

THE STATE OF GLOBAL AIR QUALITY FUNDING 2023 METHODOLOGY



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1. INTRODUCTION

This background document provides an overview of the methodology used for the analysis presented in the State of Global Air Quality Funding 2023 report. Jointly developed by Clean Air Fund and Climate Policy Initiative (CPI), the report presents a comprehensive analysis of trends in international development funding going to air quality, breaking down financial flows by region, sector, type of investors, and financial instrument.

This document outlines the methodology used to track funding flows analysed in the main report, specifically:

- Air quality funding during 2015-2021, including (i) outdoor air quality funding, and (ii) funding with outdoor air quality co-benefits; and
- Fossil fuel prolonging funding during 2015-2021.

In an effort to improve the accuracy of this tracking exercise, Clean Air Fund and CPI have worked to improve this methodology, making the following adjustments:

- We considerably expanded the list of keywords for air quality funding to better capture projects relevant for the analysis;
- 2. We linked keywords to official frameworks, taxonomies and guidelines, including WHO's <u>list of pollutants</u>, EMEP/EEA's <u>Air Pollutant Emission Inventory Guidebook</u>, UNEP/CCAC's <u>Global Methane Assessment</u>, the <u>EU Policies to improve AQ</u>, and <u>World Bank's working paper Integrating Air Quality Management and Climate Change Mitigation</u>;
- 3. We made a clearer distinction between primary and secondary air quality projects. We also renamed these flows as (i) outdoor air quality funding, and (ii) funding with outdoor air quality co-benefits, to better capture the scope of flows covered;
- 4. We improved the identification of keywords potentially leading to false positives.

This methodology is to be considered an iterative document, subject to regular updates and improvements. This year, it was circulated to members of the Advisory Group, including key international development funders. Comments and suggestions received were integrated into this final version of the methodology. Clean Air Fund and CPI aim to continue to improve this methodology to ensure that the analysis in future reports accurately captures air quality funding trends. Additional feedback and suggestions can be sent to info@cleanairfund.org.

2. SCOPE OF THE ANALYSIS

2.1 DEFINITIONS

The State of Global Air Quality Funding 2023 report shares our analysis of funding for projects that tackle outdoor/ambient air pollution between 2015 and 2021, and compares these flows with funding to projects that may work against the clean air agenda by prolonging the use of polluting fossil fuels. The report also analyses the overlap between air quality funding and climate finance.

Table 2.1 includes all the definitions used in the report for air quality funding, fossil fuel prolonging funding and climate finance analysed in the State of Global Air Quality Funding 2023 report.

TABLE 2.1 DEFINITIONS OF FUNDING CATEGORIES ANALYSED

Funding category	Funding type	Definition	Examples
Air quality funding	Outdoor air quality funding	Finance committed to projects where improvements to outdoor/ambient air quality are a primary objective (usually explicitly stated in the project description). This includes projects across various sectors, including transport, energy and health. It also includes funding to air quality monitoring and modelling projects, aimed at filling air quality data gaps	Air pollution prevention programme
	Funding with outdoor air quality co- benefits	Finance committed to projects where improvements to outdoor/ambient air quality are a co-benefit to the investment. The link to outdoor air quality, in this case, may not be explicitly mentioned in project description	Wastewater treatment/ management project with methane and/or nitrogen oxide mitigation
		This funding category also includes interventions to tackle indoor air pollution which can be a significant contributor to outdoor/ambient air pollution especially in areas where the population relies significantly on solid fuels for cooking and heating.	
Fossil fuel prolonging funding	Direct fossil fuel prolonging funding	Projects or interventions involving the construction of assets and infrastructure which directly cause air pollution	Development or expansion of a coal power plant
	Indirect fossil fuel prolonging funding	Projects or interventions leading to the creation of, or promoting, air polluting activities	Support for research, policy engagement and advocacy in the oil and gas sector

Funding category	Funding type	Definition	Examples
Climate finance ¹	Mitigation finance	Resources directed to activities (i) contributing to reducing or avoiding greenhouse gas (GHG) emissions, including gases regulated by the Montreal Protocol; or (ii) maintaining or enhancing GHG sinks and reservoirs	Greenfield or brownfield projects that reduce methane or nitrous oxide emissions through wastewater
	Adaptation finance	Resources directed to activities aimed at reducing the vulnerability of human or natural systems to the impacts of climate change and climate-related risks, by maintaining or increasing adaptive capacity and resilience	Development of highly efficient and climate resilient irrigation networks
	Dual benefits finance	Resources directed to activities contributing to both climate change mitigation and climate change adaptation and meeting the respective criteria for each category	Afforestation project preventing slope erosion bringing significant adaptation benefits, while also making a positive contribution to mitigation

2.2 SOURCES OF FUNDING

The analysis in the report covers financial commitments from international development funders. These include multilateral development banks, bilateral development agencies and governments providing international funding to developing and emerging countries in the form of development aid, concessional and non-concessional loans, as well as grants, for development purposes, including air quality.

Specifically, international development funders include:

- i. Official development assistance (ODA);
- ii. Other official flows (00F); and
- iii. Flows from other public development funders that are not OECD-DAC members (e.g., Islamic Development Bank).²

A share of the funding provided by these funders is directed to climate mitigation and adaptation projects contributing to the goals of the Paris Agreement; we refer to this share of international development funding as "international public climate finance."

The analysis in the report does not currently include funding coming from local governments' domestic resources (e.g., from national budgets) or private-sector funding. This is due to data limitations and in no way should suggest that these sources play a small role in funding air quality projects; rather, we recognize the important contribution these make to the overall air quality funding landscape.

¹ As defined in CPI's Global Landscape of Climate Finance.

² For these funders, we rely on primary data collected by CPI. Funders that only provided aggregated data are excluded from the analysis as the keyword search is only possible when project-level data is available (see Section 3.1). This includes, for example, China Development Bank, and it means that, for this category of funders, outdoor air quality funding flows in the analysis are likely to be underestimated.

³ In this report, tracking international public climate finance is done with a different methodology from the analysis by the OECD on the progress of the \$100 billion per year that developed countries should commit to assist developing countries to meet climate goals. Therefore, the two assessments are not directly comparable, although there may be certain overlaps in what they capture.

2.3 FINANCIAL INSTRUMENTS

The analysis in the report captures funding made through the following financial instruments:

- Grants: Transfers made in cash, goods or services for which no repayment is required.
- Project-level debt: Debt relying on a project's cash flow for repayment.
 - Low-cost debt refers to loans extended at terms preferable to those prevailing on the market. We count the full amount of the loan, not the grant equivalent.
 - Market-rate debt refers to loans extended at regular market conditions.
- Project-level equity: Equity investment relying on the project's cash flow for repayment.
- Balance sheet financing: Direct debt or equity investment by a company or financial
 institution. Unlike with project-level financing, where only the specific project's assets are
 held as security, with balance sheet financing the investors have a legal claim on the overall
 company assets in case of a payment default.

We acknowledge the importance of risk management instruments like guarantees and insurance in enabling increased private climate flows, in particular to areas and sectors with low risk appetites for private investment. However, following the principle of conservatism, we exclude these instruments from the analysis because actual disbursements from these instruments are contingent upon uncertain future events. Guarantees are only exercised in particular circumstances, and there is a chance of there never being any financial outflow from the guarantor.

3. BUILDING THE DATABASE

3.1 METHODOLOGICAL STEPS

The methodological steps below were followed to build the air quality funding and fossil fuel prolonging funding databases.

STEP 1: Data collection

Data on international development funding for 2015-2021 was initially collected from relevant data sources (see Section 3.2).

STEP 2: Data processing (identifying relevant data)

As not all development projects collected were relevant for the scope of the analysis, the next step was to identify air quality and fossil fuel prolonging projects within the broader database. This was carried out by applying a keyword search on project names and descriptions implemented in Python, using the lists of keywords developed for air quality, and fossil fuel prolonging projects – included in Section 4.1 and 4.2, respectively.

Air quality projects were selected as follows:

Outdoor air quality projects:

- Projects that have outdoor air quality stated as a primary objective in the project description; or
- Projects that provide improvements to outdoor air quality as a primary objective and benefit. Such projects were identified by descriptions that contain reference to topics defined as primary air quality improvement funding in Clean Air Fund's Methodology Rule Book for the State of Global Air Quality Funding (e.g., soot).

Projects with outdoor air quality co-benefits:

- Projects that have outdoor air quality as a secondary objective in the project description; or
- Projects that have direct outdoor air quality impact (i.e., through proven technologies) but
 with no primary or secondary outdoor air quality objective. These projects could, for example,
 include rapid transit development, sustainable forestry, prevention of desertification etc.

Projects that claim to have outdoor air quality benefits but have weak impact evidence were excluded. This includes, for example, new buses that use <u>compressed natural gas</u> for which some evidence suggests that despite the claim of being a clean solution, the technology emits high levels of toxic pollutants. These were excluded in cases where other best-in-class alternatives (for example, electric vehicles) are available.

Once the keywords have been applied to project titles and descriptions, and relevant air quality and fossil fuel prolonging projects were extracted and categorised accordingly, the data extracted was double checked to ensure that the classification is accurate.⁴

⁴ This is done for all projects amounting, cumulatively, to 95% of the total value of the extracted projects.

Additional processing and checks were done using project names, descriptions, and project IDs to ensure there was no double counting between projects extracted from data sources.

STEP 3: Data standardization and cleaning

- Once all relevant projects were extracted, the data was standardized and cleaned as follows:
- All projects were further categorized based on economic sectors (e.g., transport) which were further broken down by solutions (e.g., electric and hybrid road vehicles).
- Using CPI's categorization used in the Global Landscape of Climate Finance (GLCF) database, international development funders were categorized as bilateral development finance institutions, multilateral development finance institutions, national development finance institutions, governments and government agencies, export credit agencies, multilateral climate funds, and public funds (see Section 2.2).
- Funding instruments were categorized as grants, market-rate debt and low-cost (below market rate or concessional) debt, and equity (see Section 2.3).
- Air quality projects with climate finance co-benefits were tagged based on their climate use (mitigation, adaptation, or multiple objectives), cross-checking against CPI's GLCF database.
- Countries of origin of multilateral development banks were split according to the share of subscribed capital (or ownership) by the country stakeholders. For example, if Country A has a subscribed capital representing 2% of the multilateral development bank's total shares, then 2% of the total project value is assigned to Country A as the country of origin.
- Amounts reported in currencies other than USD, we converted using a consistent exchange rate (World Bank or European Central Bank annual average rate).
- Data that was shared to CPI under data licensing or confidentiality agreement were anonymized.

3.2 DATA SOURCES

The analysis is based on project-level data drawn from a range of primary and secondary sources. As depicted in Table 3.1, the main data source for both air quality and fossil fuel prolonging data are the OECD Creditor Reporting System (CRS).

As not all international development funders are members of, and report to, the OECD (e.g., Islamic Development Bank), we integrate data from the OECR CRS with other relevant sources used in CPI's GLCF database, namely, CPI's proprietary survey data as well as publicly available data reported by development finance institutions.

TABLE 3.1 DATA SOURCES USED FOR THE ANALYSIS

Database	Data sources
Air quality funding Development funding flows OECD Creditor Reporting System for 2015-2021	
	International public climate finance flows CPI's proprietary survey data for 2015-2021 Climate Funds Update database maintained by ODI Publicly available data reported by development finance institutions
Fossil fuel prolonging	Development funding flows OECD Creditor Reporting System for 2015–2021

3.3 PRINCIPLES APPLIED IN DATA COLLECTION AND REPORTING

Track primary investment

The analysis captures total primary financial transactions and investment costs and components of activities that directly contribute to outdoor air quality, climate mitigation/adaptation, and prolong the use of fossil fuels. Secondary market transactions (e.g., re-selling of stakes or public trading in financial markets) are not tracked, as they do not represent new investment targeting new assets, but rather capital being exchanged for existing assets.

Include tangible financial commitments

In the analysis, "funding" generally refers to financial commitments – as opposed to disbursements – represented by a firm obligation by means of a board's decision on investment programs, the closure of financing contracts or similar actions. Such commitments are backed by the necessary funds to provide the specified financing to a project.

Commitments record the amount of an expected transfer at the time when the corresponding contract was closed, irrespective of the time required to complete the disbursement. This approach can yield results that differ from those of approaches that consider investment based on disbursements. For example, under the approach adopted in this analysis, a project which reaches financial close in 2017 but becomes operational in 2018 will be recorded as a 2017 investment, regardless of when construction starts and ends. By contrast, an approach which records investment when an asset becomes operational would treat the same investment as having occurred in 2018.

Disbursement information would provide a more accurate picture of the actual volume of financial resources devoted to outdoor air quality projects in a given year. However, consistent data on disbursements are not universally made available by all donors that report to OECD-DAC. Data gaps in disbursements are particularly high among multilateral development finance institutions. As such, to avoid information bias due to partial data, the analysis continues to use commitments data (at least until data quality on disbursements improve). Furthermore, commitment data provides a better view of the trends of funding decisions and priorities by donors who are the main target audience for the report.

Err on the conservative side

In case of insufficient details, a conservative approach is taken, and under-reporting of funding flows is preferred to over-reporting. Based on this principle, the analysis excludes risk-mitigation instruments, such as guarantees and insurance products, since actual disbursements from these instruments are contingent upon uncertain future events.

Avoid double counting

The analysis tracks only investments in new projects. Investments in private research and development which might be relevant for air quality are excluded, since the costs to develop new technologies are capitalised and factored into the investment amounts of new projects implementing these technologies. Including R&D investments would, therefore, increase the risk of double counting.

Similarly, policy-induced revenue-support mechanisms and other public subsidies whose primary function is to pay back investment costs are not tracked. Revenue-support mechanisms, such as feed-in tariffs, pay back investment costs, so including the investments made for their implementation would constitute double counting.

4. KEYWORDS

4.1 KEYWORDS FOR AIR QUALITY PROJECTS

Keywords to extract air quality projects from the database were developed by Clean Air Fund and CPI, building on the Clean Air Fund's Methodology Rule Book for the State of Global Air Quality Funding. Compared to 2022, the list was considerably expanded and keywords were separated into three groups to capture respectively:

- i. Explicit air quality improvements
- ii. Pollutants and their effects
- iii. Air quality sector solutions

To make sure all relevant projects are captured, the lists of keywords include both US and UK English spelling. In addition, wherever project descriptions were in a language different than English, these were translated before running the keyword search. The keyword search was applied to a combination of project descriptions and project titles. For the purposes of the search, both the project strings and the keywords to be searched for were converted to lower case and singularized programmatically to most efficiently and accurately perform the search. This removes the need to create multiple versions of words to search for in their singular and plural form

The three lists of keywords – in Table 4.1., Table 4.2, and Table 4.4, respectively – indicate whether the project captured would be categorized as *outdoor air quality funding* or as *funding with outdoor air quality co-benefits*, and flag whether projects captured should be double checked for false positives. Whenever more than one set of keywords are captured in a project description, which would result in conflicting air quality categorization, the project is categorized as outdoor air quality funding.

Explicit air quality improvements

This group of keywords extracts projects where the explicit intent is to improve outdoor/ambient air quality. This list (included in Table 4.1) was developed via coordination between Clean Air Fund and CPI, building on Clean Air Fund's Methodology that was used in previous State of Global Air Quality Funding reports.

All explicit air quality improvements projects are categorized as *outdoor air quality funding*, with the sole exception where any of these keywords are found with a clear mention of indoor air pollution, in which case projects are classified as *funding with outdoor air quality co-benefits*.

TABLE 4.1 LIST OF KEYWORDS FOR EXPLICIT AIR QUALITY IMPROVEMENTS

Keywords	Air quality funding type	Risk of false positive
air + management	Outdoor air quality	Yes
air + measurement	Outdoor air quality	Yes
air + measure	Outdoor air quality	Yes
air + modelling	Outdoor air quality	

Keywords	Air quality funding type	Risk of false positive
air + modeling	Outdoor air quality	
air + monitor	Outdoor air quality	Yes
air + monitoring	Outdoor air quality	
air + pollutant	Outdoor air quality	
air + pollution	Outdoor air quality	
air + sensor	Outdoor air quality	Yes
air + emissions	Outdoor air quality	Yes
air + quality	Outdoor air quality	
clean air	Outdoor air quality	
healthy air	Outdoor air quality	Yes
health + air	Outdoor air quality	Yes
exposure + air	Outdoor air quality	
acid deposition monitoring network	Outdoor air quality	
atmospheric chemistry	Outdoor air quality	
climate and clean air coalition	Outdoor air quality	
ccac	Outdoor air quality	

Note: '+' separated words appear in any order in the descriptive data; '' separated words appear in this precise order in the descriptive data.

Pollutants and their effects

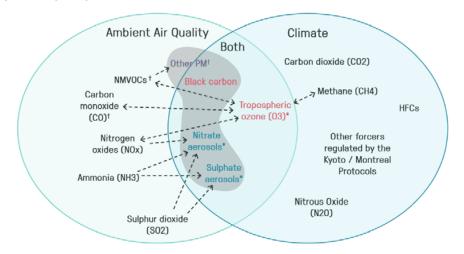
This group of keywords extracts projects mentioning outdoor/ambient air quality-related pollutants and their effects (e.g., acid rain).

To make sure this list of keywords (in Table 4.2) captured a comprehensive and widely accepted list of air quality-related pollutants, the following frameworks and guidelines were consulted:

- UNECE <u>Guidelines for Reporting Emissions and Projections Data under the Convention on Long-range Transboundary Air Pollution;</u>
- WHO's <u>list of pollutants</u>;
- Air pollutants <u>tracked by EU member states</u> (NECDs);
- EMEP/EEA <u>Air Pollutant Emission Inventory Guidebook</u>;
- CCAC's A Practical Guide For Business: Air Pollutant Emission Assessment.

Pollutants (and related keywords) are categorised based on whether they have a direct effect on outdoor/ambient air quality (outdoor air quality funding) or they have mainly an impact on climate change (funding with outdoor air quality co-benefits). This categorization was based on the Venn diagram in Figure 4.1, which shows the overlap and interlinkages between pollutants that impact air quality and climate change.

FIGURE 4.1 OVERLAP AND INTERLINKAGES BETWEEN POLLUTANTS THAT IMPACT AIR QUALITY AND CLIMATE CHANGE



Note: Pollutants shown in red have a positive climate forcing effect (warming), while those in blue have a negative cliamte forcing effect (cooling); those shown in purple can be either warming or cooling.

In Table 4.2, pollutants that primarily have an impact on climate change (such as methane and short-lived climate pollutants) are categorized as *funding with outdoor air quality co-benefits* unless they are found in combination with words such as "air" and "health", which thus suggests that tackling air pollution is a primary objective of the project.

In addition, pollutants mainly contributing to indoor air pollution are always categorized as funding with outdoor air quality co-benefits as per our definitions in Section 2.1.

TABLE 4.2 LIST OF PROPOSED KEYWORDS FOR POLLUTANTS AND THEIR EFFECTS

Keywords	Air quality funding type	Risk of false positive
sulphur dioxide	Outdoor air quality	
sulfur dioxide	Outdoor air quality	
sox	Outdoor air quality	Yes
so2 + emissions	Outdoor air quality	Yes
so2 + reduce	Outdoor air quality	Yes
so2 + remove	Outdoor air quality	Yes
sulphur oxides	Outdoor air quality	
sulfur oxides	Outdoor air quality	
nitrogen oxides	Outdoor air quality	
nitrogen dioxide	Outdoor air quality	

^{***} denotes pollutants that are secondry species - these are not emitted, but formed as a result of multiple atmospheric mechanisms.

^{&#}x27;t' denotes pollutants that can be directly emitted (primary) AND are also formed as secondary pollutants. Dashed arrows show atmospheric mechanism that link primary species to secondary species. Pollutants included in gray are components of PM2.5 are aerosols.

Keywords	Air quality funding type	Risk of false positive
nox	Outdoor air quality	Yes
no2	Outdoor air quality	Yes
ammonia + emission	Outdoor air quality	Yes
ammonia + air	Outdoor air quality	Yes
nh3	Outdoor air quality	Yes
non-methane volatile organic compounds	Outdoor air quality	Yes
non methane volatile organic compounds	Outdoor air quality	Yes
nmvoc	Outdoor air quality	Yes
particulate matter	Outdoor air quality	
particulate emissions	Outdoor air quality	
pm1	Outdoor air quality	
pm 1	Outdoor air quality	
pm2.5	Outdoor air quality	
pm 2.5	Outdoor air quality	
pm7	Outdoor air quality	
pm 7	Outdoor air quality	
pm10	Outdoor air quality	
pm 10	Outdoor air quality	
ultrafine particles	Outdoor air quality	
ufp	Outdoor air quality	Yes
total suspended particulate matter	Outdoor air quality	
black carbon	Outdoor air quality	
bc	Outdoor air quality	Yes
soot	Outdoor air quality	Yes
carbon monoxide***	Outdoor air quality co-benefits	
carbon monoxide + ambient	Outdoor air quality	
co + ambient	Outdoor air quality	
carbon monoxide + outdoor	Outdoor air quality	
ground-level ozone	Outdoor air quality	
ground level ozone	Outdoor air quality	
ground-level o3	Outdoor air quality	
ground level o3	Outdoor air quality	
tropospheric ozone	Outdoor air quality	

Keywords	Air quality funding type	Risk of false positive
tropospheric o3	Outdoor air quality	
methane + health*	Outdoor air quality	
ch4 + health*	Outdoor air quality	
methane**	Outdoor air quality co-benefits	
ch4**	Outdoor air quality co-benefits	
short-lived climate pollutants**	Outdoor air quality co-benefits	
short lived climate pollutants**	Outdoor air quality co-benefits	
slcp**	Outdoor air quality co-benefits	Yes
super pollutants**	Outdoor air quality co-benefits	
short-lived climate pollutants + health*	Outdoor air quality	
short lived climate pollutants + health*	Outdoor air quality	
slcp + health*	Outdoor air quality	
super pollutants + health*	Outdoor air quality	
heavy metals + air	Outdoor air quality	
formaldehyde + air***	Outdoor air quality co-benefits	
lead + air	Outdoor air quality	Yes
mercury + air	Outdoor air quality	
cadmium + air	Outdoor air quality	
persistent organic pollutants + air	Outdoor air quality	
pops + air	Outdoor air quality	Yes
radon + air	Outdoor air quality	
arsenic + air	Outdoor air quality	
chromium + air	Outdoor air quality	
copper + air	Outdoor air quality	
nickel + air	Outdoor air quality	
selenium + air	Outdoor air quality	
zinc + air	Outdoor air quality	
construction dust	Outdoor air quality	
smog	Outdoor air quality	
smoke	Outdoor air quality	Yes
acid rain	Outdoor air quality	
volatile organic compounds	Outdoor air quality	Yes
voc	Outdoor air quality	Yes

Keywords	Air quality funding type	Risk of false positive
sulphur trioxide	Outdoor air quality co-benefits	
sufur trioxide	Outdoor air quality co-benefits	
so3	Outdoor air quality co-benefits	
sulphuric acid	Outdoor air quality co-benefits	
sulfuric acid	Outdoor air quality co-benefits	
h2so4	Outdoor air quality co-benefits	
hydrogen sulphide	Outdoor air quality co-benefits	
hydrogen sulfide	Outdoor air quality co-benefits	
mercaptans	Outdoor air quality co-benefits	
dimethyl sulphides	Outdoor air quality co-benefits	

Note: '+' separated words appear in any order in the descriptive data; ' 'separated words appear in this precise order in the descriptive data.

Air quality sector solutions

This group of keywords is aimed at capturing activities which – even in the absence of specific intentional air quality objectives – would still lead to air quality improvements and therefore be categorised as funding with outdoor air quality co-benefits.

The list of keywords was based on the taxonomy for air quality sector solutions developed by Clean Air Fund and CPI (depicted in Table 4.3). The taxonomy aims to capture all solutions identified in the following sources:

- <u>EU Policies to improve AQ</u>
- UNEP/CCAC's <u>Africa Integrated Assessment</u>
- UNEP/CCAC's Global Methane Assessment
- CCAC SLCP Solutions
- World Bank's working paper <u>Integrating AQ Management and Climate Change Mitigation</u>

^{*} Health indicates primary air pollution focus

^{**} Categorised as funding with outdoor air quality co-benefits because predominantly climate motivated

^{***} Categorised as funding with outdoor air quality co-benefits because predominantly related to indoor air quality.

TABLE 4.3 TAXONOMY FOR AIR QUALITY SECTOR SOLUTIONS

Sector	Solution	Description
Transport	Cleaner road vehicles and modal shift	The adoption of cleaner vehicle technologies, such as low- emission vehicles and alternative fuels, combined with a shift towards more sustainable transportation modes, like public transit, cycling, and walking. This contributes to improved air quality by reducing tailpipe emissions from road transport
	More public transport and railways	Expansion and increased use of public transportation systems, including buses, trams, and trains, which tend to have lower perpassenger emissions compared to personal vehicles. This reduces overall transportation-related emissions and improves air quality
	Electric and hybrid road vehicles	Promotion and adoption of electric and hybrid-electric vehicles that produce fewer or zero tailpipe emissions. These vehicles contribute to improved air quality by reducing transportation-related emissions, particularly in urban areas
	Cleaner fuels and vehicles for shipping	A targeted approach to mitigating air pollution by implementing low-sulphur fuels, alternative propulsion systems, and advanced exhaust treatment technologies within the maritime sector. This strategy addresses the shipping industry's contribution to airborne emissions, such as sulphur oxides (SOx), nitrogen oxides (NOx), and particulate matter (PM), ultimately enhancing air quality and promoting environmental sustainability for a more ecologically responsible global transportation network
	More cycling and walking	Fostering non-motorized transportation modes, such as cycling and walking, which produce zero emissions. This ameliorates air quality by minimizing dependence on motorized transportation and its associated emissions
	Traffic planning and management	The implementation of intelligent transportation systems (ITS), congestion pricing, and other measures to optimize traffic flow and minimize idling. These strategies ameliorate air quality by curtailing emissions from vehicles in congested traffic
	Lower petrol and diesel vehicles emissions	Imposition of more stringent emissions standards for internal combustion engine (ICE) vehicles, as well as regular inspection and maintenance programs, to reduce tailpipe emissions. This ameliorates air quality by ensuring vehicles operate with minimal emissions
Residential sector/ buildings	Reduce indoor air pollution	The adoption of cleaner residential energy sources and appliances, such as improved cookstoves and efficient heating systems, to minimize indoor air pollution. This ameliorates air quality by curtailing emissions from residential sources
		Note: LPG projects are included in the analysis as, while they do not represent solution for climate mitigation, they have a positive impact on indoor air pollution
	Using waste heat from industry and clean energy sources for district heating	The capture and utilization of waste heat from industrial processes, and the integration of clean energy sources for district heating systems, to reduce fossil fuel combustion for heating purposes. This ameliorates air quality by minimizing heating-related emissions
	Efficiency in buildings	The application of energy-efficient building designs, materials, and technologies, as well as retrofitting existing buildings to boost energy efficiency, which curtails energy consumption and associated emissions. This ameliorates air quality by reducing emissions from energy generation and usage in buildings

Sector	Solution	Description
Energy generation + industry	Phasing out and replacement of fossil fuel plants	The decommissioning of coal, oil, and gas-fired power plants, and their explicit substitution with clean and renewable energy sources. This ameliorates air quality by curtailing emissions from power generation
	Clean and renewable energy	A pivotal strategy in air quality management that entails explicit transitioning from fossil fuel-based power generation to sustainable, low-emission energy sources, such as solar, wind, hydro, and geothermal. This shift mitigates the release of greenhouse gases (GHGs), particulate matter (PM), and other harmful pollutants associated with conventional energy production, thereby improving air quality
		Renewable energy projects either (i) reduce present air pollution when they are built to replace fossil fuel plants, or (ii) avoid future air pollution when they are built to respond to the growing energy demand in a country. The analysis in the report focuses only on renewable energy projects which directly replace fossil fuel plants (i) as they are the only ones that have a clear positive impact on air quality
		Note: all biofuels with the exception of biogas were excluded as, despite having a positive impact in terms of GHG emission reduction, it is debatable whether they have an overall positive impact on air pollution
	Emission and pollution control in mining	The implementation of advanced pollution control measures and technologies in mining operations, such as particulate matter (PM) suppression, fugitive gas capture, and wastewater treatment, to minimize emissions and pollutant release. This ameliorates air quality by mitigating the environmental impact of mining activities
	Pollution control and energy increased efficiency in energy and industrial processes	This solution focuses on implementing advanced pollution control technologies and enhancing energy efficiency in both energy generation and industrial processes. By reducing emissions from these sectors, this strategy contributes to improved air quality. Pollution control technologies, such as flue gas desulfurization, selective catalytic reduction, and electrostatic precipitators, can significantly reduce emissions of particulate matter, sulfur dioxide, and nitrogen oxides
Agriculture	Improvements in livestock production to reduce emissions	This solution aims to optimize livestock production practices to minimize emissions of air pollutants, particularly ammonia (NH3) and methane (CH4), which contribute to air quality degradation and climate change. By implementing targeted strategies, such as adjusting animal diets, improving manure management, and enhancing grazing systems, emissions from livestock production can be substantially reduced. For instance, the use of dietary additives or altering the composition of animal feed can decrease methane emissions from enteric fermentation and ammonia emissions from excretion. Furthermore, better manure storage and treatment methods can reduce ammonia volatilization and methane emissions
Agriculture	Improved food production and consumption	This solution addresses the air quality impacts associated with the entire food production and consumption system, from agriculture to processing, distribution, and consumption behaviours. By implementing more sustainable and efficient agricultural practices, reducing food waste, and promoting dietary shifts towards lower-emission foods, this approach can significantly reduce emissions of air pollutants, particularly ammonia (NH3), nitrogen oxides (NOx), and volatile organic compounds (VOCs)

Sector	Solution	Description
Waste	Solid waste management	Solid waste management refers to the systematic control of the generation, collection, storage, transport, processing, and disposal of solid waste materials. Proper SWM practices can help reduce air pollution by minimizing the emissions of harmful substances, such as methane (CH4), volatile organic compounds (VOCs), and particulate matter (PM), which are released during waste decomposition and incineration processes. Techniques such as recycling, composting, waste-to-energy conversion, and sanitary landfilling can significantly contribute to improving air quality and mitigating the environmental impacts of solid waste
	Improved waste water treatment and water sanitation	Improved wastewater treatment and water sanitation refer to the enhancement of processes and technologies employed in the treatment and management of wastewater and the provision of safe drinking water. These improvements can help mitigate air quality issues by reducing the emissions of greenhouse gases (GHGs), such as methane (CH4) and nitrous oxide (N2O), and volatile organic compounds (VOCs) that are released during wastewater treatment and sanitation processes. Advanced treatment methods, such as membrane bioreactors, anaerobic digestion, and nutrient recovery systems, can minimize these emissions while also conserving energy and recovering valuable resources
Natural sources	Reduction of non- anthropogenic air pollution	Reduction of non-anthropogenic air pollution refers to the mitigation of air pollution sources that are not directly attributable to human activities. These sources can include natural events such as wildfires, and biogenic emissions from vegetation and soil. In the context of air quality management, strategies to reduce non-anthropogenic air pollution can involve monitoring and forecasting of forest fires and implementing land management practices to prevent wildfires

Table 4.4 shows the list of keywords for air quality sector solutions. Projects captured by these keywords are categorized as *funding with outdoor air quality co-benefits*, unless keywords are found together with either "air", "health" or "exposure", in which case they count as *outdoor air quality funding* (see example below). Projects categorised as outdoor air quality funding, in this case, were then double-checked manually to avoid false positives.

Sector	Solution	Keywords for projects with outdoor air quality co-benefits	Keywords for outdoor air quality projects
Transport	Cleaner vehicles and modal shift		cleaner transport + air
		cleaner transport	cleaner vehicle + health
			cleaner vehicle + exposure
		cleaner vehicle	cleaner vehicle + air
			cleaner vehicle + health
			cleaner vehicle + exposure

The only exception to this rule are solutions to reduce indoor air pollution which are always categorised as funding with outdoor air quality co-benefits as per definitions in Section 2.1.

TABLE 4.4 LIST OF KEYWORDS FOR AIR QUALITY SECTOR SOLUTIONS

Sector	Solution	Keywords for funding with outdoor air quality co-benefits	Risk of false positive
Transport	Cleaner road	cleaner transport	
	vehicles and modal shift	cleaner vehicle	
	modal Silic	modal shift	Yes
		lorry + replace	Yes
		freight + transport + replace	
		truck + replace	Yes
	More public	public transport	
	transport and railways	public transportation	
	Tallways	brt	Yes
		bus rapid transit	
		bus	Yes
		public bus	
		rail	Yes
		rolling stock	Yes
		train	Yes
		railway	Yes
	Electric and	electric vehicle	
	hybrid road vehicles	ev	Yes
	venicies	battery electric vehicle	
		bev	Yes
		plug-in hybrid electric	
		plugin hybrid electric	
		phev	Yes
		electric car	

Sector	Solution	Keywords for funding with outdoor air quality co-benefits	Risk of false positive
Transport	Electric and	electric bus	
	hybrid road vehicles	hybrid vehicle	
	verlicles	hev	Yes
		hybrid bus	
		hybrid car	
		electric truck	
		electric lorry	
		electric + freight + transport	
	Cleaner fuels	sulphur emission control area	
	and vehicles for	seca	
	shipping	shipping + emissions	Yes
		shipping + health	Yes
		green corridor + shipping	
		zero-carbon shipping	
		zero emission vessels	
		zero-emission vessels	
		roll-on/roll-off + electric	
		ro-ro ship + electric	
		cargo ship + electric	
		zero emission berth standard	
		continuous emissions monitoring systems	Yes
		low-sulphur fuels	
		low-sulfur fuels	
		non-residual fuels	
		scrubbers + ship	
		water injection + ship	
		exhaust gas recirculation + ship	
		humid air motor + ship	
		selective catalytic reduction + ship	
	More cycling and	cycling	Yes
	walking	walking	Yes
		bike	
		bicycle	
		pedestrian	Yes

Sector	Solution	Keywords for funding with outdoor air quality co-benefits	Risk of false positive
Transport	More cycling and walking	active travel	
	Traffic planning	traffic planning	Yes
	and management	traffic management	Yes
		car free days	
		clean air zones	
		ultra low emissions zones	
		ulez	
		smoke control areas	
		congestion	Yes
		congestion charge	
		limited traffic zone	
		Itz	Yes
		low-emission zone	Yes
		low emission zone	Yes
		lez	Yes
	Lower petrol and diesel vehicles emissions	emission standards	Yes
		diesel + filter	Yes
	Reduce indoor air	kerosene + lamp + replace	
	pollution	kerosene + lamp + replacement	
		clean light	
		clean lighting	
		solar lamp	
		solar light	
		clean cookstove	
		clean cooking	
		lpg + stove	
		lpg + cook	
		liquefied petroleum gas + stove	
		liquefied petroleum gas + cook	
	Using waste heat	waste heating	Yes
	from industry	district heating	Yes
	and clean energy sources for	clean heat	
	district heating	clean air conditioning	

Sector	Solution	Keywords for funding with outdoor air quality co-benefits	Risk of false positive
Residential	Using waste heat	clean cooling	
sector/ buildings	from industry and clean energy	clean ac	
	sources for	geothermal heat pump	Yes
	district heating	ground source heat	
		solar water heater	
		swh	Yes
	Efficiency in	insulation + building	
	buildings	building + insulate	
		energy + efficiency + household	
		efficient + appliance	Yes
		efficient + boiler	
		low-emission boiler	
		low + emission + boiler	
		eco + boiler	
Energy	Phasing out and	fossil + phase + out	
generation +	replacement of	fossil + replace	
industry	fossil fuel plants	coal + replace	
		gas + replace	
		oil + replace	
		diesel + replace	
		gasoline + replace	
	Clean and	clean energy	
	renewable energy	renewable energy	
		hydropower	
		hydro	Yes
		hydro power	
		wind power	
		wind energy	
		onshore wind	
		offshore wind	
		on-shore wind	
		off-shore wind	
		solar power	
		solar energy	
		solar pv	
		solar photovoltaic	
		solar thermal	
		concentrating solar power	

Sector	Solution	Keywords for funding with outdoor air quality co-benefits	Risk of false positive
Residential Sector/ Clean and renewable buildings		csp	Yes
	renewable energy	concentrated solar power	
bullulliys		geothermal	Yes
		waste to energy	
		waste-to-energy	
		biogas	
		ocean energy	
		tidal energy	
		marine energy	
	Emission and	gas leak detection	
	pollution control in mining	repair + gas + pipeline	
	in mining	repair + oil + pipeline	
		blowdown capture	
		pre-mining degasification	
		flooding + mines	
		air methane oxidation	
		vented gas + vapor recovery	
		gas flaring + phase out	
		gas flaring + phasing out	
	Pollution control and energy increased	pollution + control + industry	Yes
		pollution + prevention + industry	Yes
	efficiency in	emission + control + industry	Yes
	energy and	end-of-pipe control system	
	industrial processes	efficient charcoal production	
		efficiency + industry	
		energy efficiency	
		boiler + replace	
		brick kiln	Yes
		coke oven	Yes

Sector	Solution	Keywords for funding with outdoor air quality co-benefits	Risk of false positive
Agriculture	Improvements	livestock + emission	Yes
	in livestock production to	livestock + feeding	Yes
	reduce emissions	livestock + feed	Yes
		manure management	Yes
		closed manure storage	
	Improved food	crop + burning + reduce	
	production and consumption	agricultural burning	Yes
	Consumption	fertilizers + emission	
		fertilisers + emission	
		fertilizer + management	
		organic fertilizer	
		organic fertiliser	
		nitrogen-based fertilizer + reduce	
		nitrogen-based fertiliser + reduce	
		nitrogen based fertilizer + reduce	
		nitrogen based fertiliser + reduce	
		alternate wet and dry + rice	
		phosphogypsum addition	
		rice straw + composting	
		sulfate addition	
		direct wet seeding	
		alternative hybrid cultivars	
		methane emissions + rice	
		crop loss + reduction	
		food waste + reduction	
		dietary change	Yes
		diet + substitution	Yes
Waste	e Solid waste	waste burning	
	management	open burning	
		landfill + gas + collection	
		landfill + gas + flaring	
		closure + open dump	
		close + open dump	
		waste collection	
		sanitary landfill	
		organic waste + reduce	Yes
	Improved waste	wastewater treatment plants	
	water treatment	methane collection + wastewater treatment	
	and water sanitation	water sanitation	Yes
Natural	Reduction of non-	wildfires + prevent	
sources	anthropogenic air pollution	wildfires + firefight	
	policion	forest fires + firefight	
		forest fires + prevent	

4.2 KEYWORDS FOR FOSSIL FUEL PROLONGING ACTIVITIES

This group of keywords is used to extract projects related to fossil fuel activities that impact air pollution either directly or indirectly. Keywords are based on the taxonomy for fossil fuel prolonging activities developed by CPI as part of the State of Global Air Quality Funding 2022 report (depicted in Figure 4.5).

TABLE 4.5 TAXONOMY FOR FOSSIL FUEL PROLONGING ACTIVITIES

Sector	Sub-sector	Project category	Pollution type
Energy systems	Power and Heat Generation	Coal-fired power plant	Direct
		Fossil gas-fired power plant	Direct
		Oil-fired power plant	Direct
		Dual fuel- or fossil fuel-fired of unknown type	Direct
	Power and Heat Transmission and Distribution	Power lines to connect fossil fuel-fired power plant to the grid	Indirect
	Policy and National Budget Support and Capacity Building	Support to fossil fuel sector (Up- mid- and downstream)	Indirect
	Upstream	Coal mining & extraction	Direct and Indirect
		Oil and Gas extraction, production, refinery, storage, transportation, distribution	Direct and Indirect
Transport	Private Road Transport	Road constructions and upgrades	Indirect
	Aviation	Aviation support (Airports, Aircrafts, etc.)	Direct and Indirect
	Waterway	Fossil fuel-powered water transportation	Direct
	Policy and National Budget Support & Capacity Building	Support to fossil fuel-powered transport sector	Indirect

When building the list of keywords in Table 4.6, only projects leading to additional air pollution were considered. This excludes all business-as-usual projects such as the expansion of transport infrastructure (e.g., roads, airports) or transmission and distribution networks.

TABLE 4.6 LIST OF KEYWORDS FOR FOSSIL FUEL PROLONGING ACTIVITIES

Keywords	Related fossil fuel prolonging activity
coal + power plant	Coal-fired power plant
coal + power-plant/plant/power	Coal-fired power plant
coal-fired/coal-powered	Coal-fired power plant
gas + power plant	Fossil gas-fired power plant
gas + power-plant/plant/power	Fossil gas-fired power plant
gas-fired/ccgt/gas-powered	Fossil gas-fired power plant
gas fired	Fossil gas-fired power plant
incineration/incinerator/combustion	Manual check
power plant	Manual check
oil + power plant	Oil-fired power plant
oil + power-plant/plant/power	Oil-fired power plant
oil-fired/oil-powered	Oil-fired power plant
oil fired	Oil-fired power plant
waste + incineration/incinerator/combustion/burning	Waste incinerators
gas + pipeline/pipe/transport/transportation/ distribution	Upstream oil and gas
coal mining/mine/production/extraction/ transportation	Upstream coal
gas/oil/petroleum/kerosen/lng + extraction/ production/upstream/refinery	Upstream oil and gas
fossil/coal/oil/gas + policy/technical assistance/ measure/capacity building/support	Fossil fuel sector support
fossil/coal/oil/gas + capacity building	Fossil fuel sector support
fossil/coal/oil/gas + technical assistance	Fossil fuel sector support
transport/transportation + policy/measure/support	Fossil fuel transport sector support
transport/transportation + capacity building	Fossil fuel transport sector support
transport/transportation + technical assistance	Fossil fuel transport sector support
airport/plane/aviation	Aviation support
waterway/boat	Fossil fuel-powered water transportation
van/bus/train/carriage/locomotive/engine/motor + diesel/diesel-powered/diesel-fuelled/oil/coal/ice	Road transport
coal/gas/Ing/methane	Manual check
(palm/olive/edible/vegetable) oil	Manual check
(greenhouse) gas	Manual check
passenger vehicle + diesel/ice/oil/gas	Road transport
passenger car + diesel/ice/oil/gas	Road transport
car/ldv/pldv + diesel/ice/oil/gas	Road transport

Note: '+' separated words appear in any order in the descriptive data; '' separated words appear in this precise order in the descriptive data; '/' separated words were searched separately; words in parentheses were used as discriminants to exclude projects.

5. METHODOLOGY LIMITATIONS

This methodology presents a number of limitations:

Tracking of commitments. As mentioned in Section 3.3, the analysis in the report is based on financial commitments rather than disbursements. Commitments record the total amount of a transaction in the year when it is closed, irrespective of the time required to complete the disbursement. The result is that with relatively small funding volumes such as for outdoor air quality funding, single large transactions can significantly skew investment in specific years, making it hard to identify long-term trends. To overcome this limitation, in the analysis we do not focus on annual trends but rather look at the cumulative funding in the most recent five years for which data is available to smooth the possible impact single large transactions. Using disbursement data would provide a more accurate picture of the actual funding volume flowing air quality projects in a given year; however, current data gaps in disbursement data make it difficult to use this information.

Use of keywords. As mentioned in Section 3.1, once the data is collected, we run a keyword search to identify air quality and fossil fuel-prolonging projects within the broader database. While we have significantly improved and expanded the list of keywords, which were then reviewed by the Advisory Group, it is possible the keyword search may not capture all relevant projects for the analysis. The keyword search approach is also dependent on the quality and level of detail provided in the project descriptions; in cases where project descriptions are not very exhaustive, we might have failed to capture air quality or fossil fuel-prolonging projects. Furthermore, because the keyword search only works with project-level data, investors and sectors for which data is only available in an aggregate format cannot be included in the analysis, leading to potentially considerable data gaps. In the absence of an air quality tag or taxonomy to more accurately identify relevant projects, the use of keywords seems to be the only way to extract projects for the analysis. Clean Air Fund and CPI will continue to refine the list of keywords to make sure the accuracy of our methodology improves over time.

Scope of analysis. As mentioned in Section 2.2, the analysis does not currently include funding provided by the private sector or national governments (*e.g.*, through domestic budgets), which nevertheless play a key role in funding air quality and fossil fuel-prolonging projects. The analysis also focuses on direct investment into projects and excludes any funding that may go towards policies in support of either air quality or fossil fuel projects (*e.g.*, subsidies, tax credits, etc.). This is due to the focus of the analysis (*i.e.*, on international flows of public development finance to low- and middle-income countries) and in no way seeks to suggest that these do not play an important role in the air quality funding landscape.

Definitions. The distinction between outdoor air quality funding and funding with outdoor air quality co-benefits (see Section 2.1) can sometimes be unclear or confusing. In many cases, the categorization of a project under one funding flow or the other will depend on the interpretation of the project description and on whether outdoor air quality seems to be a key objective or the project or just a co-benefit. In some cases, funders may not provide a lot of detail about project objectives or expected impacts in the descriptions. Due to the size of the database, it is not possible to go over detailed documentation for each project to check project details that may help to interpret project descriptions and/or gather additional detail on specific objectives and impacts.

6. GEOGRAPHIC CLASSIFICATION

The analysis in The State of Global Air Quality Funding 2023 encompasses funding going to low- and middle-income countries. These include all non-OECD countries, as well as Chile, Colombia, Costa Rica, Mexico, Türkiye and Uruguay. Table 6.1 shows the regional breakdown used to group countries in the analysis. The designations employed do not imply the expression of any opinion on the part of Clean Air Fund or CPI concerning the legal status of any region, country, territory, city or area or of its authorities, or concerning the delimitation of frontiers or boundaries. Flows are classified as "transregional" when resources are channelled to more than one region.

TABLE 6.1 REGIONAL GROUPING USED FOR THE ANALYSIS OF AIR QUALITY FUNDING

Region	Country or territory	
Central Asia and Eastern Europe	Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Estonia, Georgia, Hungary, Kazakhstan, Kosovo ⁵ , Kyrgyz Republic, Latvia, Lithuania, North Macedonia, Montenegro, Poland, Slovakia, Republic of Moldova, Romania, Russian Federation, Serbia, Tajikistan, Türkiye, Turkmenistan, Ukraine, Uzbekistan.	
East Asia and Pacific	American Samoa, Brunei, Cambodia, China, Cook Islands, Democratic People's Republic of Korea, Fiji, Indonesia, Kiribati, Lao PDR, Malaysia, Marshall Islands, Micronesia (Federated States of), Mongolia, Myanmar, Nauru, Niue, Palau, Papua New Guinea, Philippines, Republic of Korea, Samoa, Singapore, Solomon Islands, Thailand, Timor-Leste, Tonga, Tuvalu, Vanuatu, Viet Nam.	
Latin America and Caribbean	Anguilla, Antigua and Barbuda, Argentina, Bahamas, Barbados, Belize, Bolivia (Plurinational State of), Bonaire, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Grenada, Guadeloupe, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, St. Barthélemy, Sint Eustatius and Saba, St. Kitts and Nevis, St. Lucia, St. Vincent and Grenadines, Suriname, Trinidad and Tobago, Uruguay, Venezuela (Bolivarian Republic of), West Indies.	
Middle East and North Africa	Algeria, Bahrain, Egypt, Islamic Republic of Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, State of Palestine, Syrian Arab Republic, Tunisia, United Arab Emirates, Yemen	
Other Oceania	Australia, New Zealand, Tokelau	
Sub-Saharan Africa	Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cabo Verde, Central African Republic, Chad, Comoros, Republic of Congo, Democratic Republic of the Congo, Côte d'Ivoire, Djibouti, Equatorial Guinea, Eritrea, Eswatini, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mayotte, Mozambique, Namibia, Niger, Nigeria, Réunion, Rwanda, São Tomé and Principe, Saint Helena, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, South Sudan, United Republic of Tanzania, Togo, Uganda, Zambia, Zimbabwe	
South Asia	Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, Sri Lanka	
US and Canada	Canada, United States of America	
Western Europe	Andorra, Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Liechtenstein, Luxembourg, Malta, Monaco, Netherlands, Norway, Portugal, San Marino, Slovenia, Spain, Sweden, Switzerland, United Kingdom, Vatican City.	

⁵ This designation is without prejudice to positions on status, and is in line with United Nations Security Council resolution 1244 and the International Court of Justice Opinion on the Kosovo Declaration of Independence.

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