiency and introduce emission standards for brick kilns	Replace old technologies with cleaner alternatives, enforce regulations, close non-compliant facilities, and set minimum standards for new plants.	PM, NO_x, SO_x, VOCs	Long-term
Reduce solvent use	Reduce solvent content in products, enhance vapor recovery, apply exhaust gas treatments, and enforce good housekeeping and leak prevention.	VOCs	Long-term
Improve emission and pollution control in mining	Implement advanced pollution control measures and technologies in mining operations, such as PM suppression, fugitive gas capture, and wastewater treatment.	PM, NO_x, SO_x	Medium-term

TABLE A.4: MEASURES TO ADDRESS AIR POLLUTION FROM AGRICULTURE

Measure	Description	Pollutants targeted	Timeline for implementation
Managing agricultural crop residues	Reduction/elimination of outdoor burning of crop residues, use satellite technology for monitoring, and implement strategies to manage harvest residues effectively (e.g., mechanization to ensure efficient removal of crop residues from fields, proper collection, and the development of a value chain that transforms these residues into economic opportunities through sustainable and alternative uses).	PM, NO_x, SO_2, methane, VOCs	Short-term
Manure management	Introduce low-till farming, cover manure storage, promote free-range poultry, adopt low-emission manure spreading techniques and/or frequent removal and integration systems, alternate use of manure for biogas production.	NH_3, PM	Medium-term
Fertilizer management	Precision application of fertilizer (e.g., deep placement and variable rate application), use mineral fertilizers (such as ammonium nitrate) instead of chemical urea.	NH_3	Short/Medium-term
Grazing management	Increased grazing of livestock (versus time spent in housing), grow multi-species swards which create improvements in soil structure, lower crude protein in livestock diets.	NH_3	Short/Medium-term
Other modern farming techniques	Include housing climatization systems to reduce air temperature, humidity, and flow, include acid or biological air scrubbers to strip ammonia from housing with forced air ventilation, plan for livestock genetics.	NH_3	Short/Medium-term
Improvements to livestock production	Optimize livestock production by implementation of targeted strategies such as adjusting animal diets, improving manure management, and enhancing grazing systems. Prioritize breed improvement programs to enhance productivity per animal.	NH_3, methane	Short/Medium-term

TABLE A.5: MEASURES TO ADDRESS AIR POLLUTION FROM WASTE

Measure	Description	Pollutants argeted	Timeline for implementation
Solid waste management	Develop waste collection, recycling, and disposal infrastructure, treat wastewater, capture waste gases for flaring or use, and reduce/recycle waste to minimize landfill use.	NO_x, NO_2, PM, SO_2, CO, VOCs, methane	Medium/Long-term
Use of waste heat from industry and clean energy	Capture and utilize waste heat from industrial processes, and the integration of clean energy sources for district heating systems, reducing fossil fuel (and therefore carbon emissions) for heating purpose.	NO_x, NO_2, PM, SO_2, CO, VOCs, methane	Medium/Lon-term
Prevent waste burning	Implement strict regulations and enforcement to prevent the open burning of waste. Promotion of alternatives like composting, recycling, and controlled waste disposal. Public awareness campaigns and incentives to reduce and properly manage waste.	NO_x, PM, CO, VOCs, black carbon	Short/Medium-term

APPENDIX 2: INDICATORS FOR TRACKING AIR QUALITY OUTCOMES

Table B.1 provides example indicators for the measurement of implementation of projects across common sectors and subsectors, where there is good potential for the project to result in an air quality benefit or co-benefit. The table provides indicators that can track project implementation progress with both qualitative and quantitative indicators.

As described in Section 1.3.1, emissions reductions are expressed using a simple equation:

Emissions Reduced = Change in Activity Level × Change in Emissions Intensity

There are therefore also indicators that would support the calculation of emissions changes – **these are highlighted in bold**.

TABLE B.1: EXAMPLE INDICATORS FOR THE MEASUREMENT OF IMPLEMENTATION OF PROJECTS ACROSS COMMON SECTORS AND SUBSECTORS, WHERE THERE IS GOOD POTENTIAL FOR THE PROJECT TO RESULT IN AN AIR QUALITY BENEFIT OR CO-BENEFIT

Project sector	Project subsector	Example indicators
Transport	Urban roads and traffic management	• Tracking the implementation of a specific measure or package of measures, such as: » Km of new cycle routes implemented » No. of bicycles hired under hire schemes » No. of new bicycle storage locations built » Km of new footpaths implemented » Frequency of traditional dust suppression measures (e.g. water spraying frequency) » Km of roads newly paved » Km of roadsides where planting & landscaping has been implemented • **Change in traffic volume, composition and/or speed following implementation of a specific measure or package of measures** • Survey to establish the reach of a public information / promotion campaign (e.g., on active travel) • No. of vehicles taking part in emissions inspections; **number of validated emissions upgrades completed**
	Urban public transport	• No. of buses upgraded / replaced with electric or other low-emission alternatives • Km of new bus routes implemented • Km of new metro lines implemented • Changes in ridership • **Change in traffic volume, composition and/or speed following implementation of a specific measure or package of measures** • Survey to establish the reach of a public information / promotion campaign

Project sector	Project subsector	Example indicators
Transport	Non-urban road transport	• Frequency of traditional dust suppression measures (e.g. water spraying frequency) • Km of roads newly paved • Km of roadsides where planting & landscaping has been implemented • Km of priority bus / high occupancy vehicle lanes • **Change in traffic volume, composition and/or speed following implementation of a specific measure or package of measures**
	Water transport	• Emissions testing for marine vessels • **Reducing sulfur content in fuel** • **Change in total quantity of fuel used** • **No. of vessels with scrubbers / other emissions reduction measures installed** • **No. of vessels upgraded / replaced with electric or other low-emission alternatives**
	Rail transport	• Km of new rail links • **No. of trains upgraded / replaced with electric or other low-emission alternatives** • Changes in ridership • **Change in traffic volume, composition and/or speed following implementation of a rail transport investment** • **Changes in volume of freight carried by rail (e.g., rather than via road, air, or marine vessel)**
	Air transport	• **Change in total quantity of fuel used** • **Change in quantity of alternative fuel used (e.g., Sustainable Aviation Fuel)** • **Change in quantity of conventional fuel used** • **No. of aircraft or aircraft movements with advanced emissions controls installed** • Implementation of emissions testing for aircraft – e.g. number of aircraft tested and/or upgraded
	Multimodal logistics	• No. of freight consolidation centers implemented • No. of freight operators signed up to partnership program • No. of vehicles taking part in emissions inspections and/or **emissions upgrades** • No. of drivers taking part in low emissions driving training and/or monitoring • **No. of vehicles upgraded / replaced with electric or other low-emission alternatives**
Residential sector/ buildings	Urban housing	• **No. of homes / businesses where clean cooking stoves have been installed and used** • **No. of homes / businesses where clean heating options have been installed and used** • No. of homes / businesses where specific energy efficiency measures (e.g., household insulation) have been implemented • No. of homes / businesses taking part in a (e.g., stove or boiler) maintenance campaign *NB: Innovative techniques are available to track and verify micro-scale (household-level) investments in clean energy technologies* • **Change in total conventional fuel use** • Monitoring indoor air pollution • Survey to establish the reach of a public information / promotion campaign (e.g., on energy efficiency)

Project sector	Project subsector	Example indicators
Residential sector/ buildings	Energy efficiency and conservation	• **Change in total energy use** (e.g., as a result of energy efficiency measures or plant upgrades) • Number of households deploying improved energy efficiency measures • Survey to establish the reach of a public information / promotion campaign
Energy generation and industry	Medium and large industries	• Industrial emissions monitoring and evaluation against emissions limits • No. of inspections being carried out on industries • No. of enforcement actions leading to reductions in emissions • No. of industries implementing Best Available Techniques for emissions reduction in different sector • **No. of brick kilns adopting lower emissions technologies** • **Change in total energy usage** • **Change in volume of solvents or other feedstocks used**
	Small and medium enterprise development	
	Renewable energy generation – solar / wind / hydro / geothermal / biomass / waste	• **Change in quantity of more polluting energy sources used – e.g. diesel fuel, coal, or wood** • Awareness of less polluting alternative sources of energy among householders/businesses • **Generating capacity (KW net) of solar/wind/hydro/ geothermal/biomass/waste energy installed** • **Electricity generated (KW net generated) from installed solar/wind/hydro/geothermal/biomass/waste plant** • *(NB. The combustion of biomass or waste may also result in a negative impact on air quality. Use of geothermal energy requires attention to control of odors)* • **Change in total energy use** (e.g., as a result of energy efficiency measures or smart networks which respond dynamically to user demand to optimize energy usage)
	Electricity transmission and distribution	
Agriculture	Agricultural waste management	• **Volume of harvest residue incorporated into soil, used as hay silage, or processed into charcoal or other product (instead of burnt / disposed of)** • Reduction in area of residue burning • Enhancing productivity per plant through mechanization • Survey to establish the reach of a public information / promotion campaign (e.g., on agricultural waste burning)
	Agricultural production	• **KW of solar/wind/hydro/geothermal/biomass energy installed at site (e.g., for irrigation; replacing fossil fuel use)** • **No. of vehicles / machinery replaced with electric / low-emission alternatives** • Area fertilized using low-emitting application methods or quantity of fertilizer applied in this way • Area fertilized using low-polluting fertilizers or quantity of fertilizer applied • **Quantity of slurry or manure moved from uncovered to covered storage** • **Quantity of manure incorporated into soil (instead of burnt / disposed of)** • **Change in feed usage from higher protein to low-protein/low-nitrogen alternatives with appropriate management of animal growth and welfare**
	Agriculture research and application	
	Livestock	
	Fishery	• No. of marine vessels upgraded / replaced by electric or other low-emission alternatives • No. of delivery vehicles upgraded / replaced by electric or other low-emission alternatives • **KW of solar/wind/hydro/geothermal/biomass energy installed at site (replacing fossil fuel use)** • Changes in the amount of (fossil) fuel burnt • Implementation of sustainable fishing practices

Project sector	Project subsector	Example indicators
Agriculture	Forestry	• **Forestry / resource management equipment upgraded / replaced by electric or other low-emission alternatives** • Implementation of dust suppression measures • **KW of solar/wind/hydro/geothermal/biomass energy installed at site (replacing fossil fuel use)** • **Changes in the amount of higher polluting fuels burnt** • **Changes in the amount of forestry wastes burnt in the open** • Implementation of sustainable forestry / other natural resource management practices
Waste	Rural solid waste management	• Volume of harvest residue incorporated into soil, used as hay silage, or processed into charcoal or other product (instead of burnt / disposed of) • Survey to establish the reach of a public information / promotion campaign (e.g., on agricultural waste burning)
	Urban water supply	• Monitoring of chemicals in water • Monitoring of algal blooms • Implementation of water conservation measures • **KW of solar/wind/hydro/geothermal/biomass energy used / installed (replacing fossil fuel use)** • Energy consumption per volume water supplied • Total net GHG emissions per 1,000 properties serviced • Quality of water inflows to treatment system (e.g., turbidity, salinity, pollutants, pathogens) • Proportion of water demand met by potable substitution or alternative water sources, such as stormwater
	Urban flood protection	• **KW of solar/wind/hydro/geothermal/biomass energy used in construction (replacing fossil fuel use)**
	Urban sewerage	• Proportion of wastewater reused • Percentage of sludge and biosolids reused • Percentage of wastewater treated only to: » Primary level » Secondary levesl » Tertiary level
	Urban sanitation	• Monitoring of chemicals in water • Monitoring of algal blooms • Volume of biogas recovered during wastewater treatment • **KW of solar/wind/hydro/geothermal/biomass energy used / installed (replacing fossil fuel use)** • Energy consumption per volume wastewater treated • Total net GHG emissions per 1,000 properties serviced
	Urban solid waste management	• **No. of low emitting waste collection vehicles purchased** • No. of waste transfer stations implemented • Quantity of waste collected / treated / composted / recycled • **Quantity of waste used to generate energy (e.g., anaerobic digestion, energy-from-waste)** • Change in quantity of waste sent to landfill • **Extent of implementation of landfill gas collection and control (e.g. volume of gas collected and burnt in flare or biogas engine)** • **KW of solar/wind/hydro/geothermal/biomass energy used / installed** • Survey to establish the reach of a public information / promotion campaign (e.g. on waste minimization, sustainable waste disposal, avoiding open burning of waste)