



# **Strengthening Solid Waste Management to Protect Marine Environments**

**The role of the World Bank's Pollution Management  
and Environmental Health (PMEH) Trust Fund**

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**POLLUTION  
MANAGEMENT &  
ENVIRONMENTAL  
HEALTH**

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# Overview and Examples of WB work in Solid Waste Management (SWM)

## Overview:

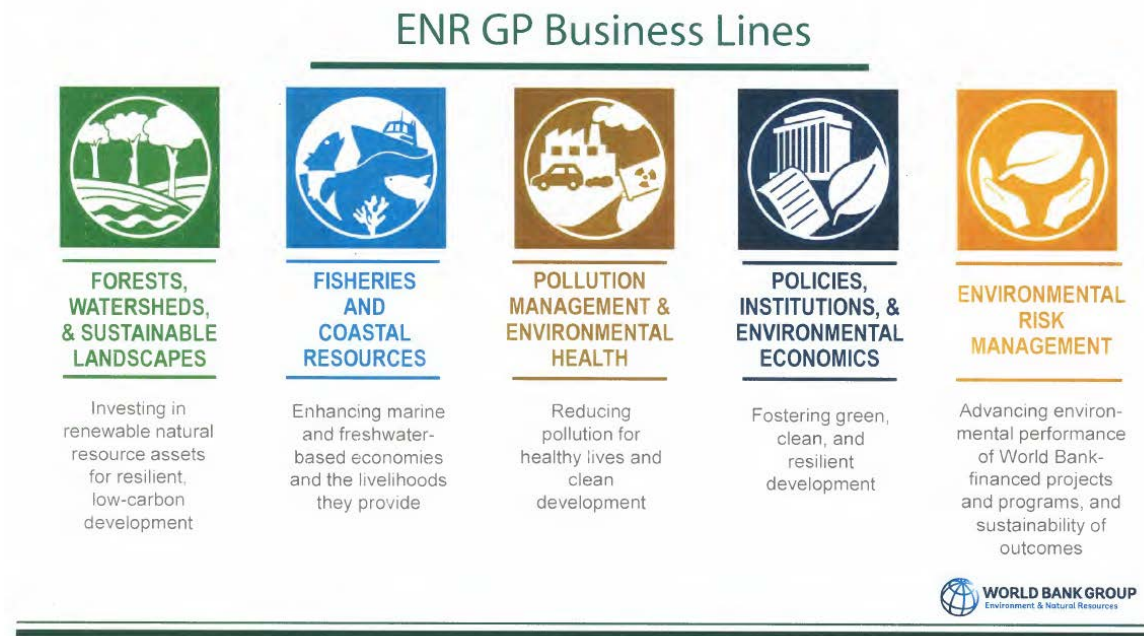
- Since 2000, \$4.5bn in World Bank lending for SWM supporting 329 programs (often combined with advisory).

## Examples:

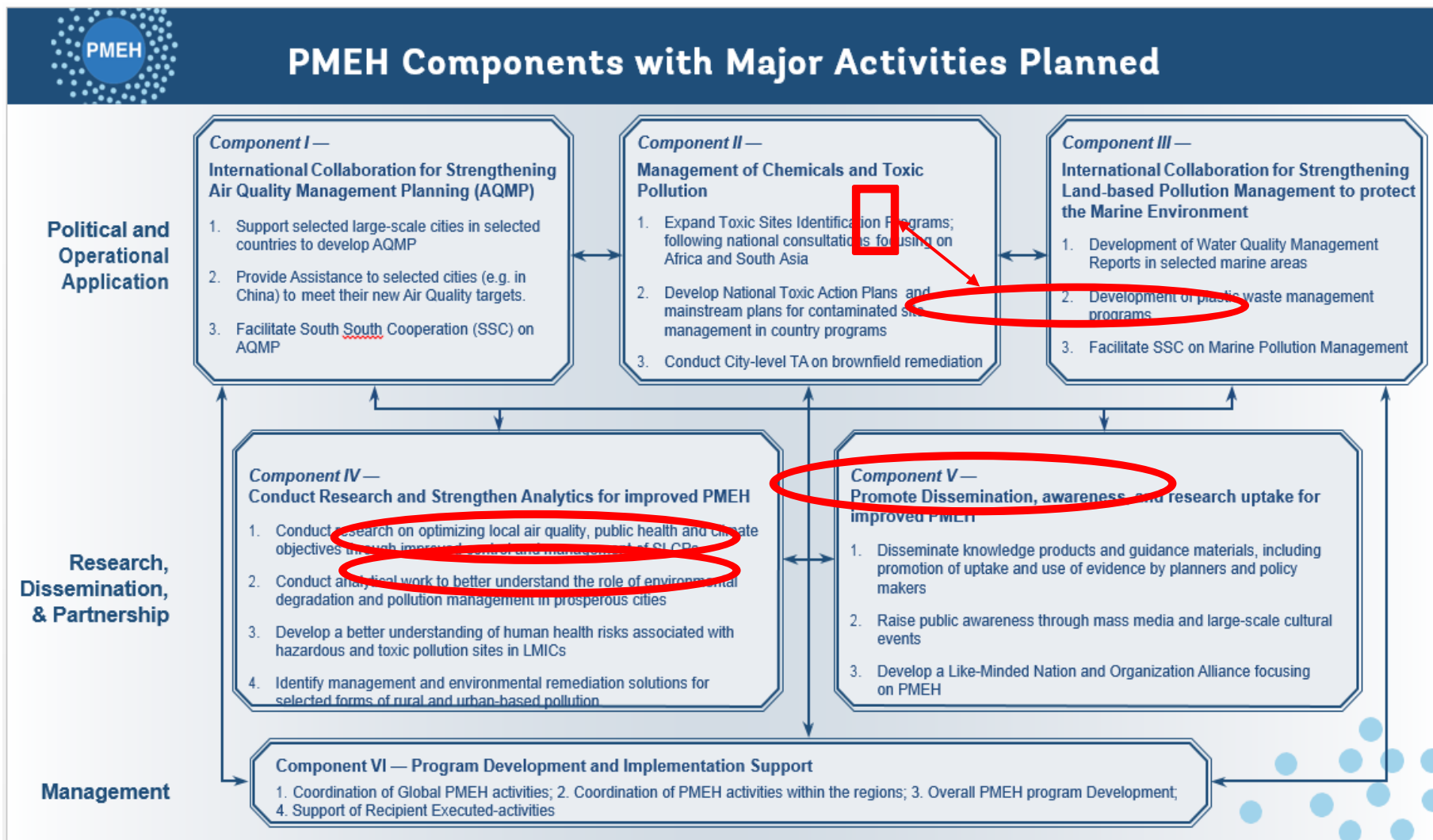
- **Africa:**
  - Liberia: emergency intervention focused on financial and contract management, procurement.
  - New waste infrastructure built, illegal dumps removed, and waste collection from 13 to 50%.
- **East Asia and the Pacific:**
  - China: municipal SW collection surged from 31 million tons in 1980 to 157 million tons in 2009, to a projected 585 million tons by 2030, triggered by rapid urbanization and population growth.
  - WB is financing a new solid waste project in Ningbo, introducing household-level waste separation for more than 2M people, and a PPP to finance construction of a treatment plant to process kitchen waste.
- **Europe and Central Asia:**
  - Move away from city-based to regional approaches in waste treatment and disposal, taking advantage of economies of scale.
- **Latin America and the Caribbean:**
  - Project in three Argentinean cities to reduce massive food waste, e.g. working with food bank networks to encourage food donation and enhancing separation and treatment of food waste to create high-quality compost.
- **Middle East and North Africa:**
  - New landfill facilities, recycling initiatives, and improved conditions for waste pickers.
  - E.g. Morocco: emphasis on waste-to-resource initiatives to increase amount of material recovered, harness energy from waste, and provide safe opportunities for informal recyclers.
- **South Asia:**
  - E.g. Nepal: innovative project bridging financial gap between costs of SWM services and revenues collected.

# How Pollution Management and Environmental Health (PMEH) is embedded in the World Bank

PMEH as one of five critical Business Lines within the Environment and Natural Resources Global Practice



# Structure of the PMEH, and the place of SWM within it



# Progress to date in the PMEH

Component 1 (AQM): full-scale AQM planning in 7 cities / countries: “Jingjinji” region, China; Hanoi, Vietnam; city cluster tbd, India; Cairo, Egypt; Lagos, Nigeria; Accra, Ghana; Johannesburg, South Africa.

Component 2 (Chemical and Toxic Pollution Management): Toxic Sites Identification Program developed in three country clusters: Nigeria and Ghana; (South) East Africa; Pakistan and Bangladesh.

**Re component 3 (Land-based Pollution Management to Protect the Marine Environment): finalizing reports to increase awareness of land-based pollution management to protect the marine environment:**

**(i) management principles to reduce the inflow of plastic waste into the marine environment, including case studies from Colombia, South Africa and Vietnam.**

**(ii) developed solution models for waste water, agro-run offs and plastic waste management.**

**(iii) water quality management report for the Wider Caribbean.**

**(iv) report on application of integrated management of the marine ecosystem in developing countries building upon European (incl. EU) practices.**

**Once funding is secured, start developing plans for both plastic/marine litter management and overall water quality management plans in selected geographic locations. Include communities of practice for south-south collaboration.**

Re component 4 (PMEH Research): research proposals being finalized for:

- AQM planning through better application of combined satellite and ground-level monitoring data.
- better understanding of health impacts from contaminated sites pollution.
- how pollution and environmental health conditions impact competitiveness of cities.

Re component 5 (PMEH Awareness and Dissemination):

- Launch during Earth Day 2015.
- full website (June / July 2016).
- Awareness events in China and Nigeria in 2016.



# Role of PMEH MDTF vs larger financing for pollution management

## **PMEH MDTF has limited grant money to provide TA and some capital goods:**

- Supports, for example, full scale pollution management planning; (ii) filling knowledge gaps; (iii) monitoring equipment and analytical instruments; (iv) dissemination and awareness raising.
- MDTF helps identify a client's investment, policy and institutional needs required to address PMEH issues effectively.

## **To achieve effectiveness at scale, clients need larger financing. Key WB instruments:**

- **IPF:** Financing of specific transactions for a wide range of activities for physical and social infrastructure.
  - *Example: SWM infrastructure / hardware investments.*
- **PforR:** Financing focused on results and capacity building, disbursing upon achievement of program results.
  - *Example: Pollution Management Action Plans or SWM infrastructure investments.*
- **DPF:** Financing to support policy and institutional reform through rapidly-disbursing non-earmarked general budget financing that is subject to the borrower's own implementation processes and systems.
  - *Example: Supporting national, regional, municipal or sectoral policy and institutional reforms for SWM such as adopting SWM standards or creating SWM agencies.*

# SWM-Environment-Health-Climate Change Linkages

- Environmental Impacts:
  - Contamination of groundwater and surface water by leachate.
  - Air pollution from burning of waste that is not properly collected and disposed.
- Health:
  - Solid waste as breeding ground for insects, vermin, and scavenging animals → air- and water-borne diseases.
  - In areas with infrequent waste collection, incidence of diarrhea is twice as high and acute respiratory infections six times higher than in areas where collection is frequent.
  - Plastic litter bonds with toxic waste such as POPs, volatile organic compounds and endocrine disruptors → carcinogens
- Climate Change:
  - Climate effects of traditional solid waste management processes produce significant amounts notably of CH<sub>4</sub> (90%) and N<sub>2</sub>O (8%).
  - IPCC: between 1970 – 2010, global emissions from waste almost doubled, with a 13% increase from 2000-2003.

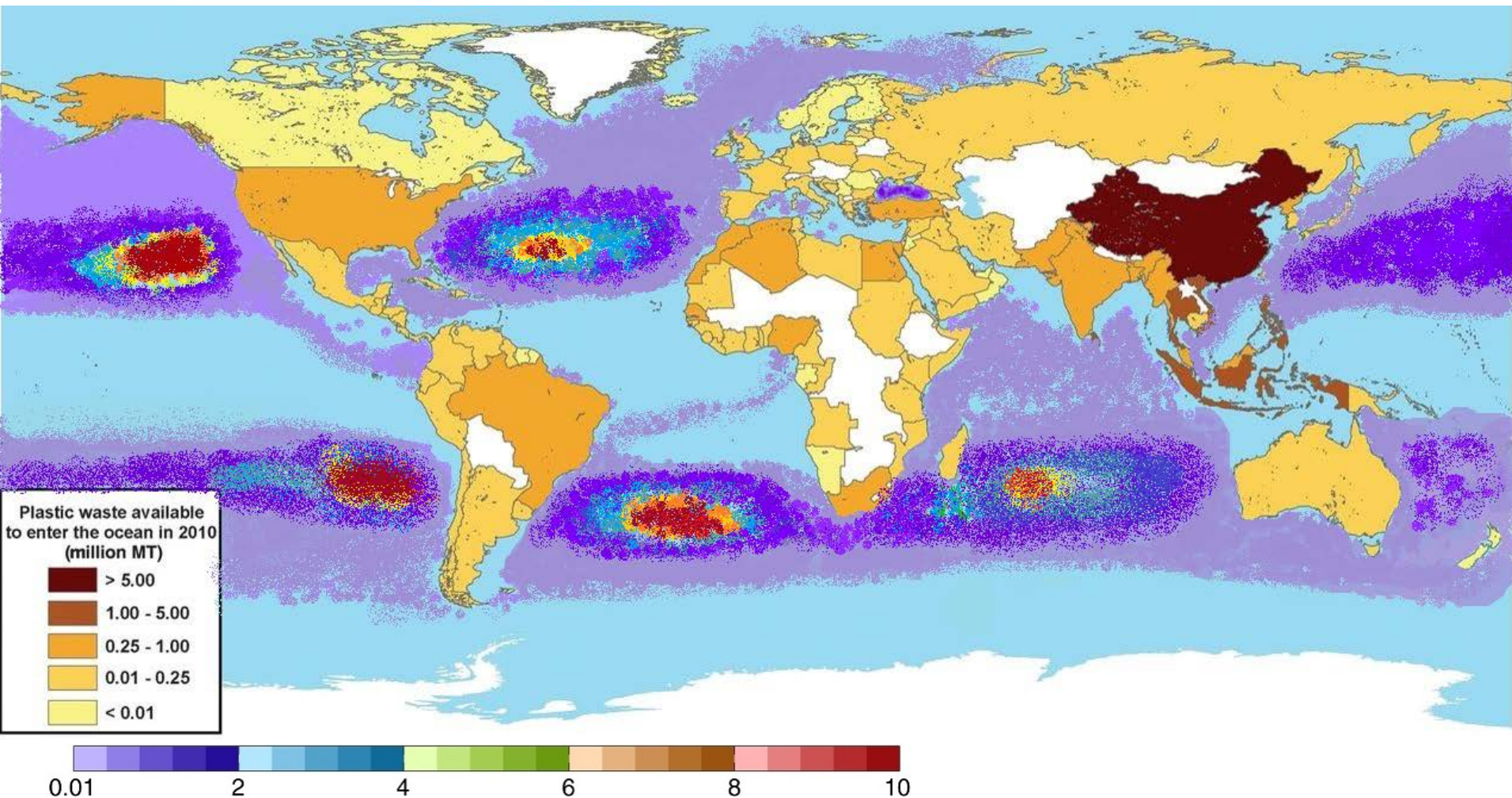


# Land-based focus of marine pollution

Jambeck et al., *Science* 2015



# Sources of plastic and 5 gyres



**Based on the following sources:**

(1) Global map with each country shaded according to the estimated mass of mismanaged plastic waste [millions of metric tons (MT)] generated in 2010 by populations living within 50 km of the coast. We considered 192 countries. *Source: Jenna R. Jambeck et al. Science 2015.*

(2) The “heat” zones show expected densities of floating plastic debris. The densest areas correspond to the five major oceanic gyres. *Source: Michael Gross, Current Biology – 18 February 2013.*



# Plastics Pilot Study Magdalena River / Colombia

## Focus

- Magnitude and effects of plastic marine litter
- Role of the cities
- Solid Waste Management (SWM) policies, programs and technology solutions

## Pilot study of The Magdalena River Basin, Colombia

- **3 cities** within the Basin: Neiva, Barranquilla and Bogota
- **interviews** with government agencies, NGOs, private companies, trade organizations, recycling cooperatives
- **site visits** to recycling facilities & plastic litter hot spots
- **review** of solid waste management plans, market studies and reports



# Plastics study: Cost Comparison of Plastic Waste Management Strategies

STRATEGIES (\$/TONT)	USD (2013)	Colombian peso (2013)
Education and Public Outreach (\$/person/year)	0.10 - 0.18	202 - 354
Waste Collection and Transportation	26	51,743
Landfill Disposal	27	53,226
Street Sweeping	101	197,800
Plastics to Fuel	127 - 152	249,019 – 298,039
SCS or UWEM type litter traps	261 - 783	511,764 - 1,535,294
Recycling	594	1,164,049
Stormdrain grates (coupled with street sweeping)	754	1,478,431
Other litter traps	2,611 – 6,526	5,119,608 - 12,796,078
Removal of litter by hand from the riverbanks	2,611 - 3,916	5,119,607 - 7,678,431

Data based on Neil Armitage, “The removal of urban solid waste from storm water drains”, Department of Civil Engineering, University of Cape Town.

# PMEH Component III going forward

## Magdalena-Cauca River Basin, Colombia



West Africa:  
Nigeria, Ghana, Ivory Coast,  
Senegal, ...



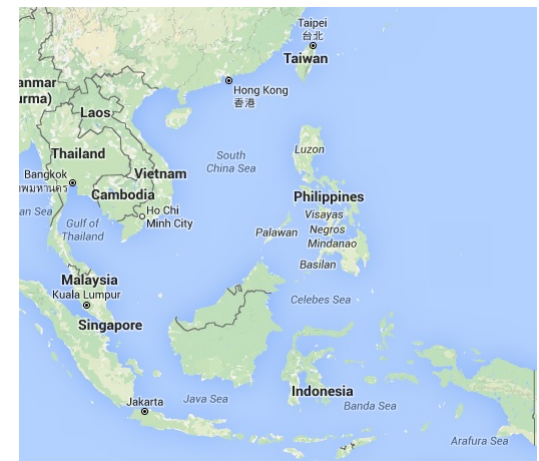
Ganges river basin:  
Nepal and Bangladesh



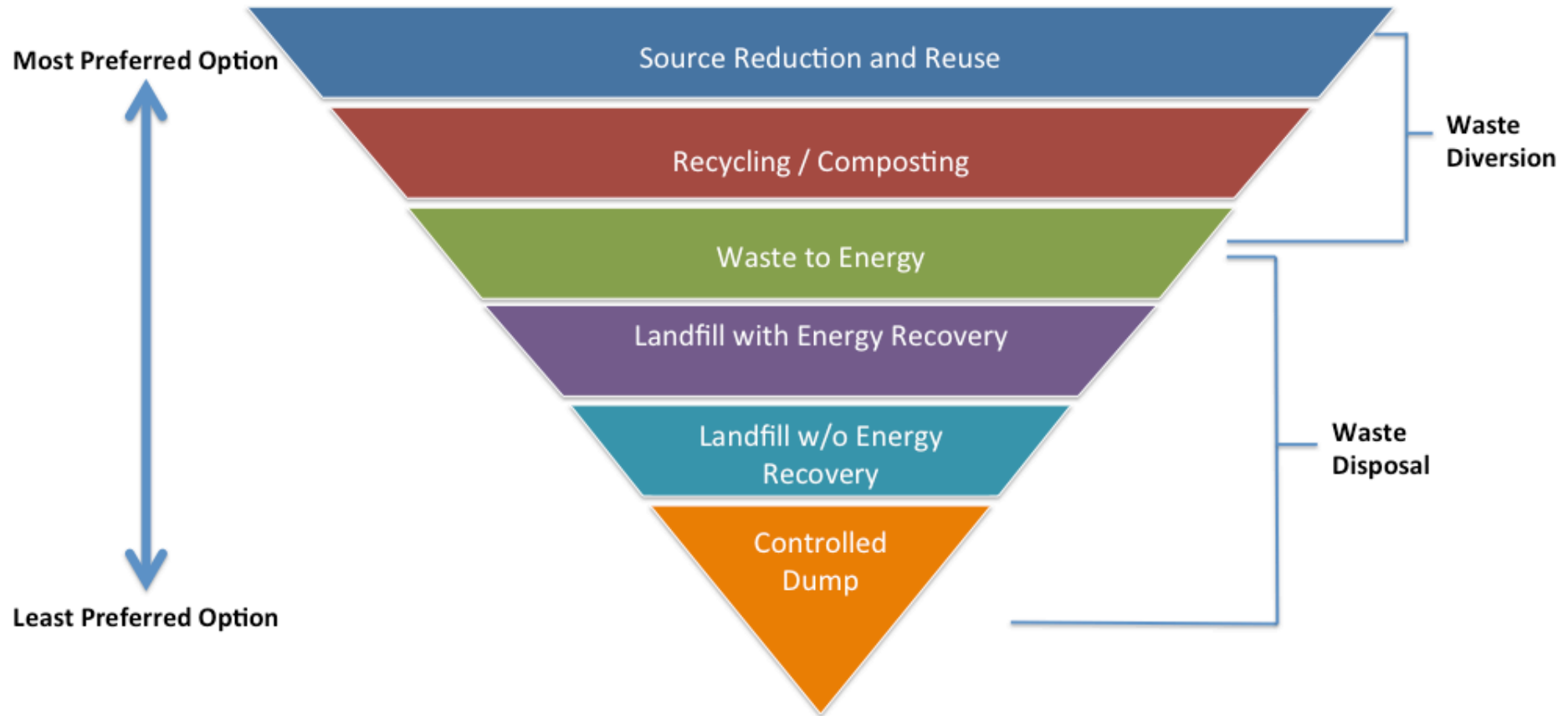
## Guanabara Bay, Brazil



South China Sea: Vietnam,  
(Cambodia), China and Indonesia



# Choosing Interventions based on the Solid Waste Management (SWM) Hierarchy: Preference for Upstream Interventions





# Choosing Regional Foci: Waste Generation Projection for 2025 by Region and Income

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	1,865,372
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

## Regions:

- Main focus on expansion in EAP and LMI.
- 44% of increases in EAP, 63% in LMI.

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

## Income Levels:

- Much higher organic waste in LI and LMI countries compared to UMI and HI countries.
- Pollution related to Organic Waste by far the highest in LI and LMI countries (methane/SLCPs).
- Plastic Waste: Highest share in LMI.
- Highest plastic waste accumulation in LMI as a source for “plastic gyres” in marine areas surrounded by LMIs (e.g. South China Sea).

**Key upcoming investment: marine litter-relevant SWM hot spots in Indonesia, up to 1bn in WB lending**



# Effectiveness through complementary types of responses

- **Investment/lending programs**, for example, Brazil (Rio de Janeiro), Belarus, China (Beijing, Zhejiang), Colombia (Magdalena River), Mexico, Moldova, Morocco, and many more.
- **Individual SWPM projects or integrated in larger Municipal Environmental Management Programs** (if prioritized by recipient country/municipality → drive: SWM often single largest budgetary item in cities in Low Income/LI countries).
- **Major Analytical and Political Advisory initiatives** (e.g. *“What a Waste – A Global Review of Solid Waste Management”* – WB perspectives towards 2025).
- **Increased focus on linking SWPM** to contaminated/brownfield site management and reduced inflow of litter into the marine environment (WB, GEF, PMEH etc).
- **Cross-sectoral effort** between Global Practices for Environment, Urban & Social, Health and Climate Change.
- **Likely priorities going forward:**
  - Internal portfolio review, reshaping WB lending portfolio on marine-litter relevant SWM work.
  - Determine “toxic” & “contaminated” waste parts of SW accumulation.
  - Improve understanding of health impacts of SWP
  - Increase finance into LIs and ULI through combined approaches e.g. TA+ upfront financing (e.g. from development impact bond) + ongoing finance (e.g. programmatic lending schemes).
  - Build further pilot SWPM cases in West Pacific (China, Indonesia, Vietnam) other LMI countries with highest SWM accumulation.