SOLID WASTE MANAGEMENT IN INDIA

Utkarsh Patel

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ICRIER, New Delhi

STRUCTURE OF THE PRESENTATION

1. Municipal Solid Waste Scenario in India
2. Resource Recovery
3. Unscientific Disposal of Solid Waste
4. Towards Sustainable Solid Waste Management

1. MUNICIPAL SOLID WASTE SCENARIO IN INDIA

- *Construction and Demolition (C&D) waste is no longer a part of municipal solid waste. C&D Waste Management Rules 2016, Plastic Waste Management Rules 2016, E-Waste Management Rules 2016, Biomedical Waste Management Rules 2016, and Hazardous and Other Waste Management Rules 2016 are separately notified by MoEF&CC*

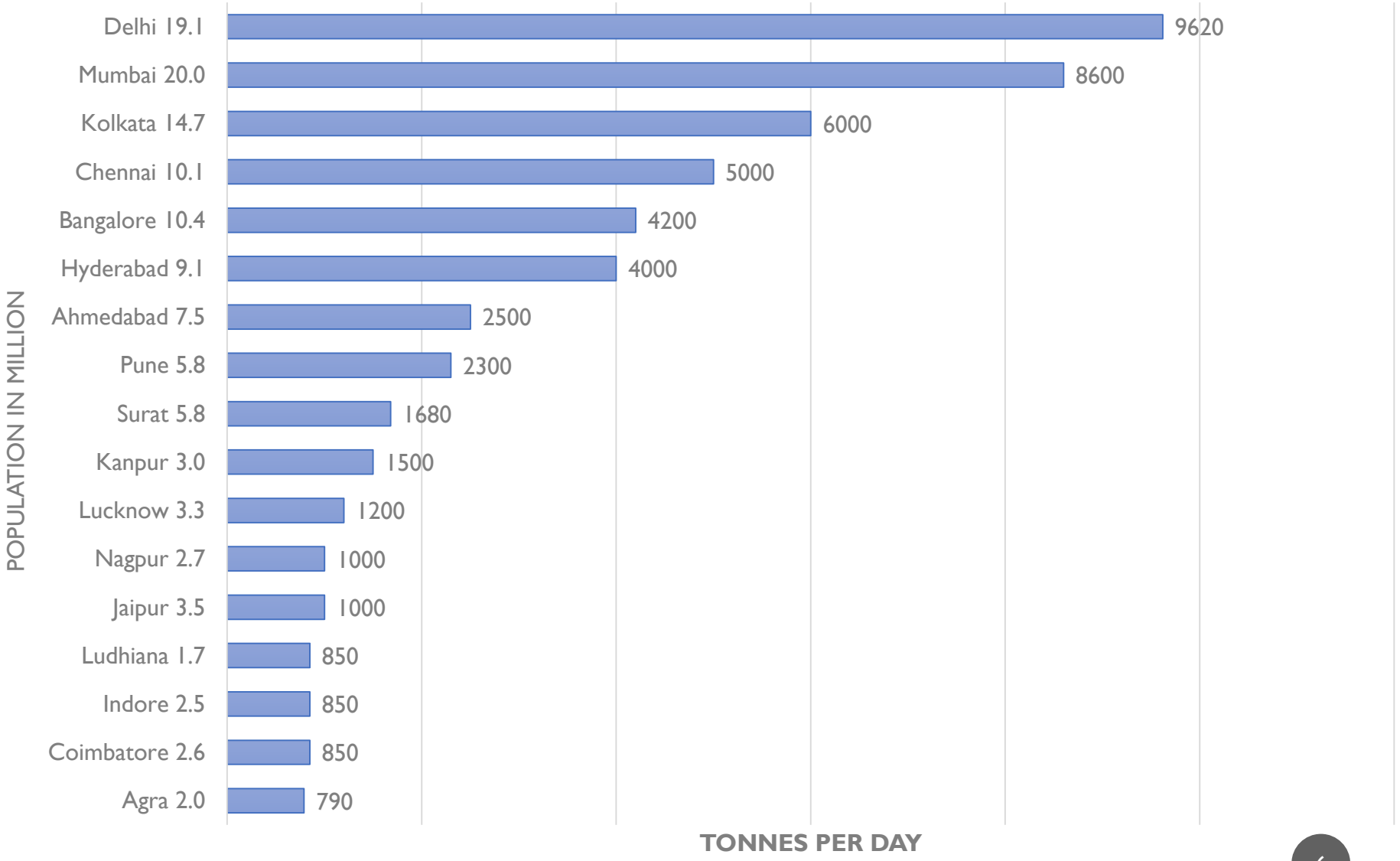
ALTERNATIVE ESTIMATES FOR MSW GENERATION

Year	Source	Annual Generation (million tonnes)
2017	Our estimate 1 based on 450 gm per capita daily generation and urban population of 440 million*	72
2017	Our estimate 2 based on 400 gm per capita daily generation and urban population of 440 million*	64
2014-15	Central Pollution Control Board	52
2014-15	Ministry of Urban Development	52
2013-14	Task Force on Waste to Energy, Planning Commission	62

** based on United Nations population estimates*

Source: CPCB, MoH&UA, Planning Commission

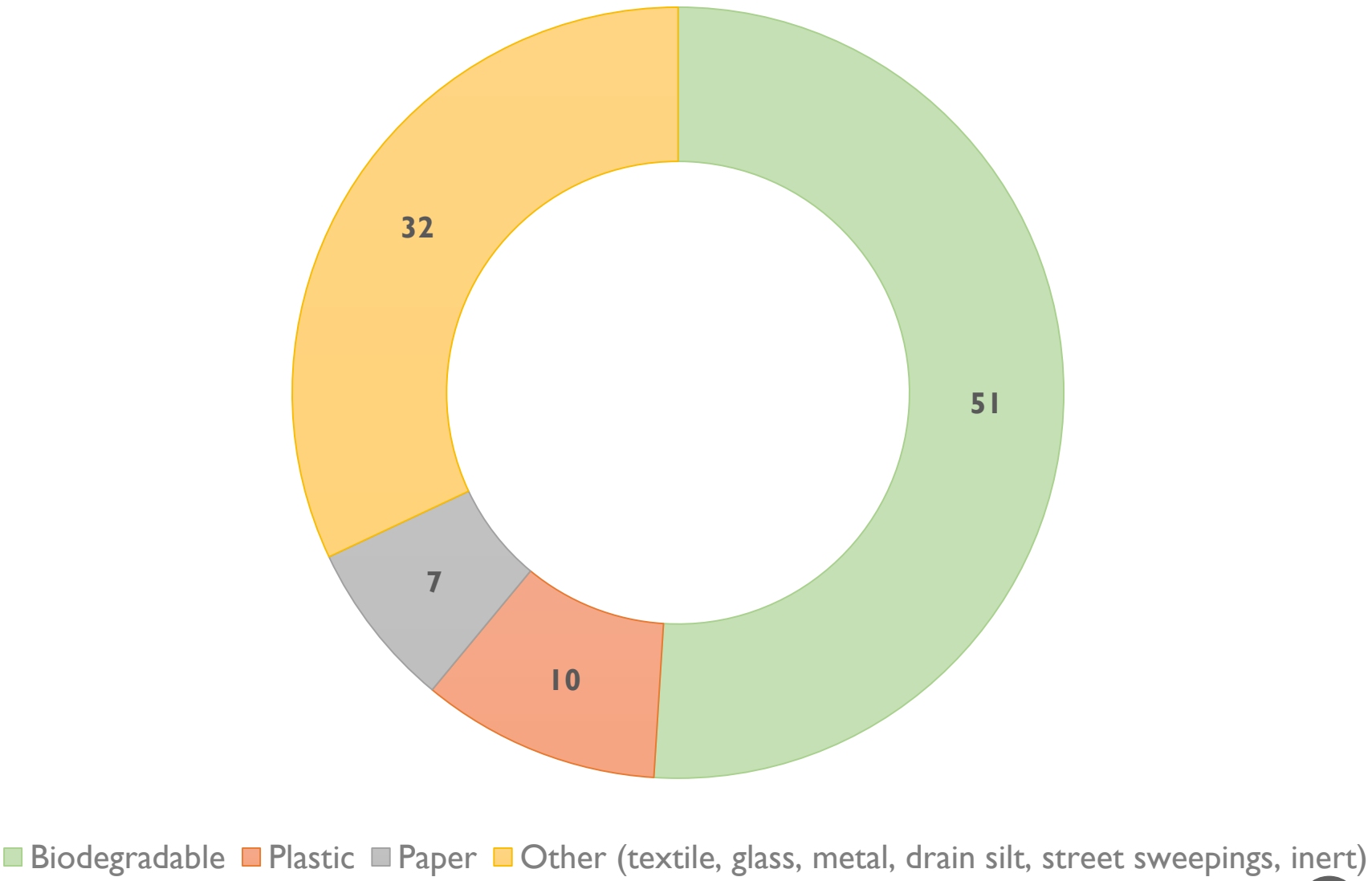
TOP MSW GENERATING CITIES IN INDIA 2016*



** Urban Agglomerations*

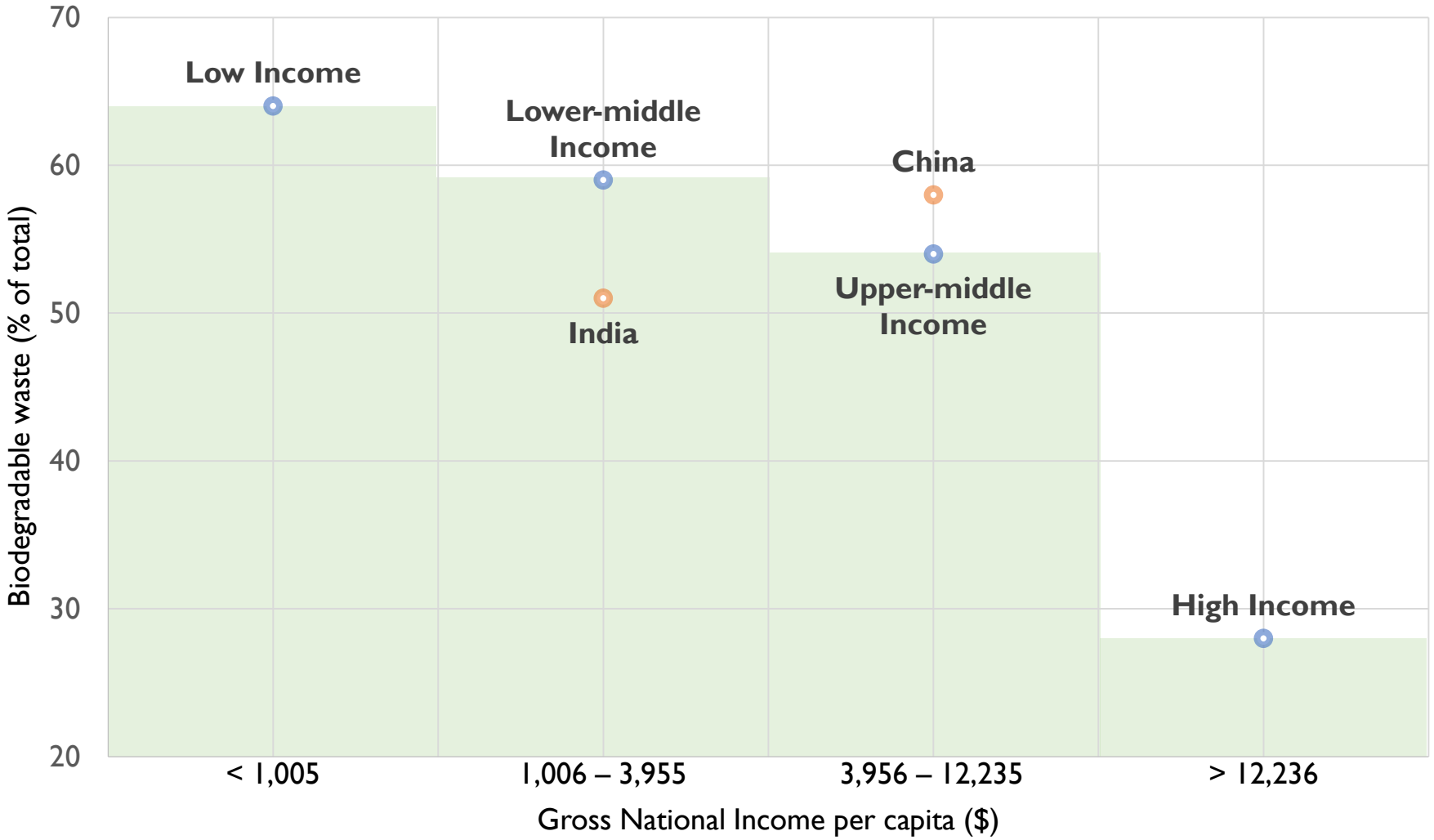
Source: State Pollution Control Boards, Municipal Corporations, and UN population estimates

COMPOSITION OF MSW IN INDIA *(% OF TOTAL)*



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

BIODEGRADABLE WASTE GENERATION INDIA, CHINA AND OTHER COUNTRIES



Groups Classified according to The World Bank estimates of 2018 GNI per capita

Source: What a Waste, The World Bank, 2012

MSW COLLECTION & SEGREGATION AT SOURCE LARGE CITIES: SELF-REPORTED

City	State	Population (million)	Door-to-door Collection from Households (%)	Segregation at Source (%)
Mumbai	Maharashtra	20.0	80	*nil*
Delhi	-	19.1	39	*2*
Bengaluru	Karnataka	10.4	71	50
Chennai	Tamil Nadu	10.0	80	*nil*
Hyderabad	Telangana	9.1	73	*nil*
Ahmedabad	Gujarat	7.5	95	*nil*
Surat	Gujarat	5.8	60	12
Pune	Maharashtra	5.8	50	52

Large cities are with population greater than 5 million
(data for Kolkata are not available)

MSW COLLECTION & SEGREGATION AT SOURCE SELECTED MID-SIZE CITIES: SELF-REPORTED

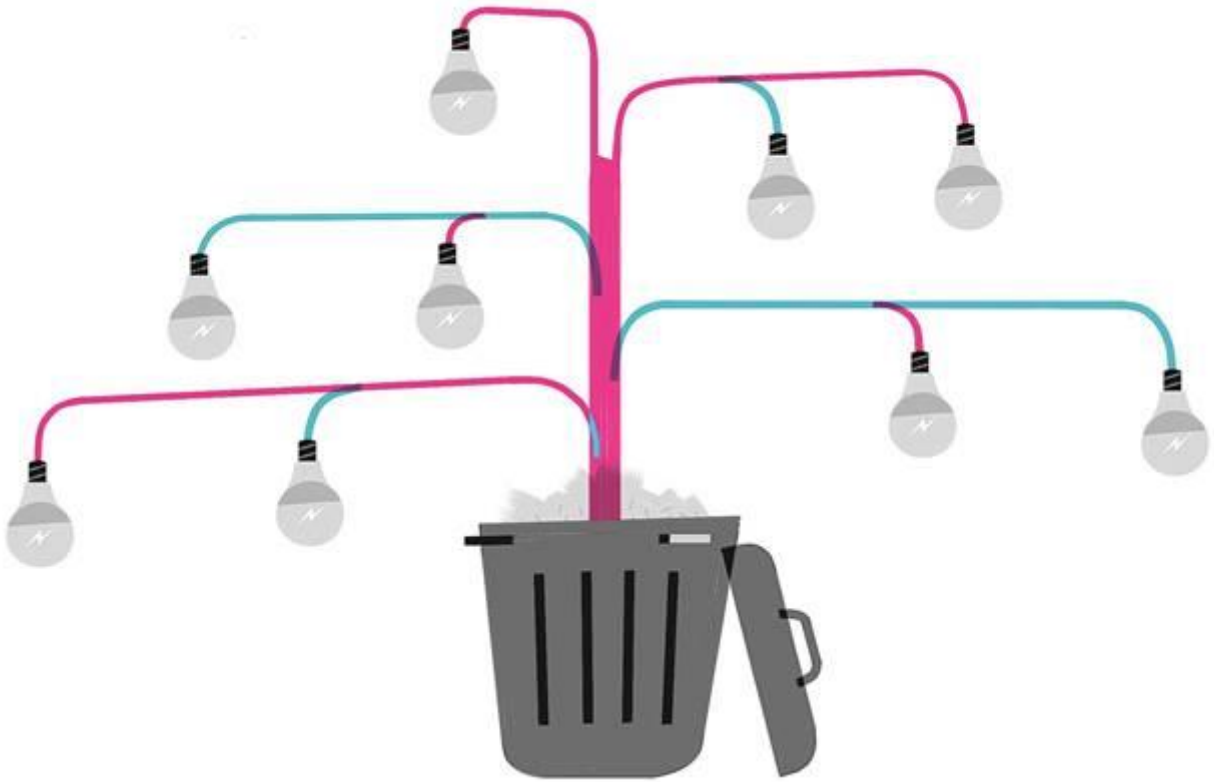
City	State	Population (million)	Door-to-door Collection from Households (%)	Segregation at Source (%)
Indore	Madhya Pradesh	2.5	90	53
Bhopal	Madhya Pradesh	2.1	100	*na*
Ludhiana	Punjab	1.7	25	*nil*
Chandigarh	-	1.2	95	*nil*
Mysuru	Karnataka	1.0	95	55

Mid-size cities are with population between 1 million and 5 million

MSW COLLECTION & SEGREGATION AT SOURCE SELECTED SMALL CITIES: SELF-REPORTED

City	State	Population (million)	Door-to-door Collection from Households (%)	Segregation at Source (%)
Warangal	Telangana	0.9	90	*na*
Tirunelveli	Tamil Nadu	0.5	100	100
Alappuzha	Kerala	0.2	100	76
Suryapet	Telangana	0.1	100	*na*
Gangtok	Sikkim	0.1	90	30
Warangal	Telangana	0.9	90	*na*

Small cities are with population less than 1 million



2. RESOURCE RECOVERY

INSTALLED CAPACITY OF COMPOST PLANTS BY STATE

State	Number of Plants	Installed Capacity (tonnes/year)	Operational Capacity (%)
Maharashtra	13	4,88,400	12.5
Karnataka	18	4,73,400	10.1
Gujarat	15	1,74,300	19.5
Kerala	3	1,56,000	20.0
Telangana	5	1,92,000	15.0
Delhi	4	1,68,000	16.1
Rajasthan	1	1,80,000	15.0
West Bengal	5	1,70,400	15.0
Uttar Pradesh	7	1,24,560	15.2
Tamil Nadu	9	67,680	15.8
Madhya Pradesh	1	36,000	15.0
Punjab	2	19,200	15.0
Haryana	4	18,600	15.3
Assam	1	15,000	15.0
Andhra Pradesh	2	2,400	20.0
Chhattisgarh	1	1,200	20.0
TOTAL	**95**	**23,67,480**	**14.0**

Source: 34th Report on Implementation of Policy on Promotion of City Compost, 16th Lok Sabha (2016)

OPERATIONAL MEDIUM AND LARGE-SCALE BIOMETHANATION PLANTS

City	Developer	Installed Capacity (TPD)	Output
Pune	Nobel Exchange	300*	Bio-CNG: Manure: 7.5 TPD
Bengaluru	Nobel Exchange	250	Bio-CNG: Manure: 25 TPD
Solapur	Organic Recyclers	400	Electricity: 4 MW Manure: 60 TPD
Chennai	Ramky	30	Electricity: 0.3 MW Manure: 3 TPD

** Operational capacity as of 2017 is 25%*

Source: Miscellaneous

OPERATIONAL LARGE RDF PLANTS

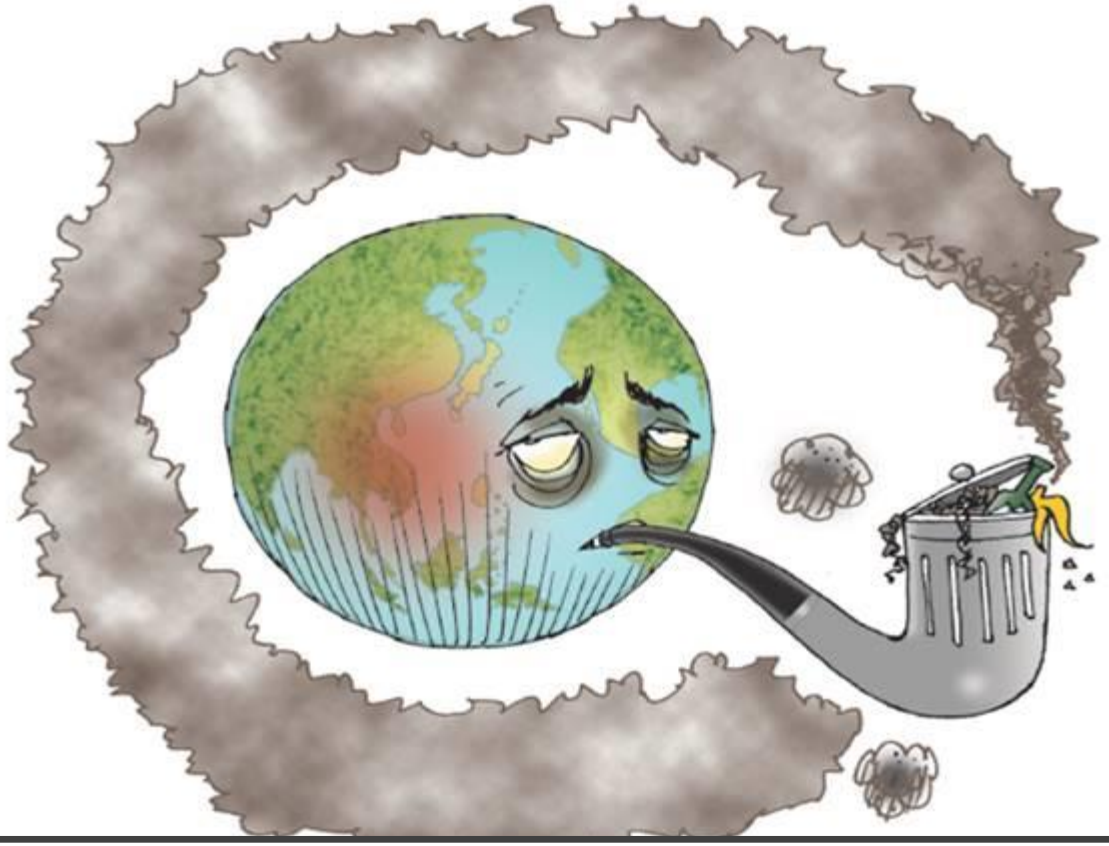
Location	Developer	Capacity (TPD)	RDF (TPD)
Kochi	Kochi MC	400	100
Jaipur	Vikram Cements	500	150
Surat	Hanjer	500	125
Chandigarh	Jaypee	500	300
Pune	Rochem	400	250
Navi Mumbai	Pyrocrat	300	
Bengaluru		500	
Bengaluru	MSGP	500	
Bengaluru	KCDC	200	
Bengaluru		200	

Source: Miscellaneous

OPERATIONAL WASTE-TO-ENERGY PLANTS

Location	Developer	Capacity (TPD)	Electricity Generation (MW)
Delhi – Okhla	Jindal Ecopolis	1,950	16.0
Delhi – Ghazipur	IL&FS Environment	1,300	14.0
Delhi – Bawana	Ramky	2,000	24.0
Chennai	Essel Infra	300	2.9
Jabalpur (MP)	Essel infra	600	11.5
Hyderabad	Ramky	2,400	20.0
Hyderabad	IL&FS Environment	1,000	11.0

Source: Miscellaneous



3. UNSCIENTIFIC DISPOSAL OF SOLID WASTE

ENVIRONMENTALLY UNSUSTAINABLE SOLID WASTE MANAGEMENT

- Consumption without regard for resource conservation leads to excess downstream demand for virgin materials
- Mixing wet waste with dry waste at the source of generation
- Increased volume of unprocessed mixed waste adds to transport demand
- Anaerobic decomposition of organic fraction (~60%) present in the mixed waste dumped at landfill sites releases methane
- Leachate oozing out of decomposing organic matter releases nitrous oxide
- Act of burning waste

LAND ALLOCATED FOR DEVELOPING LANDFILLS

	Number of Sites	Area Allocated (ha)
Chennai	2	466
Coimbatore	2	292
Surat	1	200
Mumbai	3	140
Hyderabad	1	121
Ahmedabad	1	84
Delhi	3	66
Jabalpur	1	61
Indore	1	60
Madurai	1	49
Bengaluru	2	41
Vishakhapatnam	1	41
Ludhiana	1	40

Source: Annual Report 2010-11, Central Pollution Control Board

ESTIMATED CITY-WISE CO2-E EMISSIONS FROM LANDFILL SITES IN 2016

	Total MSW (tonne/day)	MSW dumped	CO_2e emission (tonne/day)	CO_2e emission (k-tonne/yr)	Equivalence to passenger vehicles ('000, /yr)*
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 kilometre per litre and 18,350 kilometre driven in a year*

4. TOWARDS SUSTAINABLE SOLID WASTE MANAGEMENT

ENVIRONMENTAL SUSTAINABILITY SOLID WASTE MANAGEMENT

- Promoting the concept of Reduce and Reuse and thereby decrease consumption
- Recycling waste to save energy by deferring extraction of virgin materials
- Composting organic waste to improve soil carbon content and help substitute chemical fertilisers in agriculture
- Biomethanation of biodegradable waste to harnesses the latent energy in organic matter
- Converting non-biodegradable and non-recyclable waste of high calorific value into RDF to extract energy through incineration
- Depositing unrecoverable carbonic compounds into sanitary landfills to isolate them from the environment
- Bioremediating legacy of waste accumulated at dumpsites to reclaim space

FINANCIAL UNSUSTAINABILITY OF SOLID WASTE MANAGEMENT

- ULBs in India are heavily dependent on higher level governments for transfers
- Own revenues of ULBs have been on a downward trend
- ULBs not empowered to mobilise financial resources through raising taxes or levying user-fee or **unlocking land value**
- Investment of ₹70,000 crore (not incl. land cost) at 2016-17 prices over a 20-year period to bridge the infrastructure deficit in SWM (HPEC 2011)
- ULBs not in a position to fund capital investment
- User charges do not cover O&M costs
- ULBs do not have a business model to attract private investment
- Only 15-25% of municipal revenue expenditure is spent on SWM
- Collection and transportation accounts for upto 90% of this expenditure

SWACHH BHARATH MISSION

- GoI has committed 24% of a total cost of ₹62,000 crore for the Mission
- Rest to come from budgets of state governments/ ULBs
- User charges, taxes and unlocking land value?
- These are the areas where JNNURM failed
- The Mission is mostly targeted towards making cities open-defecation free, building community toilets and generating awareness on SWM
- Attention on collection and transportation: resource recovery and safe disposal have been ignored

ISSUES IN FINANCIALLY SUSTAINABLE SOLID WASTE MANAGEMENT

- Fertiliser subsidy
- Marketing of compost
- Operational efficiency of biomethanation plants
- Financial sustainability of WtE plants
- Economics of Bioremediation
- Economics of Recycling

For further reading please refer to: Ahluwalia I.J. and Patel U., *"Solid Waste Management in India: An Assessment of Resource Recovery and Environmental Impact."* ICRIER Working Paper 356 (2018)

Accessible at: http://icrier.org/pdf/Working_Paper_356.pdf

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THANK YOU