Greenhouse Gas Mitigation Options for Pakistan: Waste Sector

This factsheet provides a summary of the mitigation option analysis in the waste sector, for more details on methodology and sources, please refer to the corresponding technical report.

Key Facts

The waste sector is very small in terms of emissions: It represents less than 2 per cent of Pakistan's greenhouse gas (GHG) emissions. This share is expected to remain constant, meaning that emissions are expected to double between now and 2030. The sector can be divided into four parts that are sources of emissions: Human sewage, industrial wastewater, domestic wastewater and solid waste. These four sources produce a variety of greenhouse gasses: Carbon Dioxide (CO_2) from burned waste and waste that is exposed to air, Methane (CH_4) from waste that is digested by bacteria in the absence of air, and Nitrous Oxide (N_2O), which comes from the degradation of human waste. Both methane and nitrous oxide have GHG warming potentials much larger than carbon dioxide, meaning that one unit of methane or nitrous oxide counts as much more than one unit of carbon dioxide.

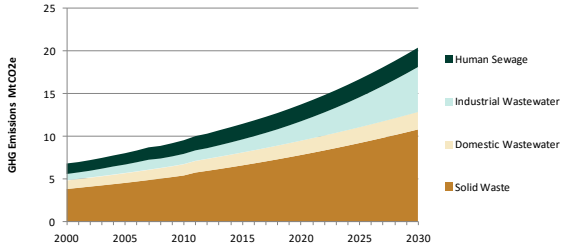
The key characteristic of the waste sector is that it is still at an early stage of development, with a relatively small proportion of the waste collected, especially outside urban centres. The collected waste is also mostly dumped in landfills that lack sanitary or processing facilities. Some steps have recently taken place, with the starting of a sanitary landfill and of a compost facility in separate locations in Lahore. These facilities involve joint ventures between the government and private companies and aim at marketing products such as compost for fertilisation and landfill gas for heat and electricity. Such products could potentially deliver enough revenue to support those facilities. The main challenge is to find the right conditions to gather value from these projects and have them standing on their own.

GHG Baseline

Projected GHG emissions from the sector by source to the year 2030 are indicated below in Figure 1. **Emissions are projected to more than double between 2012 and 2030 and are forecast to grow from approximately 10 $MtCO_2e$ in 2012 to over 20 Mt CO_2e in 2030.**

The ranking of the sources is projected to change quite dramatically. Industrial wastewater is projected to go from being the lowest emitter to the highest.

FIGURE 1: PROJECTED GREENHOUSE GAS EMISSIONS IN WASTE SECTOR (MT CO_2E)



Mitigation Options

Options were identified from a review of existing policies and strategies, independent studies and key improvements in the sector that have demonstrated their success in similar contexts. The methodology for calculating emissions reductions, as well as more detail on assumptions and figures, can be found in the corresponding technical report for the sector.

Several options were identified to improve energy use in the waste sector:

- Compost
- Landfill gas utilisation

- Changing diets of Pakistani citizens to reduce protein intake
- Wastewater treatment options

The first two options were prioritised based on feasibility, potential incentive, and the fact that such facilities already started operating in Lahore. They are examined in detail below, with a summary of GHG benefits and cost in Table 1.

TABLE 1: EMISSION MITIGATION MEASURES AND IMPACTS

Emission Mitigation Measure	GHG Emission Reductions in 2030 ($MtCO_2e$)	GHG Emission Reductions from Sector BAU in 2030	Investment costs (USD million)
Compost	0.90	4.4%	19
Landfill gas utilization	0.88	4.3%	245

Compost

This option would consist of collecting municipal solid waste and turning it into compost, which can be sold as a fertiliser. This would require increasing collection rates, sorting the waste and marketing the end product. One such (large-scale) facility is currently operating in Lahore.

Scenario Definition

The scenario involves building similar facilities in three other cities (Karachi, Faisalabad, and Rawalpindi), proportional to their population. This would bring the total number of facilities to four by 2030.

Benefits and Impacts

Composting can have important environmental and agricultural benefits when applied to the soil, increasing nutrients and moisture, improving plant quality and soil structure. Using compost reduces the need for chemical fertiliser, while increasing crop yields, hence reducing farmers' expenses and benefitting both the environment and food security. Recycling of organic waste in a decentralised and pro-poor manner can provide important livelihood opportunities for rural communities by creating formal job opportunities at better working conditions, reduce the spread of vectors, diseases and odours and improve hygiene, reducing cost of landfilling and improving crop yields through organic fertiliser. Experience from community-led waste management projects show that composting systems can empower communities and women in particular, who often make up the largest group of waste pickers and benefit from better working conditions, a formal income, and better health.

Experience from decentralised and integrated resource recovery centres (IRRCs) show that "every ton of CO2e reduced composting projects in developing countries can generate co-benefits in a range between USD 93.82 and USD 184.21 [excluding benefits] related to public health arising from avoided pollution and spread of diseases"

Landfill gas utilisation

This option would consist of collecting municipal solid waste and placing it into a sanitary landfill, which would enable the collection of landfill gas (methane). This gas could in turn be used to produce electricity or heat that would be sold on the market. This would require increasing collection rates, building a sanitary landfill and finding an outlet for the landfill gas (either with electricity generation site or through pipelines). One such (large-scale) facility is currently operating in Lahore.

Scenario Definition

The scenario involves building similar facilities in three other cities (Karachi, Faisalabad, and Rawalpindi), proportional to their population. This would bring the total number of facilities to four by 2030.

Benefits and Impacts

Capturing landfill gas allows communities to use this local energy source, while reducing air pollution and other environmental benefits and generating economic opportunities. Economic benefits can include fuel cost savings, job creation in construction and operation, as well as improved economic development near landfills. Environmental and social benefits include safer landfills with reduced odours and air pollution. Moreover, waste resources can be captured to provide access to a reliable local fuel source that may displace fossil fuel use for landfill operations, for electricity production or heating.

"This document is an output from a project commissioned through the Climate and Development Knowledge Network (CDKN). CDKN is a programme funded by the UK Department for International Development (DFID) and the Netherlands Directorate-General for International Cooperation (DGIS) for the benefit of developing countries. The views expressed and information contained in it are not necessarily those of or endorsed by DFID, DGIS or the entities managing the delivery of the Climate and Development Knowledge Network, which can accept no responsibility or liability for such views, completeness or accuracy of the information or for any reliance placed

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