MSW-to-energy – successful deployment policies and technologies - India

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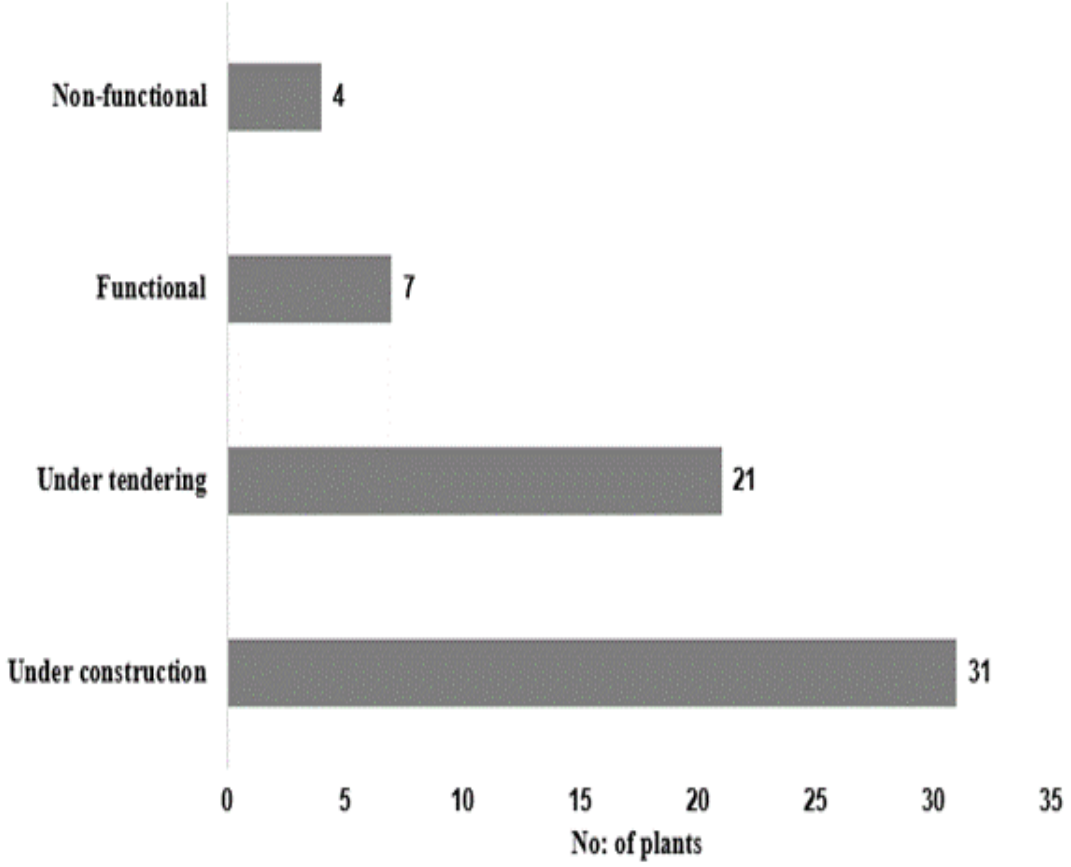
Discussion Points

- What is the current status of MSW-to-energy use and policies in India?
- What are the current successes and challenges of MSW-to-energy across India?
- What is the potential for MSW-to-energy over the next decade?

Status - WTE facilities in India, in different stages of construction/installation



Location	Capacity (TPD)	Power generation (MW)	Technology
Okhla	1950	16	Mass burning; now changed to RDF;
Ghazipur	1300	22	RDF
Village Mandur, Bengaluru	1000 (Not operational)	8	-
Nalgonda, Andhra Pradesh	-	11	RDF
Hadapsar, Pune	300	10	Gasification
Jabalpur, Madhya Pradesh	600	8.5	Mass burning
Narela Bawana, Delhi	3000	24	RDF
Karimnagar, Andhra Pradesh		12	Mixed feed

Status – WTE (Incineration) Electricity generation

WTE equipped with air pollution control device

Turbines

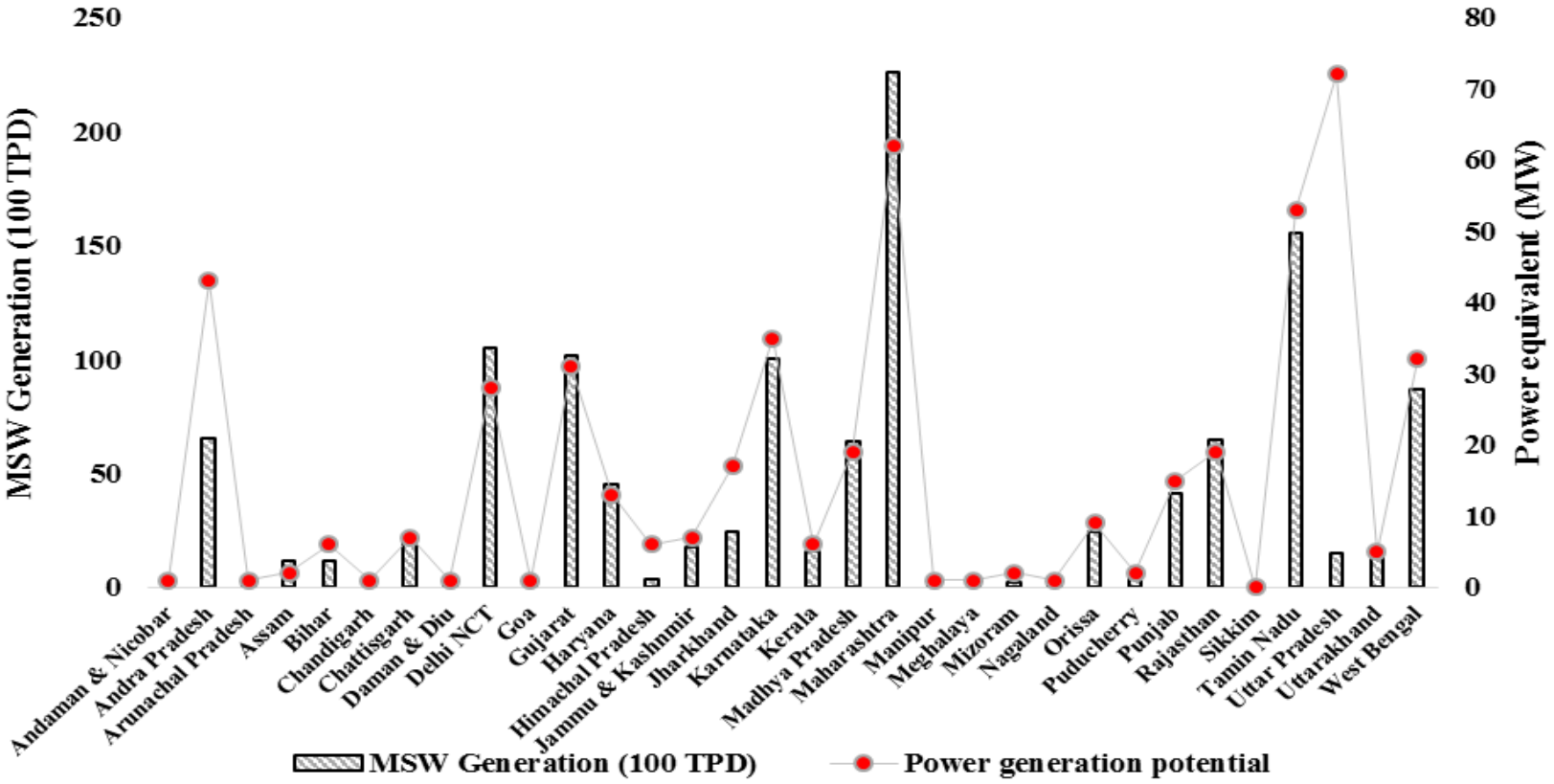
Leachate treatment

- **collection and transportation of 10,000 tons of solid waste to WTE plant = Rs.638,75,00,000 /year**
- Total waste treatment capacity for 48 existing, under-construction and proposed WTE plants is just over 30,000 TPD giving an equivalent of 439 MW of electricity.
- Capital cost of establishing a state of the art WTE incineration plant with required pollution control devices is Rs.20-25 crore per MW, which is beyond the means of small municipalities.
- Cost of production of one unit is Rs. 13-14 per Kwh while the the Central Electricity Regulatory Commission (CERC) has recently fixed a tariff of Rs 7.04 per unit for power derived from municipal solid waste. **https://cercind.gov.in/2015/draft_reg/Exp11.pdf**

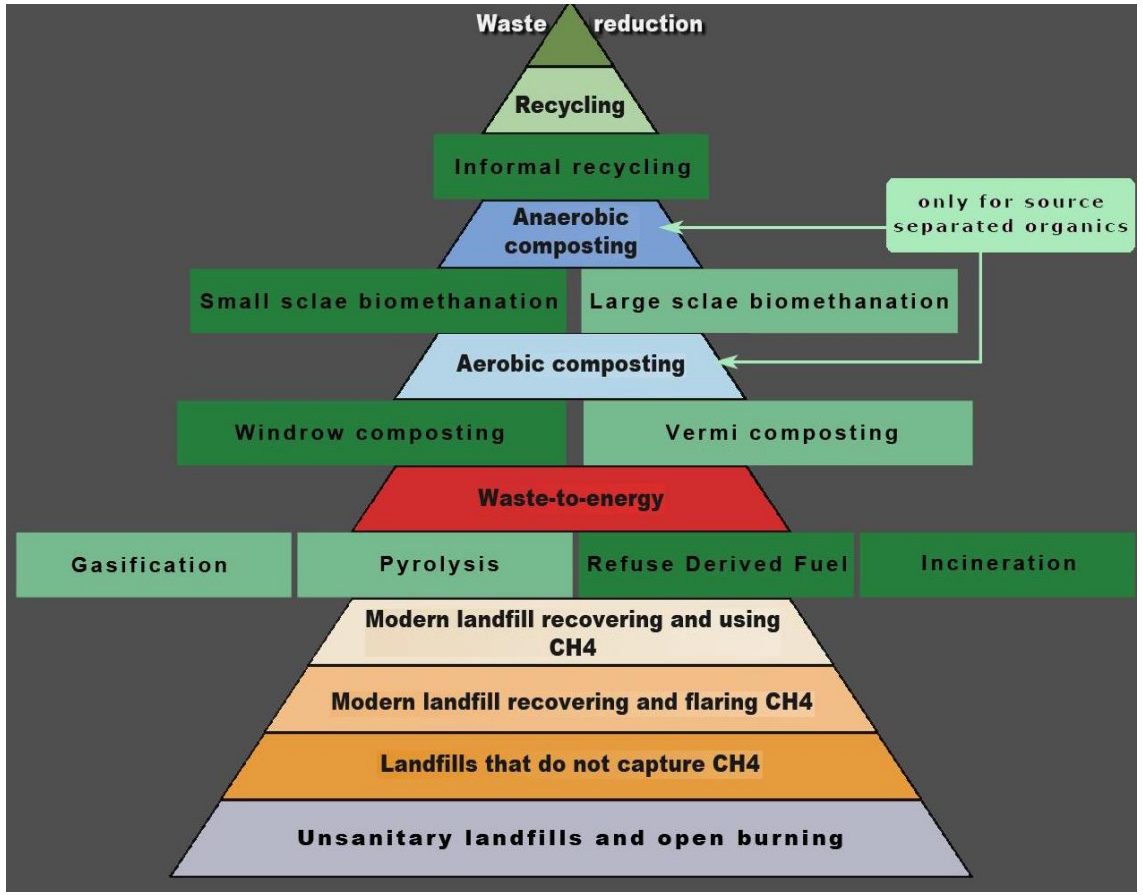
Potential of WTE as per government estimates

- 62 million tonnes of MSW generated in urban areas, which will require 3,40,000 cubic metre of landfill or 1240 hectare per year

- This waste has a potential of generating
  - **439 MW of power**
  - **1.3 million cubic metre of Biogas per day or 72 MW of electricity from biogas and**
  - **5.4 million metric tonnes of compost**



Current Waste Management Policies



- As per the Solid Waste Management Rules, 2016, only segregated, non- recyclable waste having calorific value of 1500 Kcal/kg or more shall not be disposed of on landfills and shall be utilized for generating energy either or through refuse derived fuel (RDF)

- High calorific wastes shall be used for co-processing in cement or thermal power plants. Only Non-recyclables to go for RDF production

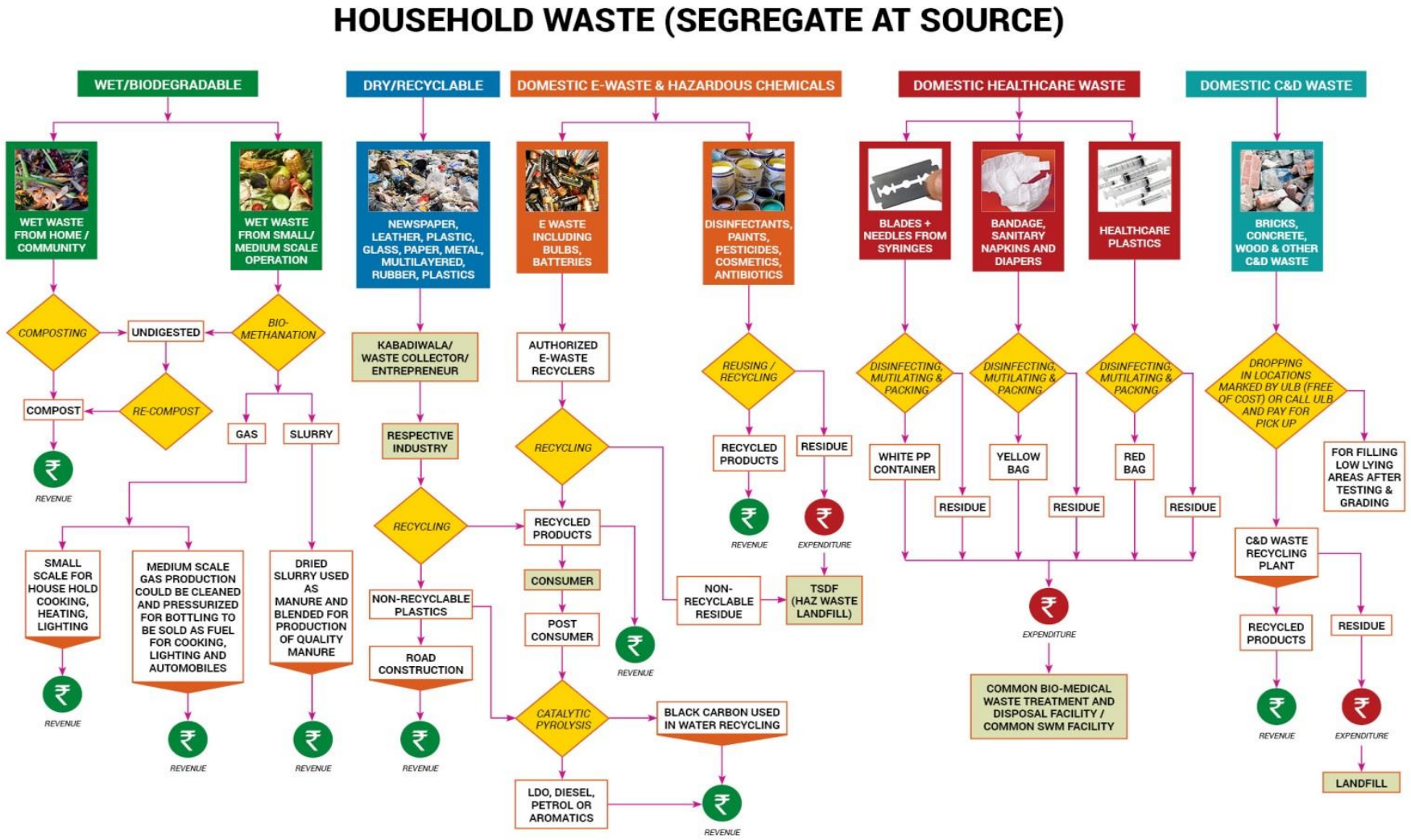
Policy and Renewable Energy Potential in India

- According to the annual report of the Ministry of New and Renewable Energy (MNRE) for 2017–2018, the estimated potential of wind power was 302.251 GW (at 100-m mast height), of small hydropower 19.749 GW, biomass power 17.536 GW, bagasse cogeneration 5 GW, waste to energy (WTE) 2.554 GW, and solar 748.990 GW. The estimated total renewable potential amounted to 1096.080 GW.

- According to the SWM Rules 2016, bulk generators occupying 5000 sqm and generating 100kg/day or more (this can be reduced as per the bye-laws in any particular city) have to manage their own wet (biodegradable) waste. This amounts to approximately 15% of the waste in Indian cities which contribute to 60% of the MSW. This would amount to 5.6 million tonnes per year, to yield 1.3 million cubic metre of biogas, which can be used as Bio-CNG or for electricity generation.

Solid Waste management Rules 2016

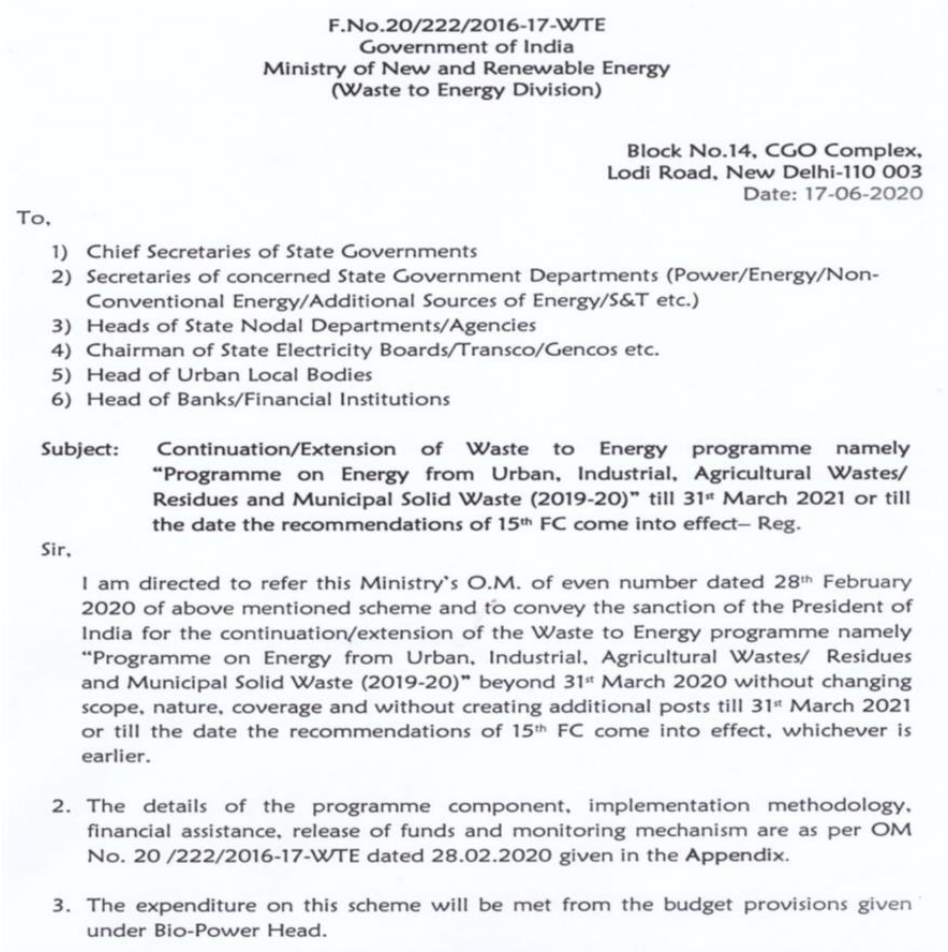
Pictorial Representation



Government Subsidy for WTE from MNRE

For gasifier projects	
Subsidy	Technology
INR 2,500 per kWe	Dual fuel engines
INR 15,000 per kWe	100 per cent gas engines
INR 2.0 lakh / 300 kWh	Thermal applications
INR 10,000 per kWe	100 per cent producer gas engines with gasifier system
INR 8,000 per kWe	100 per cent producer gas engine alone

For other waste to energy technologies			
Output	Subsidy	Per unit	Maximum subsidy
Biogas plants	INR 1 crore	Per 12,000 cubic metres biogas /day	INR 10 crore/project
Bio-CNG plants	INR 4 crore	Per 4,800 kg of bio-CNG/day generated from 12,000 cubic metres biogas /day (MWeq)	
Power from biogas	INR 3 crore	Per MW for gas engine/turbine	
	INR 1.5 crore	Per MW for boiler + steam turbine	
Power from RE waste other than MSW	INR 0.5 crore	Per MW	
Power based on MSW and refuse-derived fuel (RDF)	INR 5 crore	Per MW	INR 50 crore/project



F.No.20/222/2016-17-WTE
Government of India
Ministry of New and Renewable Energy
(Waste to Energy Division)

Block No.14, CGO Complex,
Lodi Road, New Delhi-110 003
Date: 17-06-2020

To,

1) Chief Secretaries of State Governments
2) Secretaries of concerned State Government Departments (Power/Energy/Non-Conventional Energy/Additional Sources of Energy/S&T etc.)
3) Heads of State Nodal Departments/Agencies
4) Chairman of State Electricity Boards/Transco/Gencos etc.
5) Head of Urban Local Bodies
6) Head of Banks/Financial Institutions

Subject: Continuation/Extension of Waste to Energy programme namely "Programme on Energy from Urban, Industrial, Agricultural Wastes/ Residues and Municipal Solid Waste (2019-20)" till 31st March 2021 or till the date the recommendations of 15th FC come into effect– Reg.

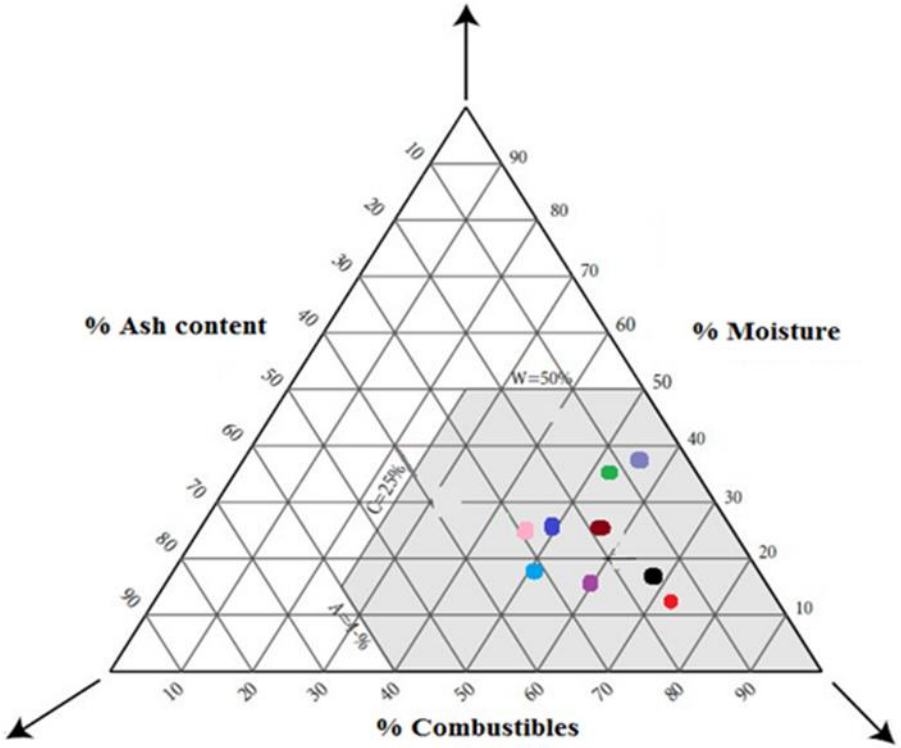
Sir,

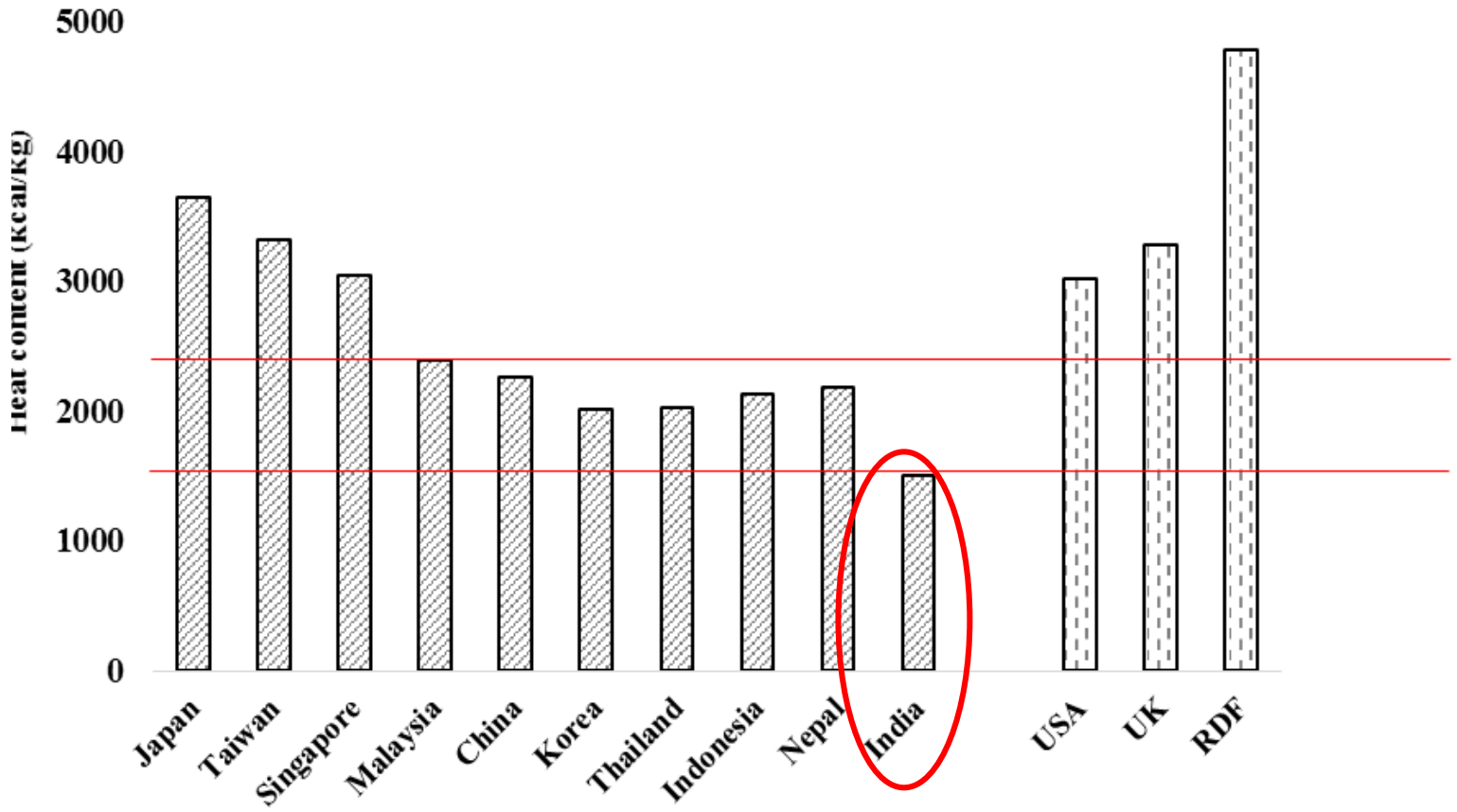
I am directed to refer this Ministry's O.M. of even number dated 28th February 2020 of above mentioned scheme and to convey the sanction of the President of India for the continuation/extension of the Waste to Energy programme namely "Programme on Energy from Urban, Industrial, Agricultural Wastes/ Residues and Municipal Solid Waste (2019-20)" beyond 31st March 2020 without changing scope, nature, coverage and without creating additional posts till 31st March 2021 or till the date the recommendations of 15th FC come into effect, whichever is earlier.

2. The details of the programme component, implementation methodology, financial assistance, release of funds and monitoring mechanism are as per OM No. 20 /222/2016-17-WTE dated 28.02.2020 given in the Appendix.

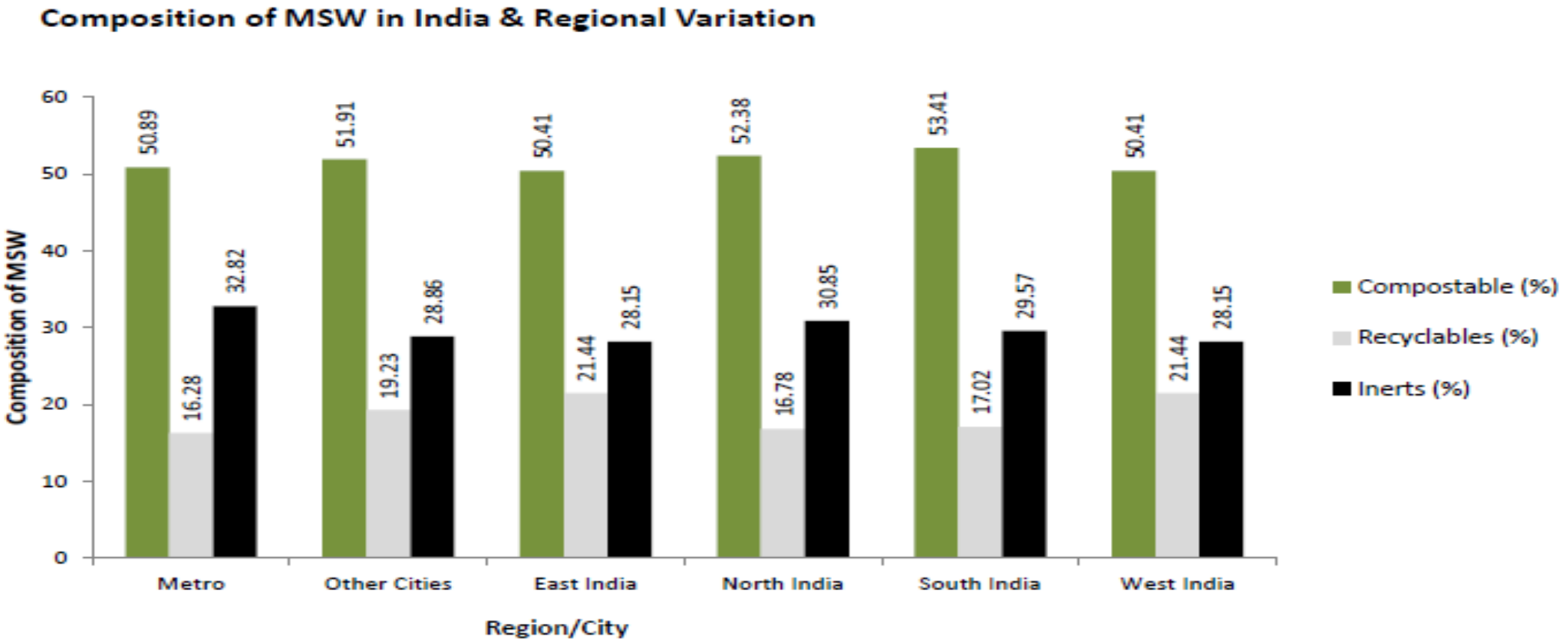
3. The expenditure on this scheme will be met from the budget provisions given under Bio-Power Head.

One of the key challenges for WTE – Low Calorific value of solid waste





High % of compostables in Indian MSW



Source: Earth Engineering Centre, 2012

Summary of Challenges

- WTE plants do not get many buyers for the power they generate due to cheaper alternatives. WTE plants sell electricity at about Rs 14-17 per kWh.

- A high capital cost, high O&M expenses, high transportation cost and low calorific value of the fuel used and the additional fuel used to burn the waste.

- The WTE plants in Germany and Sweden receive largely segregated, high calorific value wastes whereas mixed waste received in WTEs in India leads to 50% rejection which go to the dumpsites.

- WTEs in India handle a vast quantity of mixed waste, therefore the housekeeping is challenging. Exposure of workers to particulate matter, pathogens is high.

- WTEs of higher capacity require public hearing and mostly face resistance from the public.

Alternative WTE technologies

REVISED GUIDELINES OF WASTE-TO-ENERGY PROGRAMME

Programme on Energy from Urban, Industrial, Agricultural Wastes/Residues and Municipal Solid Waste

1. OBJECTIVE

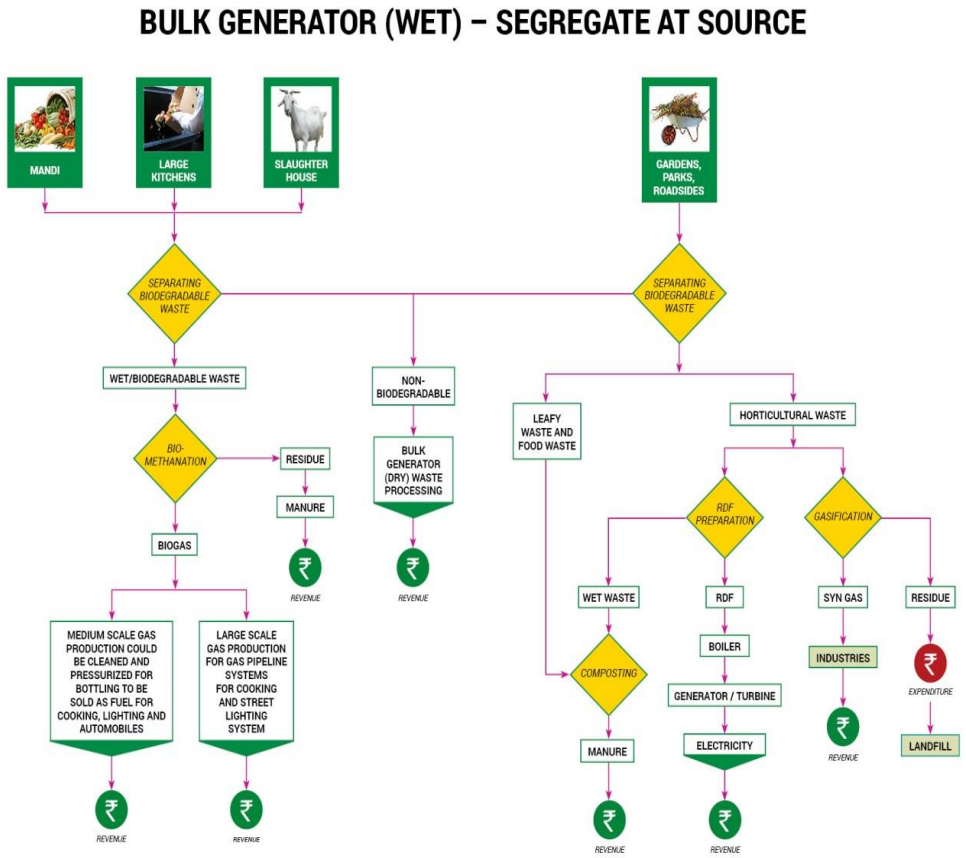
The main objectives of the Programme are as follows:

a. To promote setting up of projects for recovery of energy in the form of Biogas / BioCNG / Power from Urban, Industrial and Agricultural Waste and Captive Power and Thermal use through Gasification in Industries.

b. To promote setting up of projects for recovery of energy from Municipal Solid Waste (MSW) for feeding power into the grid and for meeting captive power, thermal and vehicular fuel requirements.

- There is clearly a need for different technologies to manage waste sustainably
- Whether waste will be burned or recycled or composted — depends on the quality of waste
- Biomethanation technologies for segregated wet waste from large kitchens, restaurants, slaughter houses and market waste have proved to be more viable and feasible in India

SWM Rules 2016 urge bulk waste generators to manage wet waste



Successes

Indore -

Mahindra – SEZ Chennai, Indore running a **fleet of over 20 city buses** from the Bio-CNG generated from market waste

Pune – 5 TPD plants in many locations providing **street lighting**, replicated in Chennai, Bengaluru, Tiruchi and several other Indian cities

Delhi – Three WTE incineration plants with capacity of processing over 5000 TPD and about **50 MW electricity generation**

Thank you

For further information

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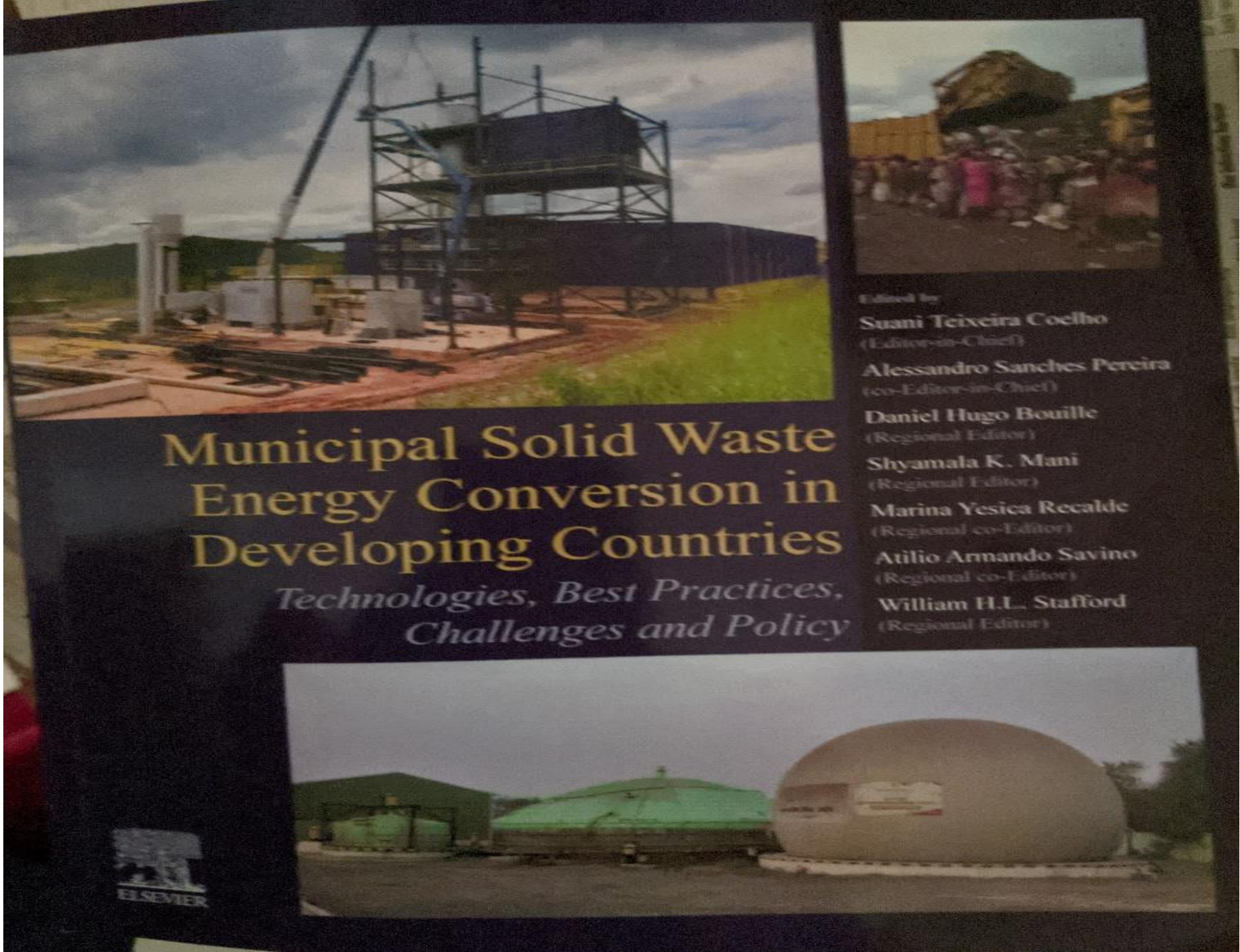
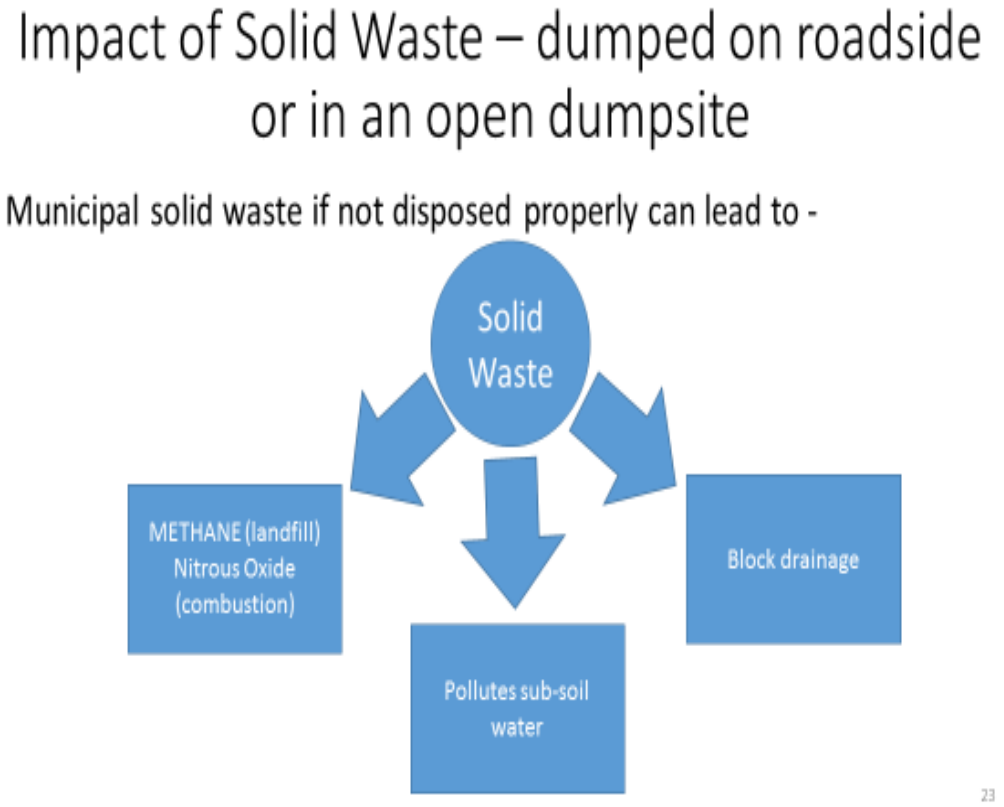
https://www.Elsevier.com/books-and-journals



Extra slides

Impact of Improper Management of Solid Waste – Methane trapped under Dry waste and Inerts explodes causing death and destruction! (Ghazipur, Sept. 2nd, 2017)

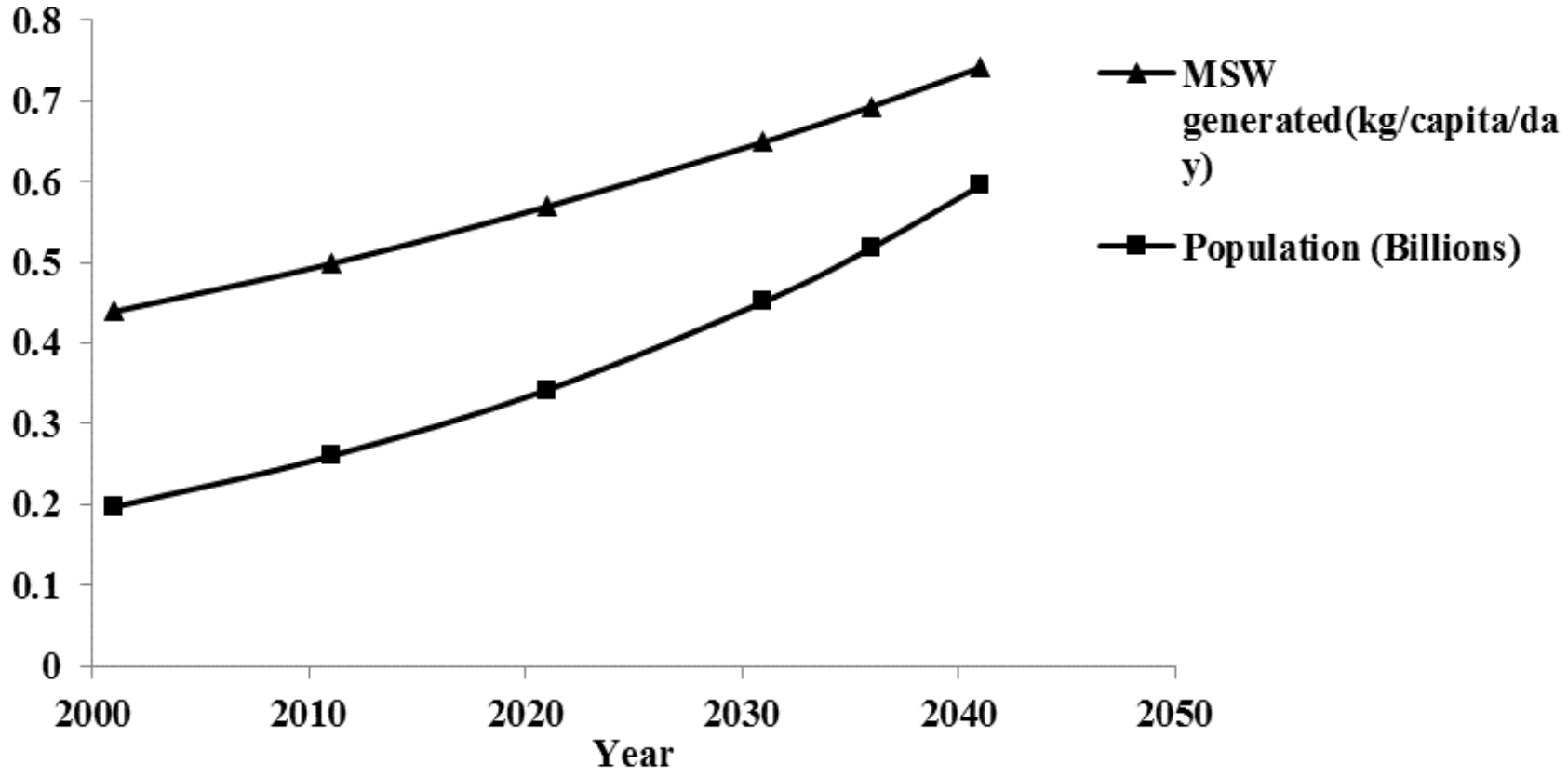
Offset Potential of avoiding transportation of MSWM to Landfill



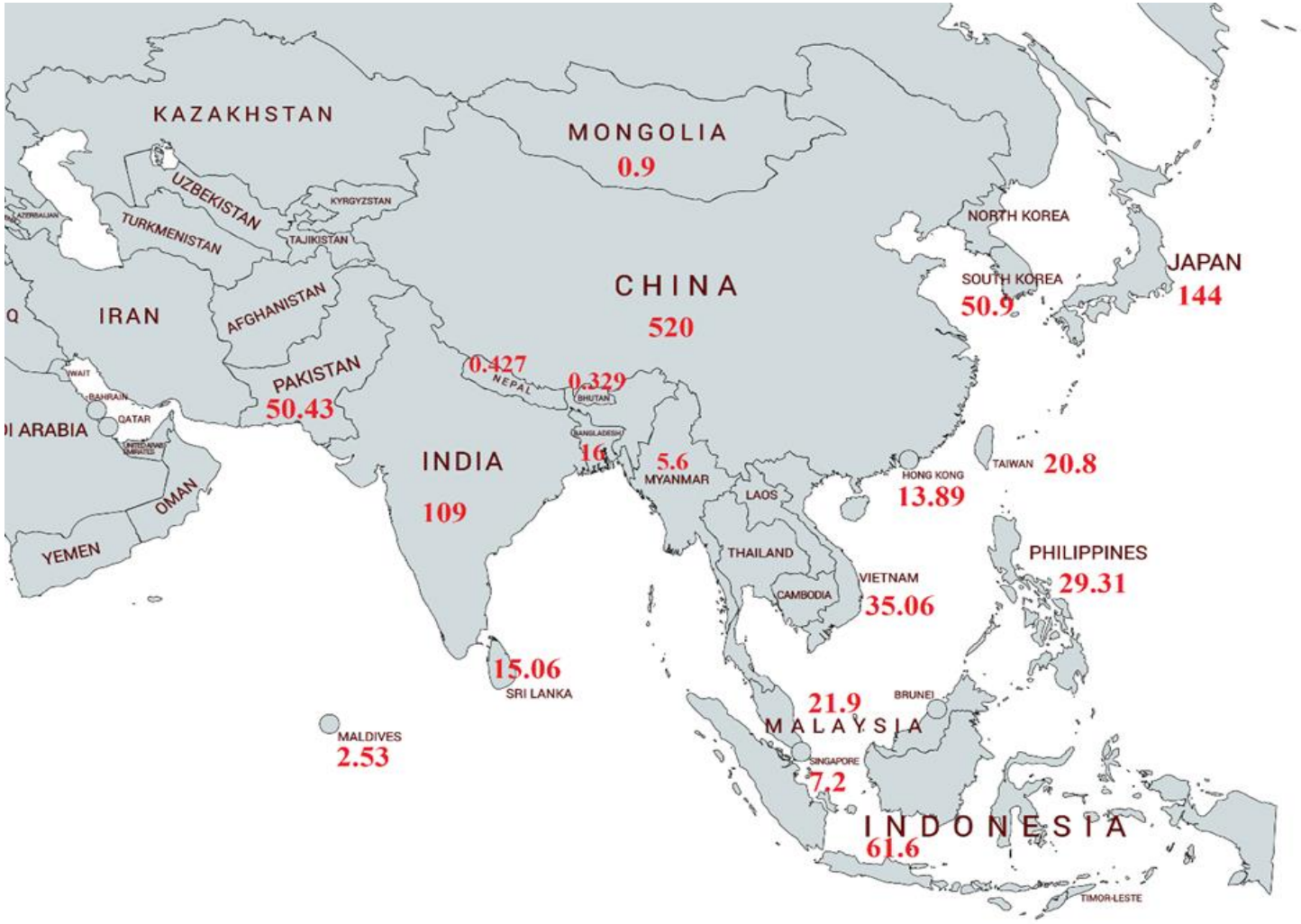
- **Savings on avoiding the Dumpsites: collection and transportation of 10,000 tons of solid waste to landfill = Rs.638,75,00,000 /year since most concessionaire documents contract to pay Rs.1700-1800 per ton to the concessionaire for collection, transportation and dumping of solid waste at the dumpsites**

- **CO_2 Emissions avoided by avoiding the transport of 1 ton of MSW = 721.4 kg/year**

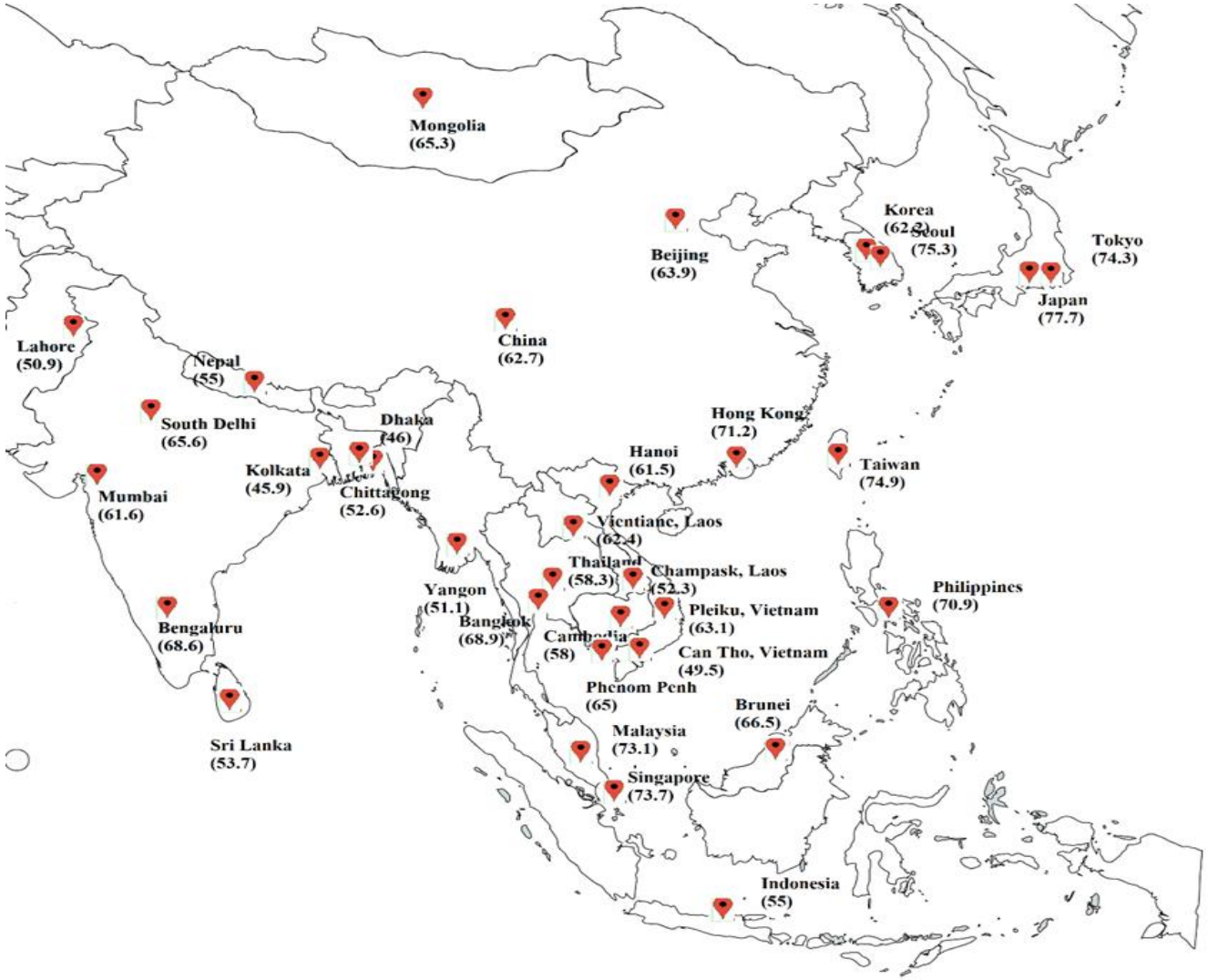
Per capita MSW generation rates and the population growth in India (Sebastian and Alappat, 2016)



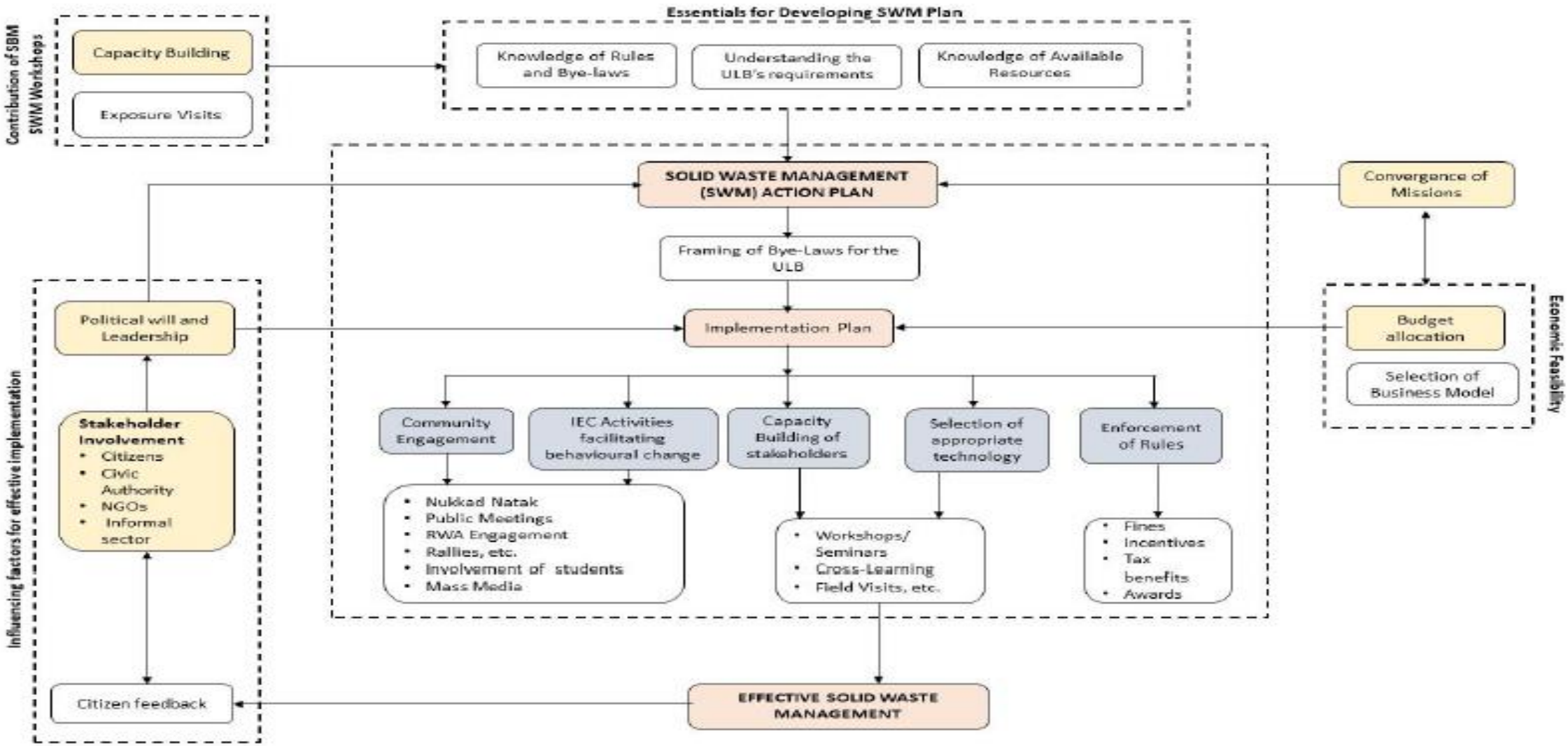
South and East Asian countries and their daily urban MSW generation rates (in Thousand TPD)



Incinerability of MSW generated in South East Asian countries on a scale of 0-100



METHODOLOGY FOR AN EFFECTIVE SOLID WASTE MANAGEMENT SYSTEM FOR ULBS



(Source: NIUA SBM Team)

GLIMPSES FROM THE EXPOSURE WORKSHOPS, 2018-19

MADURAI

Waste Segregation at the centralized composting facility

Compost produced at the centralized composting facility

Micro Composting Centre at Central Market

Shredder at the Micro Composting Centre

Compost Pit

Composting facility, Hotel Temple City

Organic Farming by Hotel Temple City

Bio box Technology at GRT Regency Hotel

Gasifier Crematorium at Thathaneri

Door To Door Waste Collection & Primary Segregation at source

SWM TRANSFER STATION STRUCTURES I/C EQUIPMENT

OBJECTIVES OF ESTABLISHMENT OF TRANSFER STATIONS ARE:

- To comply with Solid Waste Management Rules, 2016.
- To improve the existing standards of public health and environmental quality by establishing efficient mechanism for collection and transportation of Municipal Solid Waste.
- Ensure clean and hygienic collection and transportation system of Municipal Solid Waste.
- Improve productivity of man, materials and equipment.

WASTE COLLECTION

TRANSFER STATION

TRENCHING GROUND

PROCEDURE FOR WASTE COLLECTION FROM RESIDENTIAL

Generating Revenue by selling recyclables to Recyclers and non-recyclables to cement plants / WTEs (Ambikapur)