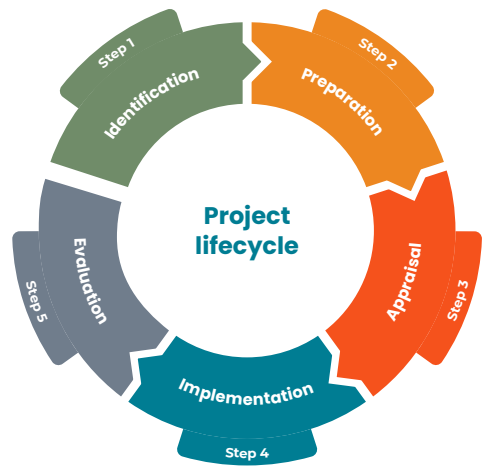


Enhancing Air Quality Outcomes in Waste Management Projects: A Case Study from Greater Malé



The *Air Quality Toolkit for Development Finance Institutions* (DFIs) guides DFI Project Officers to include air quality considerations into their sectoral development projects, and track the associated air quality co-benefits by identifying meaningful monitoring indicators. The case study is framed around the core project lifecycle steps from Identification to Evaluation. At the concept *Identification* stage, it is important to establish if the project will have an air quality positive impact. During *Preparation* and *Appraisal*, the potential impact of a project on air quality is assessed, opportunities identified to enhance air quality benefits and indicators selected to be used in evaluation. *Implementation* and *Evaluation* involves ensuring that planned air quality benefits are realised during project delivery, collecting relevant data to track progress against indicators, and assessing the actual air quality outcomes after project completion.

OPPORTUNITIES TO MAINSTREAM AIR QUALITY THROUGHOUT A PROJECT LIFECYCLE



Project factsheet

Name

Greater Malé Environmental Improvement and Waste Management and Waste-to-Energy Projects

Date

2018 – 2027

Location

The Maldives

Sector(s)

Waste, energy

Funders

Asian Development Bank (ADB), Asian Infrastructure Investment Bank (AIIB) Islamic Development Bank (IsDB), Japan Fund for the Joint Crediting Mechanism (JFJCM), Japan Fund for Prosperous and Resilient Asia and the Pacific

Value

US\$ 35 million (Waste Management);
US\$ 144 million (Waste-to-Energy)

Main objectives

Improve waste collection, transfer and processing in the Maldives capital region and its outer islands, making systems climate and disaster resilient. Improve waste processing at the Thilafushi landfill site by developing waste treatment infrastructure and installing Waste-to-Energy technology.

Project site

www.adb.org/projects/51077-002/main

www.adb.org/projects/51077-003/main

Background and context

This case study looks at how two related existing ADB projects, the Greater Malé Waste Management and Waste-to-Energy projects, incorporated air quality considerations and explores where the *Air Quality Toolkit for DFIs* could have supported enhanced inclusion of air quality as an explicit co-benefit. Malé, the capital of the Maldives, is the eighth most densely populated island in the world, which poses significant problems for waste management and electricity generation. The Greater Malé capital region encompasses the capital city of Malé, located on its own island, along with other nearby islands that are becoming increasingly developed. In 1991, the government of the Maldives reclaimed the nearby lagoon of Thilafushi (6km to the west of Malé) as a landfill site, filling in the lagoon with waste from the capital.



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Starting in 2018, the Environmental Improvement and Waste Management project was implemented to establish a regional solid waste treatment system in the Greater Malé capital region. This aimed to modernise waste collection, transfer, and processing, while also strengthening institutional capacity to deliver sustainable services. In 2020, the Waste-to-Energy project was initiated to construct a climate and disaster-resilient Waste-to-Energy (WtE) plant and recycling infrastructure at Thilafushi to improve waste processing and supplement the diesel generators currently used to provide electricity to the islands.

Identification of opportunities to improve air quality

While the original projects were primarily conceived as waste management interventions, the scope for potential air quality benefits was recognised and incorporated. Within the *Air Quality Toolkit for DFIs*, Appendix 1 lists example measures to improve air quality and can be used to identify potential solutions for improving air quality. The table below highlights the projects' existing benefits related to air quality and suggests additional actions that could have been considered.

Following creation of this 'long list' of potential options for air quality improvement, the 'Initial Feasibility Assessment Checklist' within Section 2.2.3 of the *Air Quality Toolkit for DFIs* can be used to refine the list, before more in-depth assessments of the options take place.

Potential air quality benefits in existing project	Suggestions for additional actions / solutions to improve air quality outcomes
Waste Management project	
<ul style="list-style-type: none"> Improved waste collection and transfer infrastructure leads to a reduction in open burning of domestic waste. 	<ul style="list-style-type: none"> Implement strict regulations and enforcement to prevent the open burning of waste. Use electric vehicles (EVs) for waste collection/transfer. Charge electric waste collection/transfer vehicles using renewable energy e.g., solar, or electricity from the WtE plant.
Waste-to-Energy project	
<ul style="list-style-type: none"> Improved waste treatment and the controlled processing of waste (via WtE) leads to a reduction in open burning of waste at Thilafushi landfill. Electricity generated by the WtE plant can replace use of (at least some) diesel generators. WtE plant was designed with state-of-the-art pollution control technologies to reduce pollutant emissions, including flue gas cleaning and a selective catalytic reduction system for NO_x. 	<ul style="list-style-type: none"> Implement strict regulations and enforcement to prevent the open burning of waste at Thilafushi landfill. Undertake emissions monitoring at the WtE plant to make sure pollution control technologies are effective and air pollutant emissions are below required levels.

Preparation and appraisal

To quantitatively assess the WtE project's impact on air quality, both air pollution monitoring and modelling assessments were undertaken. An air quality baseline was established using monitoring surveys at the existing landfill site and in the surrounding area in 2018 and 2019. As there were no national air quality limit values in the Maldives at the time, concentrations were compared with World Health Organization (WHO) [Air Quality Guidelines](#). Concentrations of pollutants including PM_{2.5}, PM₁₀, NO₂ and SO₂ WHO guidelines downwind of the site during open burning. Air quality modelling of the potential adverse impacts from the WtE plant was also conducted, which demonstrated that the new plant, with suitable pollution control technologies in place, would not cause new air quality issues. The Toolkit describes further steps that could have been considered using population/exposure data, health impact functions, and economic valuation methods to estimate the potential health and economic benefits arising from the air quality improvements. More detail on these types of assessments can be found in Section 2.2.4 of the *Air Quality Toolkit for DFIs*.

Implementation and evaluation

For quantitative assessment, air quality monitoring allows direct evaluation of the pollutant concentrations recorded in previous years (the baseline) with concentration changes due to project implementation. However, explicit air quality co-benefits can also be tracked using other relevant data. Within the *Air Quality Toolkit for DFIs*, Appendix 2 provides example indicators for tracking air quality outcomes. The table below highlights project indicators contained in the Design and Monitoring Framework which can be related to air quality and recommends further examples to help track air quality co-benefits.

Project Design and Monitoring Framework Indicators	Recommendations for indicators to track air quality co-benefits
Waste Management project	
<ul style="list-style-type: none"> At least 90% of all types of solid waste collected and transferred to Thilafushi or island waste management centres. 21 additional refuse collection vehicles and 3 vessels for waste transport from islands to Thilafushi commissioned. Two waste transfer stations in Malé and Villimalé constructed. 	<ul style="list-style-type: none"> Reduction in domestic solid waste openly burnt (e.g., in tons) → decrease in amount of waste burnt could be used to estimate reduction in emissions of air pollutants such as NO_x, PM, VOCs, etc.
Waste-to-Energy project	
<ul style="list-style-type: none"> By 2027, at least 80% of combustible solid waste treated. At least 50,000 megawatt-hours (MWh) of electricity per year generated from the WtE plant. Ministry of Environment and Environmental Regulatory Authority capacity improvement plan for supervising sustainable WtE service delivery finalised and implemented. 	<ul style="list-style-type: none"> Reduction in (untreated) waste openly burnt at Thilafushi (e.g., in tons) → decrease in amount of waste burnt could be used to estimate reduction in emissions of air pollutants such as NO_x, PM, VOCs, etc. Amount of waste processed at Thilafushi (e.g., in tons) → proxy for the decrease in amount of waste burnt; could be used to estimate reduction in emissions of air pollutants such as NO_x, PM, VOCs, etc. MWh of electricity generated (or preferably, MWh of electricity used) from the WtE plant → a proxy indicator for emissions reductions due to reduction in use of diesel generators.

This case study demonstrates how explicit air quality co-benefits were identified from two related waste management projects. It explores how further air quality improvements could be achieved via use of EVs and renewable energy, and suggests proxy indicators to help track these improvements. For more information on how these concepts can be applied to other development projects, please see the *Air Quality Toolkit for DFIs*.

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