

3 Waste Generation

At a Glance:

- ▶ **MSW generation levels are expected to double by 2025.**
- ▶ **The higher the income level and rate of urbanization, the greater the amount of solid waste produced.**
- ▶ **OECD countries produce almost half of the world's waste, while Africa and South Asia regions produce the least waste.**

Current global MSW generation levels are approximately 1.3 billion tonnes per year, and are expected to increase to approximately 2.2 billion tonnes per year by 2025. This represents a significant increase in per capita waste generation rates, from 1.2 to 1.42 kg per person per day in the next fifteen years. However, global averages are broad estimates only as rates vary considerably by region, country, city, and even within cities.

MSW generation rates are influenced by economic development, the degree of industrialization, public habits, and local climate. Generally, the higher the economic development and rate of urbanization, the greater the amount of solid waste produced. Income level and urbanization are highly correlated

Collecting paper
to be recycled,
Mumbai, India



Photo: Jeroo Bhada

and as disposable incomes and living standards increase, consumption of goods and services correspondingly increases, as does the amount of waste generated. Urban residents produce about twice as much waste as their rural counterparts.

Waste Generation by Region

Waste generation varies as a function of affluence, however, regional and country variations can be significant, as can generation rates within the same city. Annex A. Map of Regions illustrates the regional classification used in this report. Throughout the report, when Africa is mentioned as a region, we refer to Sub-Saharan Africa. Data are particularly lacking for Sub-Saharan Africa.

Waste generation in sub-Saharan Africa is approximately 62 million tonnes per year. Per capita waste generation is generally low in this region, but spans a wide range, from 0.09 to 3.0 kg per person per day, with an average of 0.65 kg/capita/day. The countries with the highest per capita rates are islands, likely due to waste generated by the tourism industry, and a more complete accounting of all wastes generated.

The annual waste generation in East Asia and the Pacific Region is approximately 270 million tonnes per year. This quantity is mainly influenced by waste generation in China, which makes up 70% of the regional total. Per capita waste generation ranges from 0.44 to 4.3 kg per person per day for

Region	Waste Generation Per Capita (kg/capita/day)		
	Lower Boundary	Upper Boundary	Average
AFR	0.09	3.0	0.65
EAP	0.44	4.3	0.95
ECA	0.29	2.1	1.1
LAC	0.11	14 ²	1.1
MENA	0.16	5.7	1.1
OECD	1.10	3.7	2.2
SAR	0.12	5.1	0.45

TABLE 3
Current Waste Generation Per Capita by Region (see Annex J)

the region, with an average of 0.95 kg/capita/day (Hoorweg et al 2005).

In Eastern and Central Asia, the waste generated per year is at least 93 million tonnes. Eight countries in this region have no available data on waste generation in the literature. The per capita waste generation ranges from 0.29 to 2.1 kg per person per day, with an average of 1.1 kg/capita/day.

Latin America and the Caribbean has the most comprehensive and consistent data (e.g. PAHO's Regional Evaluation of Solid Waste Management, 2005). The total amount of waste generated per year in this region is 160 million tonnes, with per capita values ranging from 0.1 to 14 kg/capita/day, and an average of 1.1 kg/capita/day. Similar to the high per capita waste generation rates on islands in Africa, the largest per capita solid waste generation rates are found in the islands of the Caribbean.

In the Middle East and North Africa, solid waste generation is 63 million tonnes per year. Per capita waste generation is 0.16 to 5.7 kg per person per day, and has an average of 1.1 kg/capita/day.

The OECD countries generate 572 million tonnes of solid waste per year. The per capita values range from 1.1 to 3.7 kg per person per day with an average of 2.2 kg/capita/day.

In South Asia, approximately 70 million tonnes of waste is generated per year, with per capita values ranging from 0.12 to 5.1 kg per person per day and an average of 0.45 kg/capita/day.

Table 3 shows current waste generation per capita by region, indicating the lower boundary and upper boundary for each region, as well as average kg per capita per day of waste generated within each region.²

Figure 1 illustrates global waste generation per region, where OECD countries make up almost half

² This table is not corrected for extraneous outliers, such as the 14.40 kg/capita/day upper bound in Latin America and the Caribbean [Trinidad and Tobago].

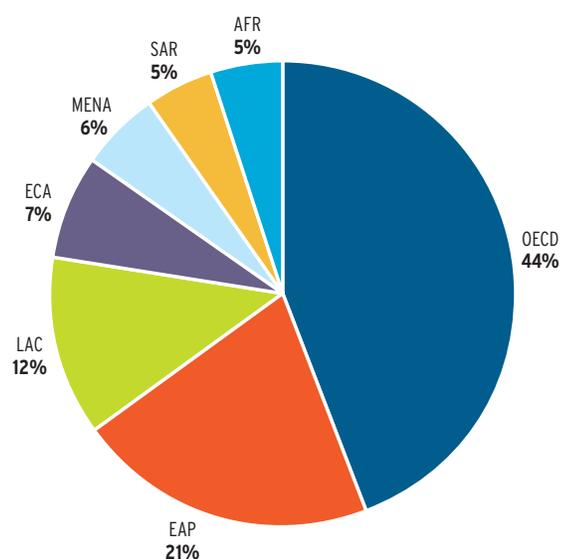


FIG. 1
Waste Generation by Region

TABLE 4
Waste Generation
Projections for
2025 by Region

Region	Current Available Data			Projections for 2025			
	Total Urban Population (millions)	Urban Waste Generation		Projected Population		Projected Urban Waste	
		Per Capita (kg/capita/day)	Total (tons/day)	Total Population (millions)	Urban Population (millions)	Per Capita (kg/capita/day)	Total (tons/day)
AFR	260	0.65	169,119	1,152	518	0.85	441,840
EAP	777	0.95	738,958	2,124	1,229	1.5	1,865,379
ECA	227	1.1	254,389	339	239	1.5	354,810
LCR	399	1.1	437,545	681	466	1.6	728,392
MENA	162	1.1	173,545	379	257	1.43	369,320
OECD	729	2.2	1,566,286	1,031	842	2.1	1,742,417
SAR	426	0.45	192,410	1,938	734	0.77	567,545
Total	2,980	1.2	3,532,252	7,644	4,285	1.4	6,069,703

TABLE 5
Current Waste
Generation
Per Capita
by Income Level

Income Level	Waste Generation Per Capita (kg/capita/day)		
	Lower Boundary	Upper Boundary	Average
High	0.70	14	2.1
Upper Middle	0.11	5.5	1.2
Lower Middle	0.16	5.3	0.79
Lower	0.09	4.3	0.60

of the world's waste, while Africa and South Asia figure as the regions that produce the least waste.

Table 4 shows estimates of waste generation for the year 2025 as expected according to current trends in population growth in each region.

Waste Generation by Country Income Level ³

High-income countries produce the most waste per capita, while low income countries produce the least solid waste per capita. Although the total waste generation for lower middle income countries is higher than that of upper middle income countries, likely skewed as a result of China's inclusion in the lower middle income

group, the average per capita waste generation amounts for the various income groups reflect the income level of the countries (see Figure 2). The high, upper-middle, lower-middle, and low income designations are somewhat inaccurate as these classifications are country-wide, and in several countries average national affluence can be very different from average affluence of the urban populations. Only the affluence of urban residents is important in projecting MSW rates. For example, India and especially China have disproportionately high urban waste generation rates per capita relative to overall economic status as they have large relatively poor rural populations that tend to dilute national figures. Annex B. Map of Income Distribution illustrates the global classification for income used in this report.

³ Countries are classified into four income levels according to World Bank estimates of 2005 GNI per capita. High: \$10,726 or above; Upper middle: \$3,466-10,725; Lower middle: \$876-3,465; and Lower: \$875 or less.

Table 5 shows current waste generation per capita by income level, indicating the lower

boundary and upper boundary for each region, as well as average kg per capita per day of waste generated within each group according to country income level.

Figure 2 presents global waste generation by country per income level, showing decreasing average rates of per capita waste generation according to income level.

Table 6 shows estimates of waste generation for the year 2025 as expected according to current trends in population growth as determined by country income level.

Methodology for collecting current data:

MSW generation data by country were collected from official government publications, reports by international agencies, and articles in peer-reviewed journals. Where possible, this report has used the same source for a group of countries so that the data are relatively standardized by methodology and year. For example, MSW generation data for high-income countries are from OECD publications; countries in Latin America and the Caribbean from PAHO studies; and some Middle Eastern countries from METAP data.

In cases where only per capita waste generation rates were available, the total urban population for that year (World Bank, World Development Indicators) was used to calculate the total urban MSW generation.

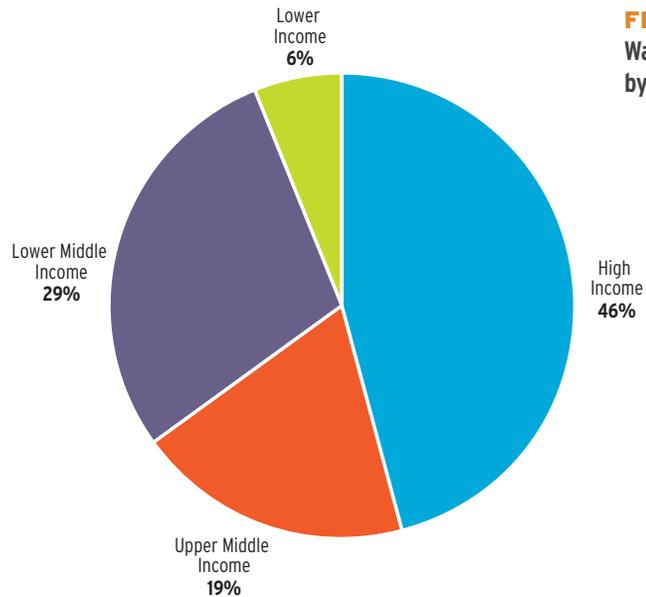


FIG. 2
Waste Generation
by Income

Where only total MSW generation numbers were available, total urban population for that year was used to calculate per capita waste generation, assuming that most of the waste generated is in urban areas and only a small fraction comes from rural areas.

For several African countries, data were not readily available. Hence, a per capita amount of 0.5 kg/capita/day is assumed for urban areas for 2005. This estimate is based on the USAID 2009 publication on *Environmental Guidelines for Small-Scale Activities in Africa* (EGSSAA), 2nd Ed. and World Bank studies. For further information on MSW generation rates by country, please see Annex J. When reviewing

Region	Current Available Data			Projections for 2025 (from Annex J)			
	Total Urban Population (millions)	Urban Waste Generation		Projected Population		Projected Urban Waste	
		Per Capita (kg/capita/day)	Total (tons/day)	Total Population (millions)	Urban Population (millions)	Per Capita (kg/capita/day)	Total (tons/day)
Lower Income	343	0.60	204,802	1,637	676	0.86	584,272
Lower Middle Income	1,293	0.78	1,012,321	4,010	2,080	1.3	2,618,804
Upper Middle Income	572	1.16	665,586	888	619	1.6	987,039
High Income	774	2.13	1,649,547	1,112	912	2.1	1,879,590
Total	2,982	1.19	3,532,256	7,647	4,287	1.4	6,069,705

TABLE 6
Waste Generation
Projections for 2025
by Income

TABLE 7
Sources for 2025
Projections of
Solid Waste
Generation

Variable	Data Source
Current GDP (current US\$, 2005)	World Development Indicators
GDP Projections by Region	IEA Annual Energy Outlook (2005)
Urban Population Projections	United Nations World Urbanization Prospects (2007)

TABLE 8
Average MSW
Generation Rates
by Income

Income Level	Average MSW Generation (kg/cap/day)
Low-Income	0.6 - 1.0
Middle-Income	0.8 - 1.5
High-Income	1.1 - 4.5

the values presented in this report, it's important to keep in mind that values for waste generation at a regional level can differ markedly because of the influence from a single country, such as the US, China or India.

GDP (high-, middle-, or low-income) and an average range of MSW generation based on that income level. Modest adjustments for current experience and waste generation practices were made where appropriate. Similar to 'energy intensity' urban residents also exhibit 'waste intensity'.

Methodology for calculating 2025 projections:

Projections for urban municipal solid waste generation in 2025 were made by factoring expected growth in population and GDP and estimated per capita waste generation. Projections for each country were made based on the level of expected

For further information on the sources used for the 2025 projections please refer to Table 7.

Table 8 illustrates the range of MSW based on country income level. These values are supported by Table 6.

FIG. 3
Urban Waste
Generation
by Income Level
and Year

