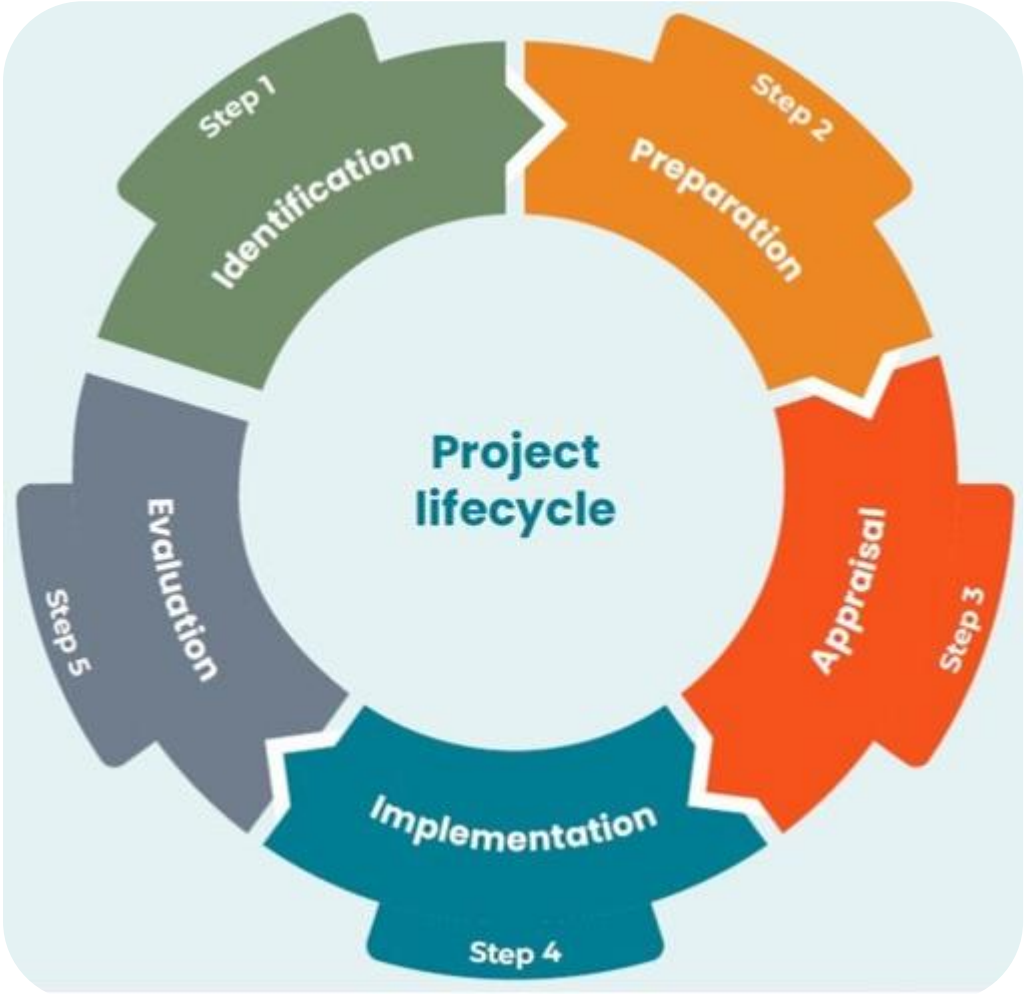
Preparation and appraisal Part 2

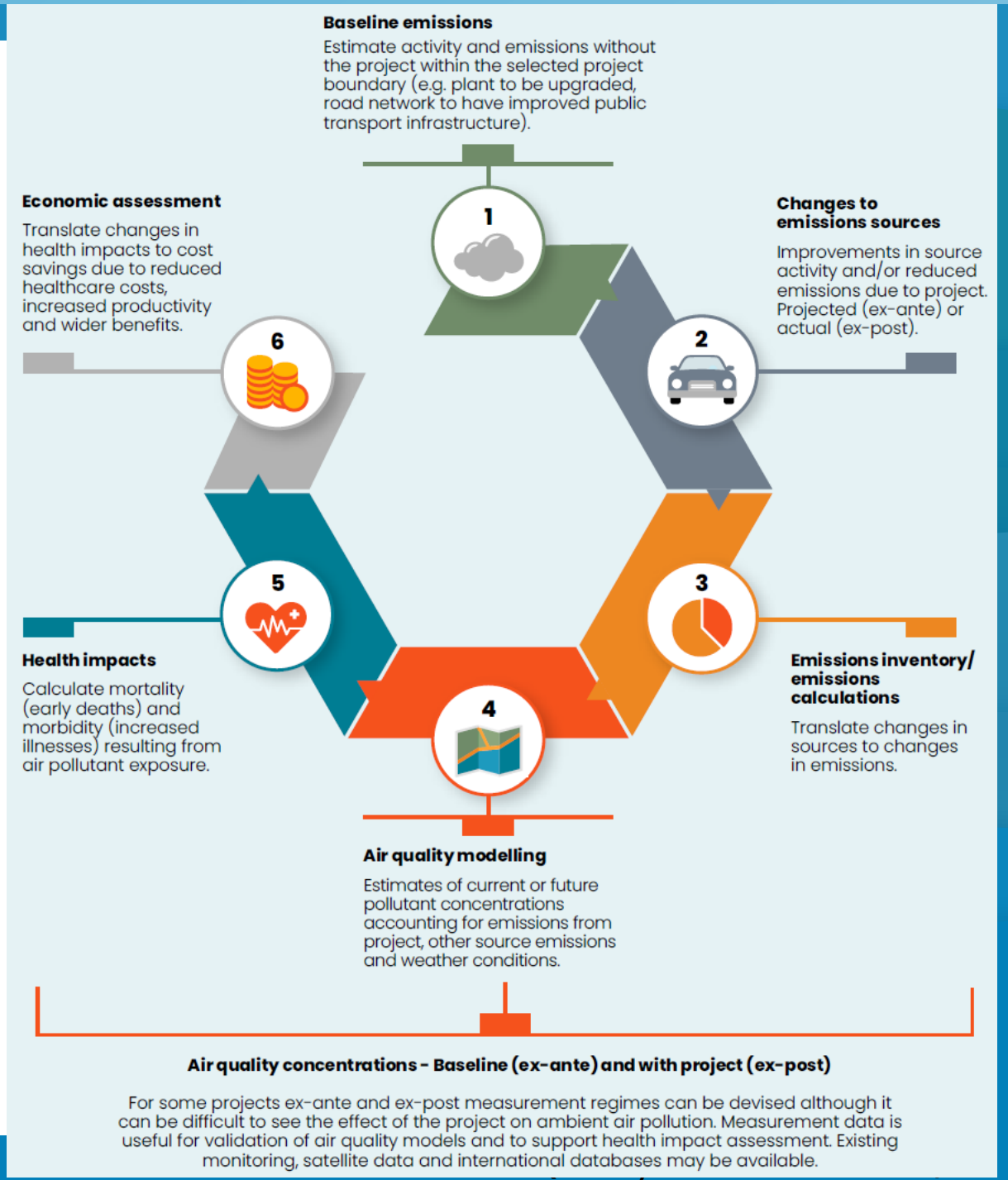
- Day 2 Session 1
- Everlyn Tamayo - Clean Air Asia

Preparation and appraisal

- Steps 2 & 3 in the Project Lifecycle
- Key points for this session:
  - ➢ 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
  - ➢ Confirmation of project benefits in the context of air quality



Steps in quantifying air pollution changes and associated benefits



ADB Urban Resilience Trust Fund UK International Development JFJCM Japan Fund for the Joint Crediting Mechanism From the People of Japan CLEAN AIR FUND

Indicators for tracking air quality outcomes

- Projects with good potential to result in an air quality benefit or co-benefit can be tracked using sector-specific qualitative or quantitative indicators

- The simple equation to estimate reduction in emissions is:

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

- This means changes in the **activities** (i.e., activities that result in changes in fossil fuel use) and/or the **emission intensity** (i.e., emission factors) can reduce emissions and likely reduce air pollution concentrations
  - In each sector, there are specific indicators that project managers can look into

Indicators for tracking air quality outcomes

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

Indicators for tracking air quality outcomes

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**

Indicators for tracking air quality outcomes

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
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)

Indicators for tracking air quality outcomes

Project sector	Project subsector	Example indicators
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	

Indicators for tracking air quality outcomes

Project sector	Project subsector	Example indicators
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
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

Indicators for tracking air quality outcomes

Project sector	Project subsector	Example indicators
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)

Assessing the air quality benefit of projects

Assessment type	Qualitative assessment of the impact of a project on air quality	Assessment of emissions changes	Detailed air quality assessment
	• Allows for the reporting of a project as air quality positive. • No expertise required. • Minimal impact on budget.	• 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.	• 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.

Refer to Table 2 of the Toolkit for complete details (p.52)

Review of the case study: Malé, Maldives

1. What are the **key sources of air pollution in Greater Male** in the context of the issues provided?

- **Open burning and dumping of waste** in the surrounding area due to inadequate waste transfer infrastructure (836 tons per day waste generation)
- **Mixed waste burned** without any pollution control
- **Disel generators** are one of primary sources of energy to the islands

2. **What are the key pollutants of concern**?

PM, BC, CH_4, NOx, VOCs, SO_2, and possibly some heavy metals (e.g., Lead)

Review of the case study: Malé, Maldives

Understanding the air quality landscape

National AQ related legislation, regulations and policy	*Transboundary air pollution issues*	*Available AQ information*
National Action Plan on Air Pollutants (2019-2030) Maldives' Third Nationally Determined Contribution	'air quality in Male' is influenced by both domestic and long range transboundary sources, especially from incomplete combustion in shipping, transport and open burning of waste' In the dry season, 90% of $PM_{2.5}$ is from transboundary sources, in remote location such as Hanimaadhoo (Budhavant et al, 2015)	'limited studies done on urban air quality with an absence of long-term monitoring' (NAP) (Noora et al. 2025): - Higher levels of $PM_{2.5}$ were measured in the dry season and the 24-h WHO-recommended level was surpassed in 67% of the days in the dry season (transboundary) -$PM_{2.5}$ concentrations in at least 93% of the days in the wet season (Apr–Oct) remained within the daily limit. - Besides vehicular emission, electricity generation, biomass burning, sea transport and construction activities are the likely local sources of $PM_{2.5}$

Review of case study: Malé, Maldives

Identifying priority air quality options

Ideas on project components or measures	How it will address air pollution	Phase (1, 2, both, or additional)

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.

Group Activity: Integrating Air Quality in the Preparation and Appraisal stages of the project lifecycle (Male Case Study)

Case study: Malé, Maldives

Integrating Air Quality in the Preparation and Appraisal stages of the project lifecycle

- With your knowledge of the project site, and the proposed project ideas discussed the prior day, we are going to look in more detail *what is needed in order to assess the air quality benefit of the project*.
  - *Key assessment approaches*: (1) qualitative/semi-quantitative assessment; (2) emission-based evaluation; (3) detailed health and economic benefit assessment
- As project managers, it is an important skill to *identify what information is needed* in order to complete the assessment. Accomplish the table in relation to the assigned assessment approach, through discussing with your group:

Data needs	Source of data	Expected outputs

- Place your answers in the meta cards and the flipcharts for your group. Top 3 groups will be asked to share their work

Case study: Malé, Maldives

Integrating Air Quality in the Preparation and Appraisal stages of the project lifecycle

Qualitative/semi-quantitative assessment

Data needs	Source of data	Expected outputs
• Basic project information: *description of the new facility and its processes*. • Identification of *sources* removed/reduced: Phase 1: open burning at Thilafushi, Phase 2: diesel generation. • Assumptions about *activity changes*: proportion of waste currently burned vs. processed in new facility; extent of diesel generator displacement. • *Community-based information*: surveys, complaints registers, local knowledge on visible smoke plumes and nuisance. • **Qualitative comparison**: "Before" vs "After" situation (e.g. *reduction in visible plumes, improved waste handling, less reliance on diesel*).	• Project information sheet, EIA • National statistics • Pre- and current/ post-implementation data from the project • Community surveys, interviews, local government	• Simple narrative assessment: "***Replacing open burning with WtE will reduce visible smoke and nuisance, likely cutting $PM_{2.5}$ and CO emissions significantly***." • Useful for stakeholder engagement and early planning.

Case study: Malé, Maldives

Integrating Air Quality in the Preparation and Appraisal stages of the project lifecycle

Emissions-based evaluation

Data needs	Source of data	Expected outputs
Baseline activity data: Waste volumes processed (836 tonnes/day total; assume 60% open burning = ~500 tonnes/day). Diesel use for electricity generation (from national statistics). Emission factors: e.g. US EPA AP-42 (for open burning of MSW). PM = 8 kg/tonnes NOx = 3 kg/tonnes SOx = 0.5 kg/tonnes CH_4 = 6.5 kg/tonnes CO = 42 kg/tonnes *Calculation*: Multiply waste burned (Mg/day) × emission factor = baseline emissions. Project scenario: Estimate emissions from WtE (stack emissions, with pollution control) + reduced diesel use. Comparison: Emissions "with project" vs "without project".	• National statistics • Local survey • Reputable references for the EFs (e.g., US EPA, EU, local studies)	• Table of emissions avoided (tonnes/year by pollutant) • Emissions map if geospatial data is available • Evidence of ***major reductions*** in PM and CO, moderate reductions in NOx, plus displacement of diesel-related emissions. • *supports feasibility and EIA documentation.

Case study: Malé, Maldives

Integrating Air Quality in the Preparation and Appraisal stages of the project lifecycle

Detailed health and economic benefit assessment

Data needs	Source of data	Expected outputs
• *Baseline emissions inventory to provide inputs to modelling* • *Meteorological data: wind patterns, seasonal variation, model inputs; also as input to AQ modelling* • *Air quality modelling: dispersion modelling under baseline and project scenarios.* • *Air quality monitoring data - use for validating modelling and assessing against AQ standards* • *Health modelling: estimating the change in health outcomes (mortality, morbidity) based on AQ changes and:* o *Population/exposure data: population distribution* o *Health incidence data (baseline health)* o *Health impact functions from WHO GBD* o *Economic valuation methods: cost of illness, productivity loss, willingness-to-pay approaches.*	• Emissions inventory • Air quality monitoring system • National statistics • Local surveys or community health records • Reputable references for the health impact functions and economic values	• Estimates of **avoided premature deaths, hospital admissions, and lost work days** due to reduced $PM_{2.5}$ exposure. • Monetary **valuation of health benefits**, potentially showing co-benefits exceeding operational costs. • *Strongest case for investment, policy alignment, and donor support.