CLIMATE FINANCING – SWM IN INDIA

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Outline of the presentation

- Municipal Solid Waste Management (MSWM) scenario in India
- Relation between MSWM, climate change and Green House Gas (GHG) emissions from the solid waste sector
- Challenges in environmental sustainability of MSWM sector in India
- Challenges in financial sustainability of MSWM sector in India
- Way forward

MSWM scenario in India



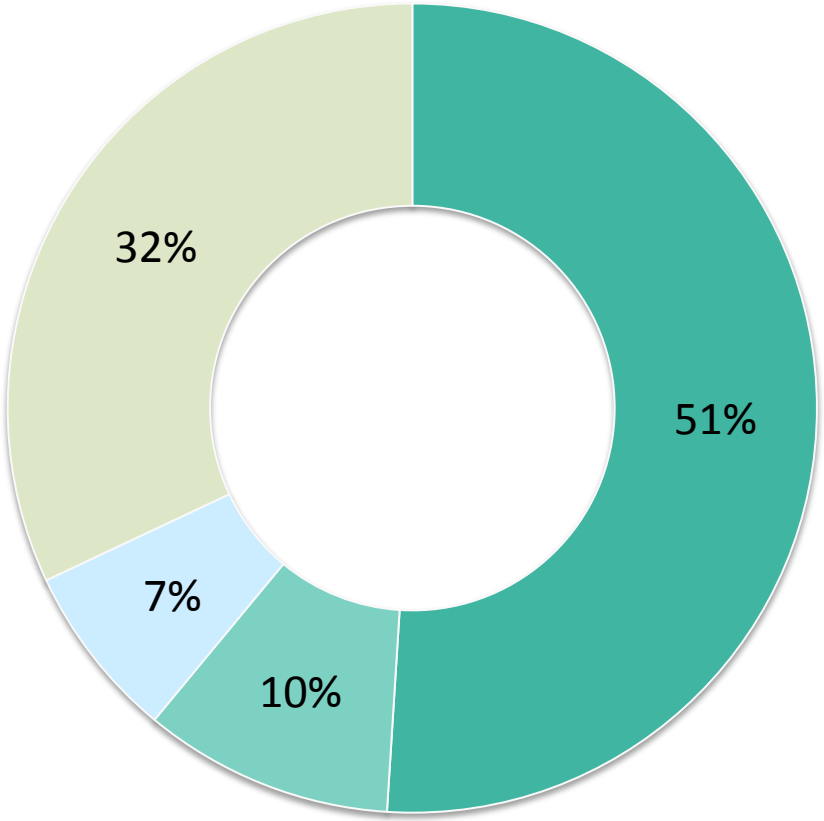



Waste Generation	*Segregation*	*Collection*	*Transportation*	*Processing*	*Scientific Disposal*
62 Million Tonnes MSW generated	**43 Million** Tonnes collected (69.4%)			**11.9 Million** Tonnes is Treated (19.2%)	**31 Million** Tonnes Dumped in Landfill Sites (50%)

- Waste generation will increase from **62 MT/yr to 165 MT/yr** in 10 yrs and **436 MT by 2050**.
- At current waste rates, **1240 hectares** of land per year are needed
- **66,000 hectares** of land will be needed by **2030**

Composition of Municipal Solid Waste

Composition of Municipal Solid Waste in India (percent of total)



- Biodegradable - 51%
- Plastic - 10%
- Paper - 7%
- Other(textile, glass, metal, drain silt, street sweepings, inert) - 32%

In India, municipal solid waste comprises 51-53% bio-degradable, 17-18% recyclables and 31% inert.

Source: Task Force on Waste to Energy, Planning Commission, 2014

SWM and GHG Emissions

- *Solid Waste accounted for up to **5 per cent** of the total global GHG emissions in 2005 (IPCC 2007)*

- *GHG emissions from solid waste disposal on land increased at the rate of **3.1 per cent** per annum between 2000 and 2010. (UNFCCC)*

- *Estimates of emissions from the waste sector **do not include emissions from transportation** of the waste.*

- *Waste management activities generate carbon dioxide **(CO_2~ 50 per cent), methane (CH_4 ~ 50 per cent) and nitrous oxide (N_2O < 1 per cent)** gas, among others.*

- *Global warming potential of **Methane (CH_4) and Nitrous Oxide (N_2O) are 25 times and 298 times higher** than that of carbon dioxide over a 100-year period (IPCC, 2007)*

SWM and GHG Emissions

- *Higher consumption, use of virgin material for extraction and manufacturing increases waste*
- *Collection of mixed waste increases transport cost*
- *High biodegradable content in mixed waste at dumpsites, releases methane gas*
- *Leachate from decomposing biodegradable matter releases nitrous oxide*
- *Burning of solid waste releases carbon dioxide and other harmful gases*

Estimated City-wise CO2e Emissions from Landfill Sites in 2016

City	Total MSW (Tons/day)	MSW dumped (%)	COe2 Emissions (Tons/day)	CO2e Emissions (KiloTons/year)	Equivalence to passenger vehicles (thousand/year)*
Delhi	9620	50	1764	643.7	137
Mumbai	8600	80	2523	920.8	196
Chennai	5000	80	1467	535.3	114
Bengaluru	4200	60	924	337.3	72
Pune	1600	35	205	74.9	16
Indore	700	60	154	56.2	12
Chandigarh	450	60	99	36.1	8

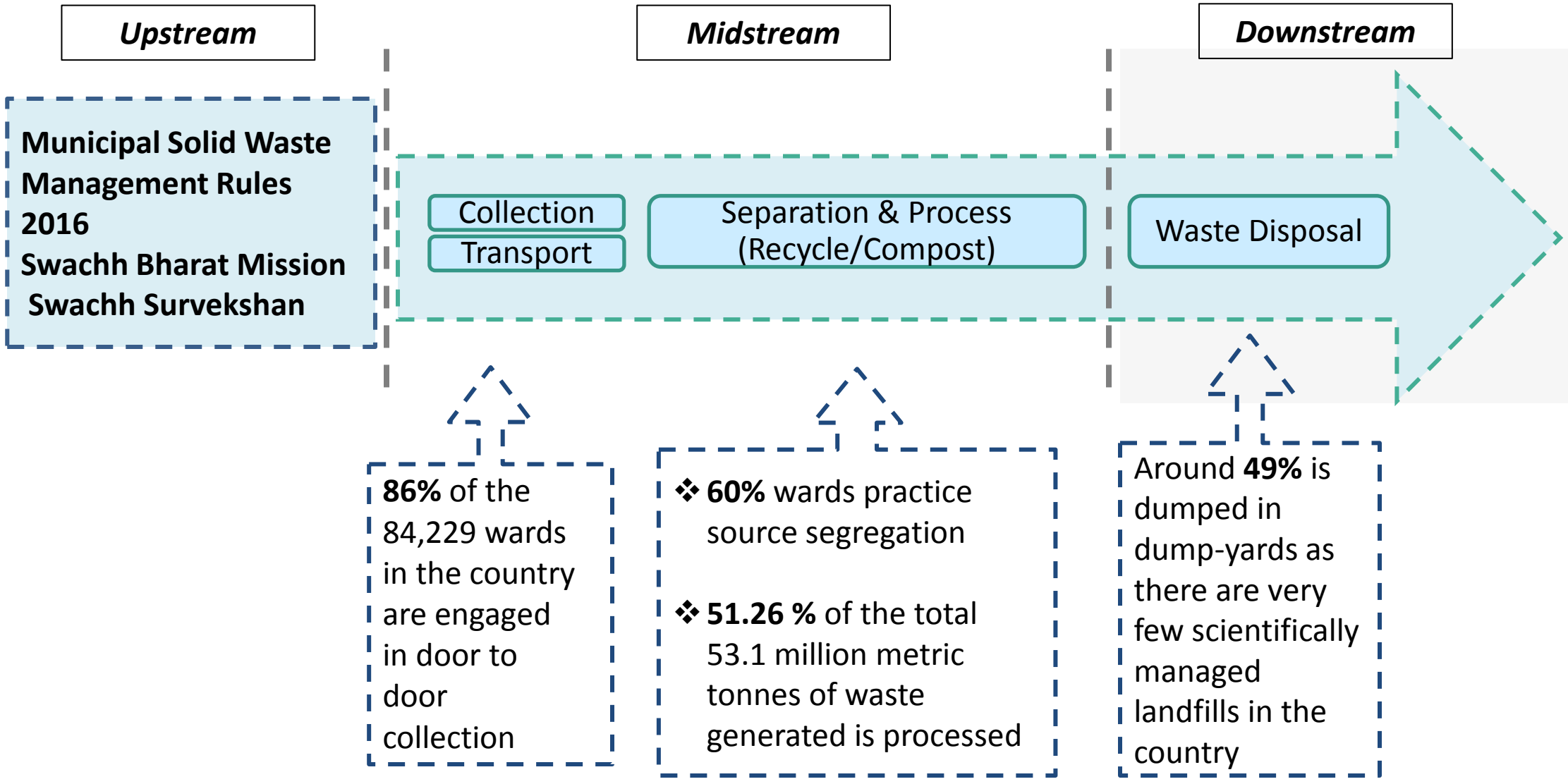
*Assuming mileage of 9.2 Km per litre and 18,350 km driven in a year, a typical passenger vehicle would emit 1 Kilo Ton of CO2e (GHG) after driving 3900 thousand Km. i.e. 10 times the distance to moon!

Source: *Solid Waste Management in India , An Assessment of Resource Recovery and Environmental Impact, Isher Ahluwalia, Utkarsh Patel, ICRIER Working paper 356, 2018*

Swachh Bharat Mission and Swachh Survekshan - paradigm shift

Conventional Approach	Approach adopted in SBM
Waste is considered as garbage	Waste is considered as a resource
Focus on awareness creation using traditional IEC tools (posters, pamphlets)	Focus on community mobilization using triggering tools leading to behavior change and collective action
Centralized approach with policy promoting collection and tipping of waste	Decentralized waste with policy incentivizing reduction of waste at source
Government seen as 'provider of services'	Role of Government as 'Facilitator of improved technology and systems support'
Around 90% waste goes to dumping sites	Around 90% waste safely treated/disposed
Mixed waste at source and collection, limited segregation at aggregation points	3 levels of segregation – at source, during collection, at aggregation point and during treatment
Informal rag-pickers work in silos	Convergence of informal rag-pickers with the Government system
Tipping fee goes to collection agents	Tipping fee goes to the ULB
Financially unsustainable	Financially self-sustainable

SOLID WASTE MANAGEMENT VALUE CHAIN



India has the capacity to process 5.882 million tonnes and more than 7.16 million tonnes capacity is under construction

Environmental sustainability in SWM – Wet Waste

- Composting, along-with biomethanation has been seen as a viable option for the biodegradable or wet waste.
- Compost helps in carbon dioxide sequestration by storing carbon back into the soil.
- For every ton of waste that is composted, carbon deposition saves up to 79 kg of CO2e and fertiliser displacement saves up to 82 kg of CO2e GHG emissions (Boldrin et al, 2009).
- Biomethanation generates biogas which can substitute gaseous fossil fuels like LPG, CNG, etc., and produces slurry which is an excellent organic fertiliser, both of which help in reducing GHG emissions.

Environmental sustainability in SWM – Dry Waste

- Recycling is a priority- e.g. SLRM in Ambikapur (Chattisgarh), Amritsar (Punjab), Rajgir (Bihar), Imphal (Manipur)

- Refuse Derived Fuel (RDF) after recovery – The RDF is used directly to substitute fossil fuels like coal in cement kilns or boilers E.g. RDF plants in India: Lucknow (Uttar Pradesh), Nashik (Maharashtra), Dehradun (Uttarakhand), Imphal (Manipur)

- RDF used in gasifiers (or pyrolysers) to produce syngas which has the potential to replace gaseous fossil fuels or can even be chemically converted into ethanol to substitute or blend liquid fossil fuels like gasoline, etc. – E.g. Plastic to fuel plants in India – Indore (Madhya Pradesh), Nashik (Maharashtra), Dehradun (Uttrakhand)

- Recycling of plastic waste to make usable products like tiles, flower pots etc.

Financial Sustainability in Biomethanation

- Biogas produced is used for cooking or bottled into compressed biogas to be used as fuel; slurry as organic manure after processing – Private sector participation encouraged through Viability Gap Funding (VGF)

Facility Name	Total Capacity	Total Cost
Mahindra & Mahindra Bio-CNG plant, Indore	20 MT	Rs. 15.00 Crore out of which Rs. 7.2 Cr. VGF was provided by Indore Municipal Corporation (IMC)
IOCL supported bio-methanation plant in Varanasi	5 MT	2 crore (CSR fund of IOCL)
Bio-methanation plant in Nasik (supported by GIZ)	27 MT	8.2 crore (6.8 crore from GIZ and 1.2 crore from a private contractor M/s Vilholi Waste Management Systems Pvt. Ltd (VWMSPL)

Financial Sustainability of Waste to Energy (WTE)

- Un-segregated waste - high inert content- additional fuel – expensive to run
- Seasonal variation of waste – plant runs below capacity
- Power generated in WTE plants is costly
  - high capital and O&M costs
  - low calorific value of the fuel used
  - additional fuel is used to burn the waste

Sanitary Landfills

- **Cost of construction (INR 2000 to INR 2300 per sq.m) plus land requirement**

Waste Quantity (Million Tonnes per Design Life of Landfill)	Required Area (Ha)
<1.0	15-20
1.0 - 2.0	20 – 30
2.0 – 3.0	30 – 40
> 3.0	> 40

Source: CPHEEO Manual, GOI, 2016

- **Non-biodegradable and non-recyclable carbon compounds of low calorific value are sent to sanitary landfills** *E.g. Indore (Madhya Pradesh), Nashik (Maharashtra), Panaji (Goa)*
- **Bioremediation of landfill sites reclaims space and saves on GHG emissions; solves problem of legacy of waste accumulated at dumpsites** *Cost of Bio mining (approx. INR 700-900 per MT) E.g. Indore (Madhya Pradesh), Amritsar (Punjab), Chandigarh, Nawanshahr (Punjab), Bhopal (Madhya Pradesh), Ahmedabad (Gujarat)*

Challenges in Indian Cities

- Institutional challenges
  - Lack skilled manpower to run systems
  - Recovery of cost of services provided by the city

- Financial challenges - financial viability and concession terms
  - Revenue model
  - Low access to finance for players
    - Lack of experience financing MSW projects
    - Lack of capacity related to MSW projects assessment

Challenges posed by Covid-19 pandemic on recycling dry waste

- Less secondary segregation – workers fear getting infected
- Recycling plants operating at 30% capacity
- Recycling units – procuring waste from aggregators difficult – many workers have gone back to native places
- This may lead to increased cost- affecting financial feasibility and shut down of some recycling units

Way forward

- Provide impetus to more innovative nature-based decentralized solutions, wherever feasible, promoted by flagship missions
- Sensitization of people by engaging with them and making sure that not only their voices are heard, their needs are also meet, keeping local cultural practices in mind
- To encourage private investment in SWM, consider (a) grant finance (one time grant on capital) (b) equity participation by government or ULB and (c) improved technology to reduce cost both capital and O&M; (d)Assured sale of products and by products, e.g., compost, gas, sludge (as fertilizer) etc.
- Need for large scale nationwide research programme – to find solutions that provide technology solutions combined with improved local capability