



Integrated Solid Waste Management in Urban India

Srinivas Chary
ASCI (schary@asci.org.in)

Where Beauty meets the Beast !

Vienna, Austria



Session Objectives

- To provide holistic perspective on ISWM and MSW Rules
- Improved understanding for developing strategies to implement ISWM
- To enhance understanding on PPP options in ISWM
- Financing options and role of citizen participation

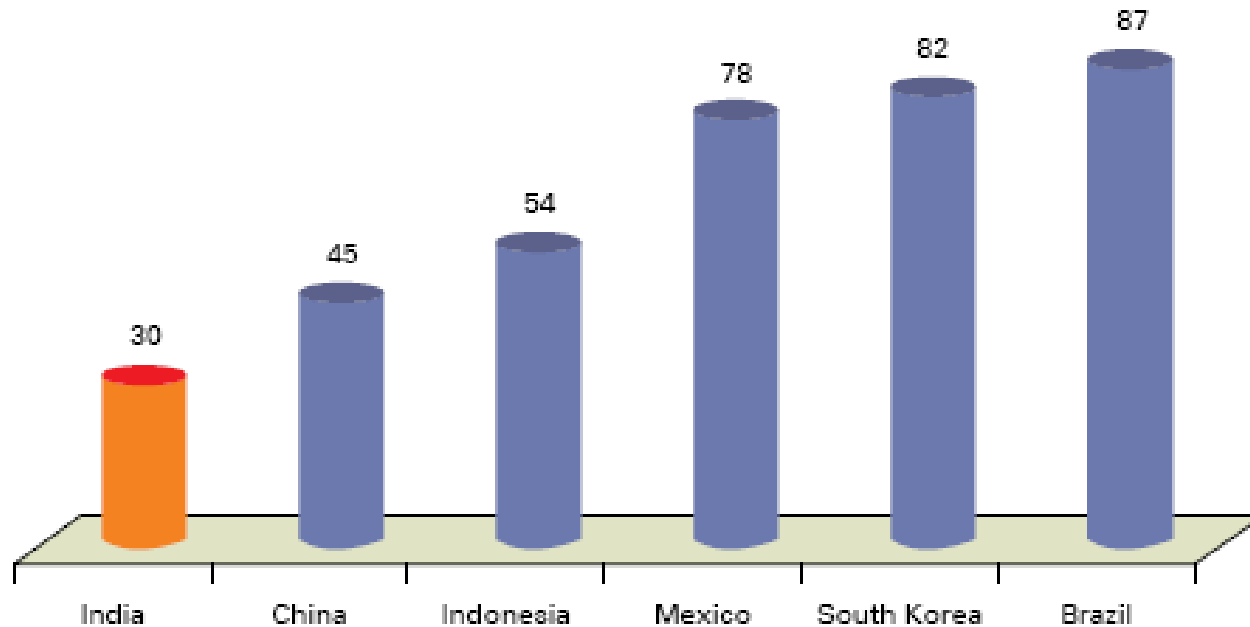
CONTEXT

Urban Transformation

India is the second largest urban system next to China

India is urbanizing fast

India is urbanising...



India's urban population to increase

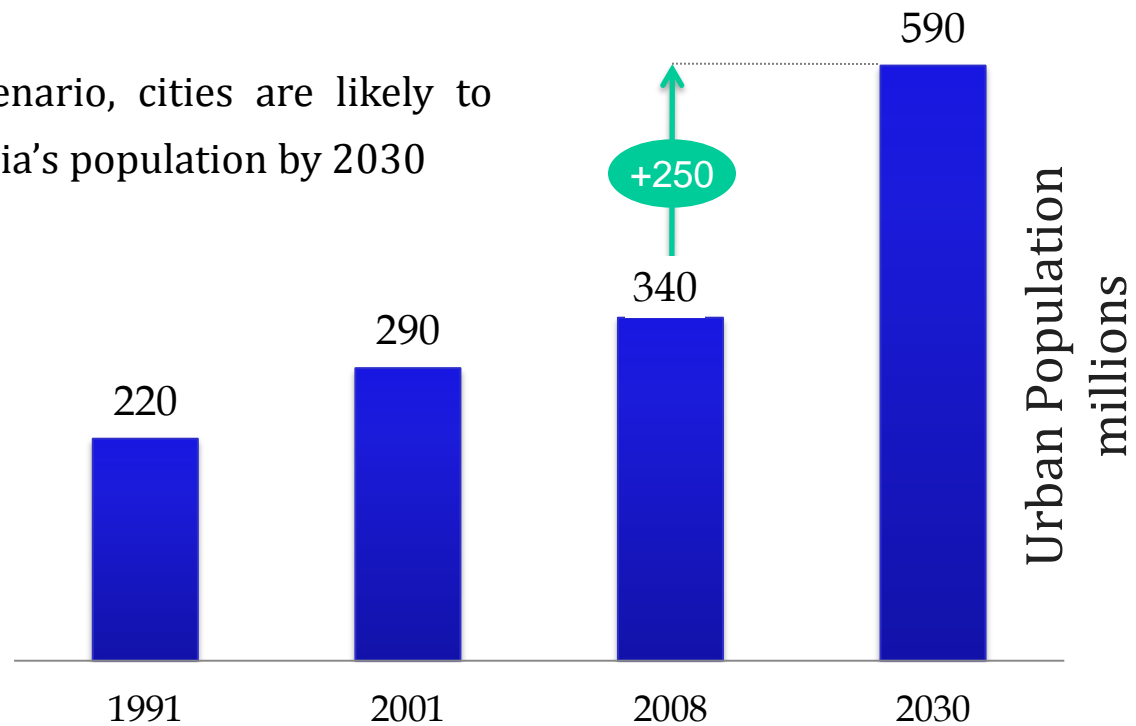
- From 350 mn today to 600 mn by 2031
- From 50 cities with population of 1 mn and above today to 87 by 2031

On average, 25 per cent of the population in Indian cities lives in slums.

Urban planning, urban infrastructure development and public service delivery of universal standards must address this challenge.

Urbanisation scenario

In MGI's base-case scenario, cities are likely to house 40 percent of India's population by 2030



Total Population millions	856	1,040	1,155	1,470
Urbanisation rate %	26	28	30	40

Source: India Urbanisation Econometric Model; McKinsey Global Institute analysis

Urban Areas and Economy

Cities and Economy

- Engines of Growth – over 60% contribution to the economy
- Hubs for enterprise, innovation, people and politics
- Increasing dependence of national/state eco growth on the productivity of cities



Indian Cities and the Economy

Contribution to GDP

1980-81	47%
1990-91	55%
2000-01	60%
2021	73%

Efficient urban areas are essential for achieving **growth** and **poverty reduction** targets. .

Cities and Poverty

Cities and Poverty

Urbanization of Poverty

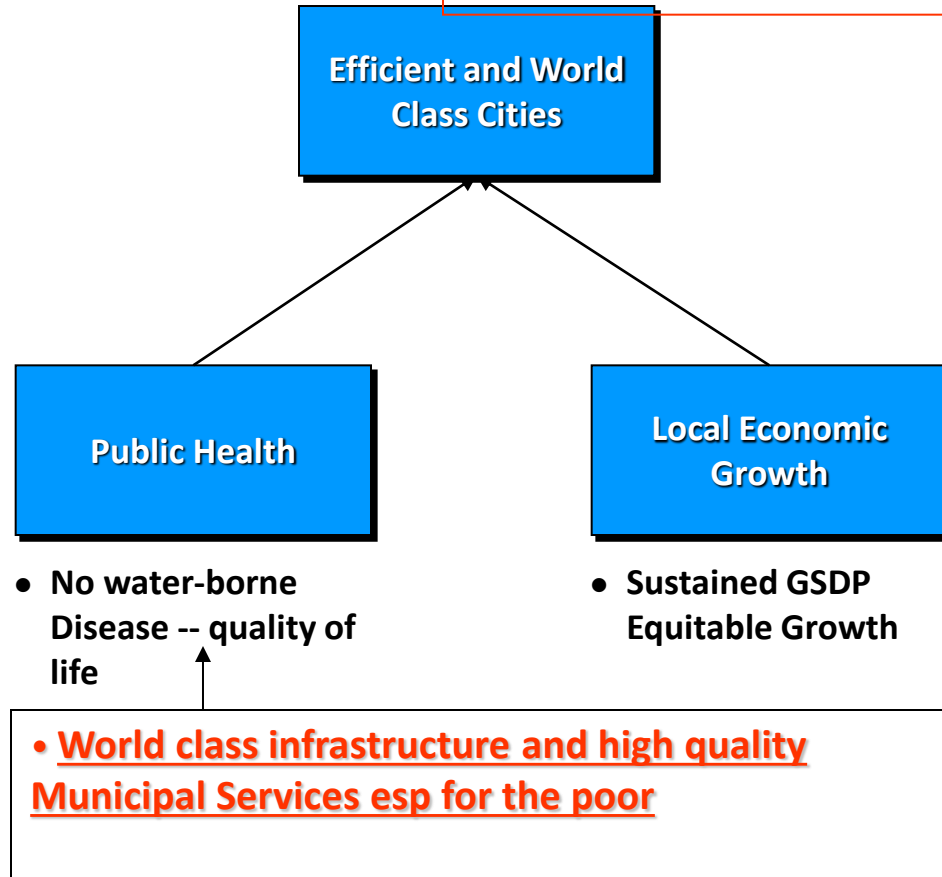
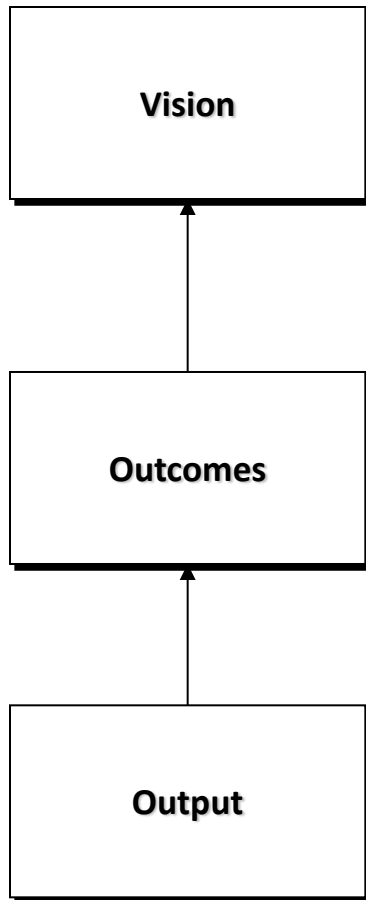


City	Slum Population (%)
Mumbai	49
Kolkata	33
Nagpur	35
Ludhiana	23
Meerut	44
Faridabad	47

Poverty moves to cities

Model Town

*Reliable, Continuous,
High quality, Affordable*

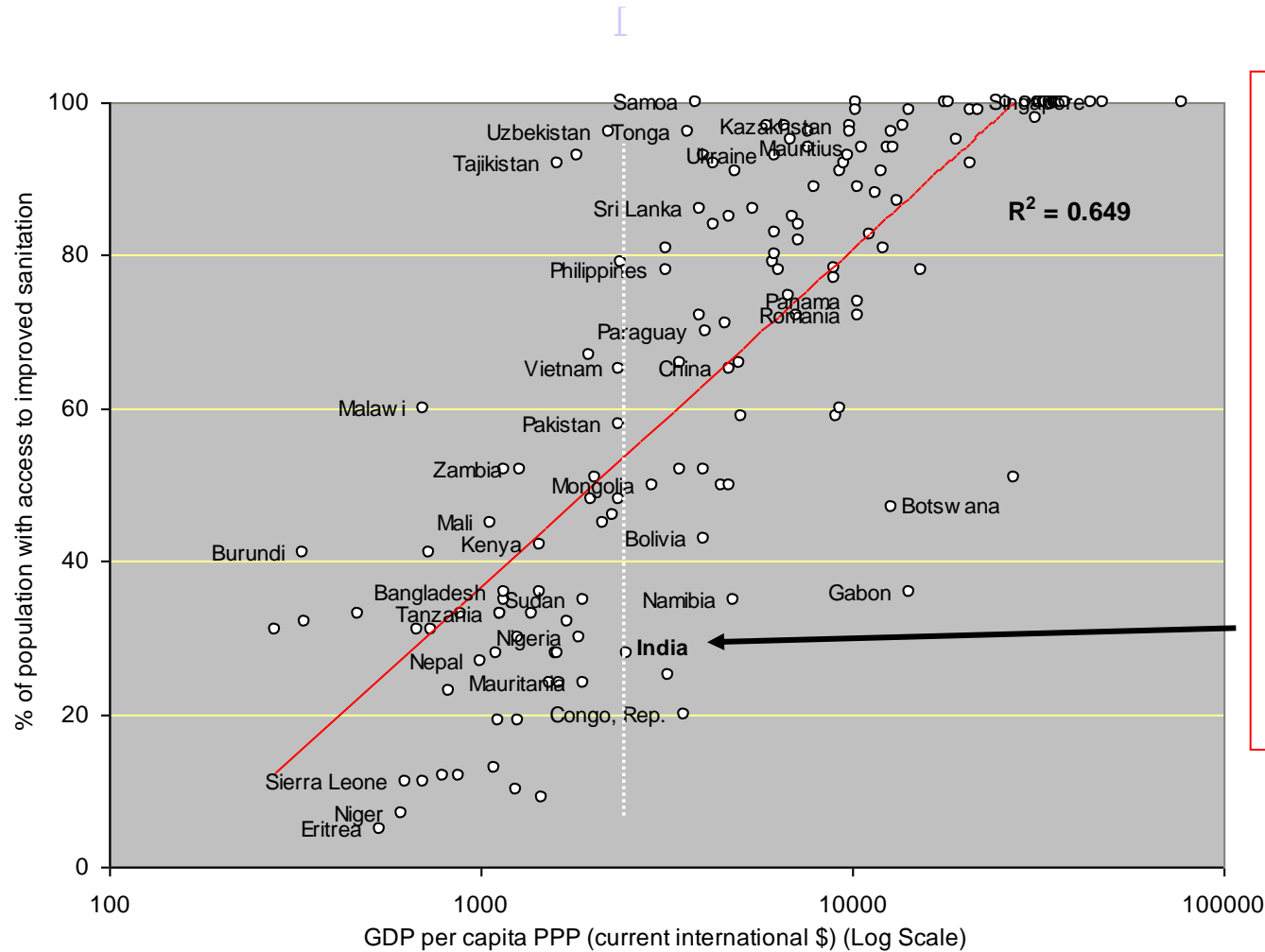


Effective governance

**Municipal waste is a
public health issue**

India's Relative Performance

Scatter-plot of % of population with access to improved sanitation and GDP per capita PPP (current international \$)



India's progress is lower than some of the other countries with similar or lower per capital GDP

Benchmarks : Solid Waste Management

Proposed Indicator	Benchmark
Household level coverage of Solid Waste Management services	100%
Efficiency of collection of municipal solid waste	100%
Extent of segregation of municipal solid waste	100%
Extent of municipal solid waste recovered/recycled	80%
Extent of scientific disposal of municipal solid waste	100%
Extent of cost recovery in solid waste management services	100%
Efficiency in redressal of customer complaints	80%
Efficiency in collection of user charges	90%
Extent of processing and treatment of MSW	100%

Standardized Service Level Benchmarks

Indicator	Definition
Household level coverage of SWM services through door-to-door collection of waste	Percentage of households and establishments that are covered by daily door-step collection system.
Collection Efficiency	Total waste collected by ULB and authorized service providers versus the total waste generated within the ULB excluding recycling or processing at the generation point.
Extent of Segregation of waste	% of households and establishments that segregate their waste.
Extent of recovery of waste collected	This is an indication of the quantum of waste collected, which is either recycled or processed. This is expressed in terms of % of waste collected.
Extent of scientific disposal of waste in landfill Sites	Amount of waste that is disposed in landfills. This extent of compliance should be expressed as percentage of total quantum of waste disposed at landfill sites, including open dump sites.
Extent of Cost Recovery for the ULB in SWM Services	This indicator denotes the extent to which the ULB is able to recover all operating expenses relating to SWM services from operating revenues of sources related exclusively to SWM.

Benchmarks : Water Supply

Proposed Indicator	Benchmark
<i>Coverage of Water Supply Connections</i>	<i>100%</i>
Per capita availability of water at consumer end	135 lpcd
Extent of metering of water connections	100%
Extent of non revenue water	15%
<i>Continuity of Water Supply</i>	<i>24X7</i>
Efficiency in redressal of customer complaints	80%
Adequacy of Treatment and Disinfection and Quality of Water Supplied	100%
<i>Cost recovery in water supply services</i>	<i>100%</i>
Efficiency in collection of water supply related charges	90%
Number of persons receiving less than 70 lpcd	0%

Benchmarks : Sewerage

Proposed Indicator	Benchmark
Coverage of Waste Water Network Services	100%
Collection Efficiency of Waste Water Network	100%
Adequacy of waste water treatment capacity	100%
Quality of waste water treatment	100%
Extent of reuse and recycling of treated waste water	20%
Extent of cost recovery in waste water management	100%
Efficiency in redressal of customer complaints	80%
Efficiency in collection of sewerage charges	90%
Extent of Sewer House Connection	100%
Coverage of Toilets	100%

Benchmarks : Storm Water Drainage

Proposed Indicator	Benchmark
Coverage of Storm Water Drainage Network	100%
Incidence of water logging/ flooding	0%

Current Status

Solid Waste Management – Median Analysis

S.no	Indicator	Unit	Benchmark	Median Value
1	Household level coverage of Solid Waste Management services	%	100	47.5
2	Efficiency of collection of municipal solid waste	%	100	70
3	Extent of segregation of municipal solid waste	%	100	10
4	Extent of municipal solid waste recovered/recycled	%	80	67.5
5	Extent of scientific disposal of municipal solid waste	%	100	20
6	Extent of cost recovery in solid waste management services	%	80	4
7	Efficiency in redressal of customer complaints	%	80	65
8	Efficiency in collection of user charges	%	90	30

Water Supply - Median Analysis

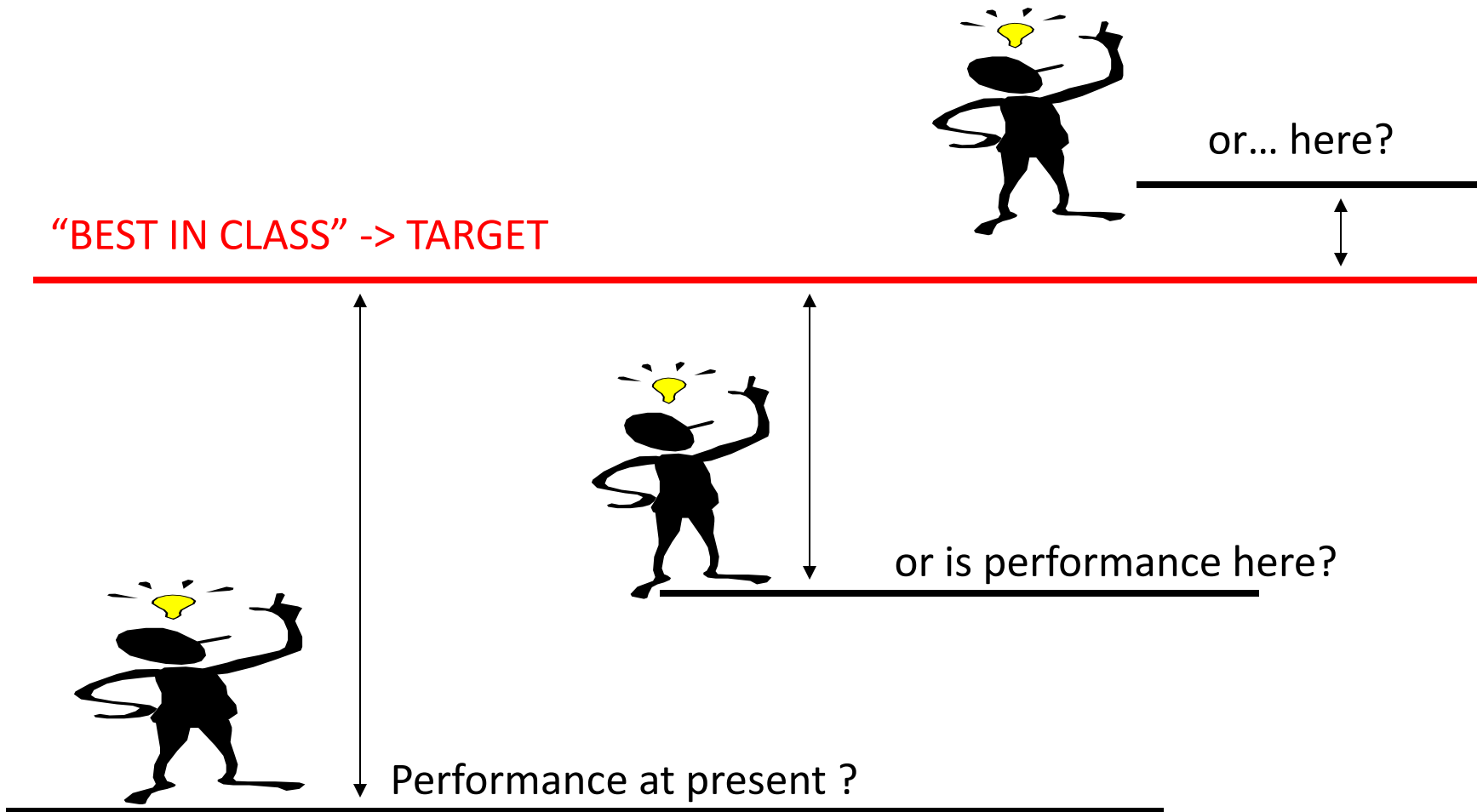
S.no	Indicator	Unit	Benchmark	Median Value
1	Coverage of water supply connections	%	100	67.5
2	Per capita availability at consumer end	Lpcd	135	93
3	Extent of metering of water connections	%	100	0
4	Extent of Non Revenue water	%	20	30
5	Continuity of Water Supply		24 X 7	1.3
6	Efficiency in redressal of customer complaints	%	80	90
7	Adequacy of Treatment and Disinfection and Quality of Water Supplied	%	100	70
8	Cost recovery in water supply services	%	100	25
9	Efficiency in collection of water supply related charges	%	90	60

S.no	Indicator	Unit	Benchmark	Median Value
1	Coverage of Toilets	%	100	70
2	Coverage of Waste Water Network Services	%	100	23.5
3	Collection Efficiency of Waste Water Network	%	100	0
4	Adequacy of waste water treatment capacity	%	100	0
5	Quality of waste water treatment		100	0
6	Extent of reuse and recycling of treated waste water	%	20	0
7	Extent of cost recovery in waste water management	%	100	0
8	Efficiency in redressal of customer complaints	%	80	0
9	Efficiency in collection of sewerage charges	%	90	0

Storm Water Drainage – Median Analysis

S.no	Indicator	Unit	Benchmark	Median Value
1	Coverage of Storm Water Drainage Network	%	100	60
2	Incidence of water logging/ flooding	Number	0	3

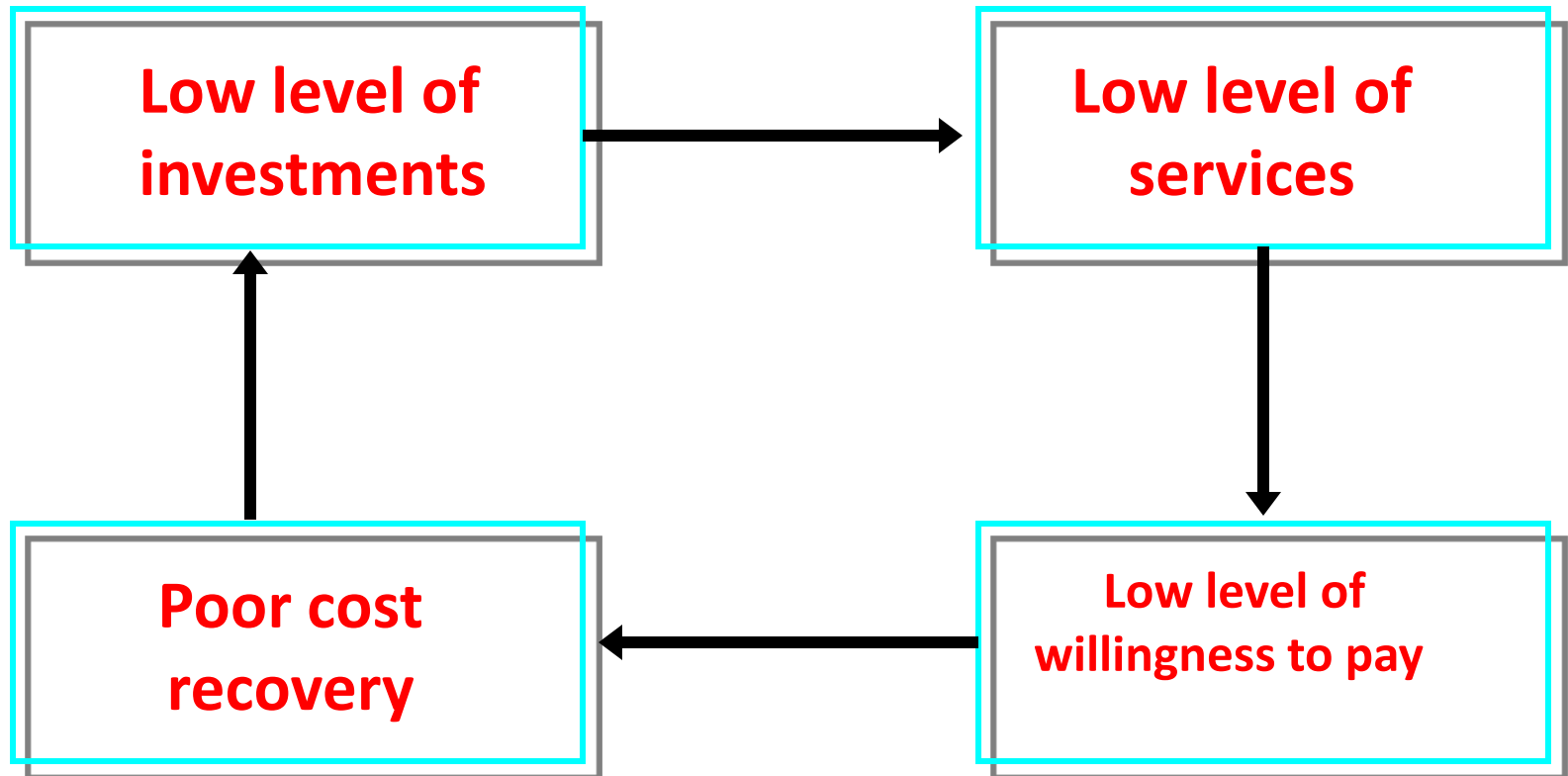
Service delivery gap



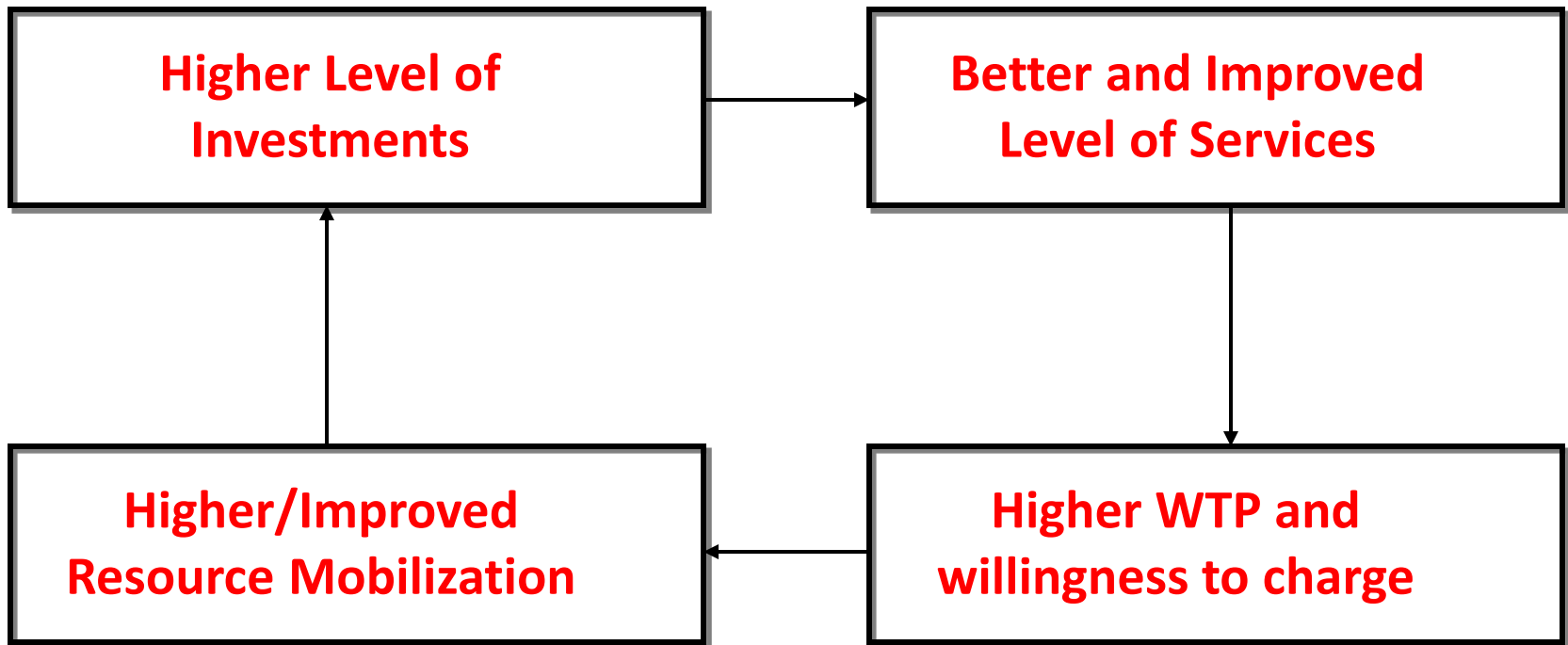
Good urban areas are essential for
sustaining economic growth

High quality municipal infrastructure &
services are essential for enhancing
urban productivity
especially to the poor

Low Level Equilibrium Trap

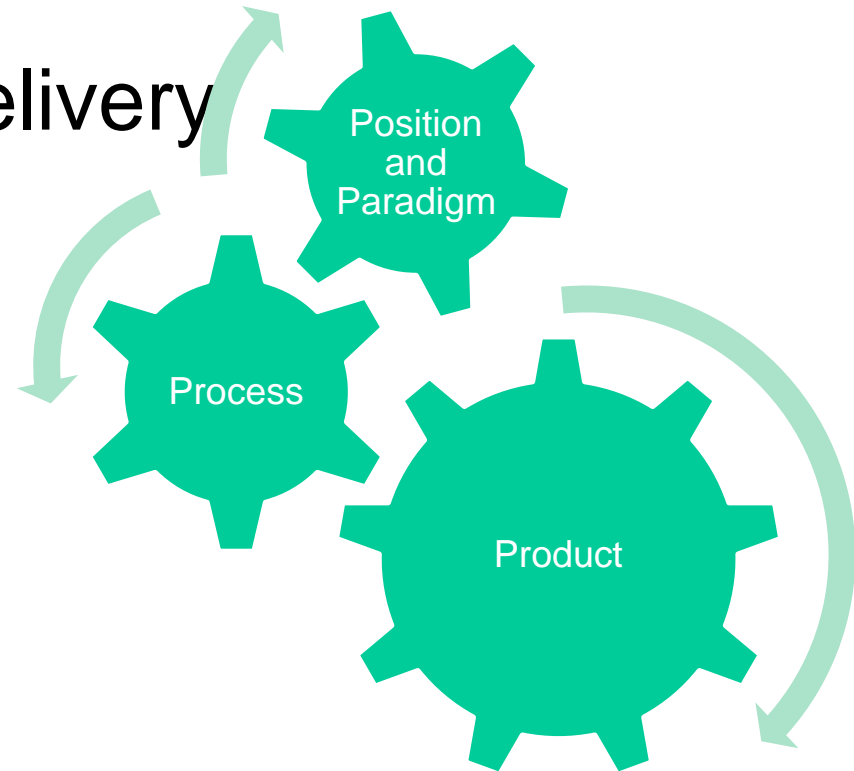


From Vicious to Virtuous Circle



Need for innovations

- To improve service delivery
- To optimize cost

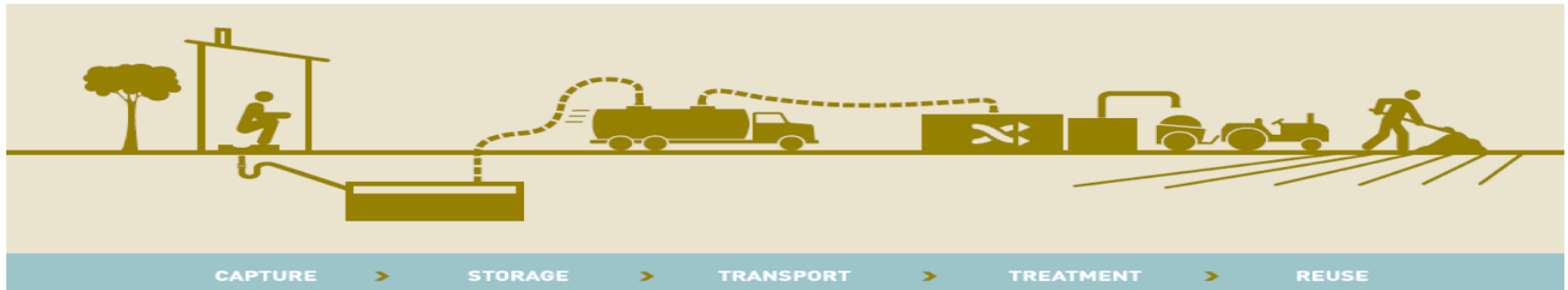


Transformational Change

- Business as usual approach will not work
- Innovation is the mantra – We need to think differently



Reinventing traditional approaches



**Biotechnology Industry Research Assistance Council
(BIRAC) , A Government of India Enterprise**

**Announcing a Grand Challenge India Funding Opportunity
“Reinvent the Toilet Challenge - India”**

MSW Scenario – India

- India generates about 1,60,000 tons of MSW daily (58 million tons per annum)
- Less than 10% of the generated MSW is managed scientifically as per ‘Municipal Solid Waste Rules, 2000’.
- Collection and transport systems have improved; treatment and disposal is weak – 4-8 % only.
- Indian raw MSW has typically - Organic Waste: 50%, Recyclables: 25% & Inerts: 25%

MSW – Need and Urgency

- **Per capita generation of waste varies from 200 gm to 600 gm per capita / day. Average generation rate at 0.4 kg per capita per day in 0.1 million plus towns.**
- **Yearly increase in waste generation is around 5% annually**

LEGAL FRAMEWORK

India – Environment Legislation

- The Parliament has enacted environment related laws based on the Articles 252 and 253 of the Constitution.
 - **The Water** (Prevention & Control of Pollution) **Act, 1974** was enacted under Article 252 of the Constitution.
 - **The Air** (Prevention & Control of Pollution) **Act, 1981** was enacted under Article 253 of the Constitution.
 - **Environment Protection Act, 1986** was promulgated under Article 253 of the Constitution.

Environmental Legislation in India

- **The Water (Prevention and Control of Pollution) Act, 1974**
- **The Air (Prevention and Control of Pollution) Act, 1981**
- **The Environment (Protection) Act, 1986**
 - **Hazardous Wastes (Management & Handling) Rules, 1989**
 - **Bio-medical Wastes (Management & Handling) Rules, 1998**
 - **Municipal Solid Wastes (Management & Handling) Rules, 2000**

Note:

Only Union Parliament is competent to make laws on Environment.

Concerned GOI Ministry: Ministry of Environment & Forests

Legal Obligations

- The Central & State Pollution Control Boards were created post 1974
- All Industries and big Infrastructure projects, before commencing work, are obliged to take permission from the Pollution Control Board under the following Acts (as applicable)
 - The Water Act, 1974
 - The Air Act, 1981
- Also the establishments producing waste like Industries, Hospitals & Municipalities are required to follow the relevant 'Rules' under the 'Environment Protection Act, 1986' as follows:
 - Hazardous Wastes (Management & Handling) Rules, 1989
 - Bio-medical Wastes (Management & Handling) Rules, 1998
 - Municipal Solid Wastes (Management & Handling) Rules, 2000
- Thus there is a legal obligation on the waste generating establishments – both public & private in the country

Responsibility under MSW Rules, 2000

Municipal Authority (ULBs)

Infrastructural development for collection, storage, segregation, transportation, processing and disposal of municipal solid wastes.

State Government

The concerned Departments of Municipal Affairs / Urban Development and Collectors are overall responsible to enforce the provisions of these rules.

Important Features of MSW Rules

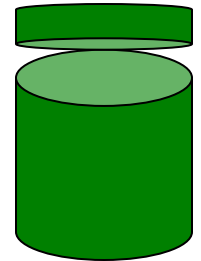
- Source segregation
- House to house collection
- Reduction of paper and plastic – household level
- Involvement of Rag pickers (recyclable)
- Transportation
- Processing
- Final Disposal

Household Waste – Segregation

Segregated Storage – Two Bin system (Green & White)

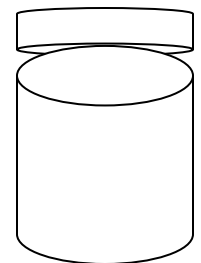
- **Green Bin Waste**

- Food waste of all kinds, cooked and uncooked, including egg shells, bones
- Flower and fruit wastes including juice peels and house-plant wastes
- House hold inert (sweepings/ashes)



- **White Bin Waste**

- Paper, cardboard and plastic, all kinds
- Containers of all kinds excluding those containing hazardous materials
- Packaging of all materials
- Glass, all kinds
- Metals, all kinds
- Rags, rubber, wood
- Foils, pouches, wrappings, sachets, tetrapaks (after rinsing)
- Cassettes, computer diskettes, printer cartridges, electronic parts
- Discarded clothing, furniture and equipment



Collection of MSW

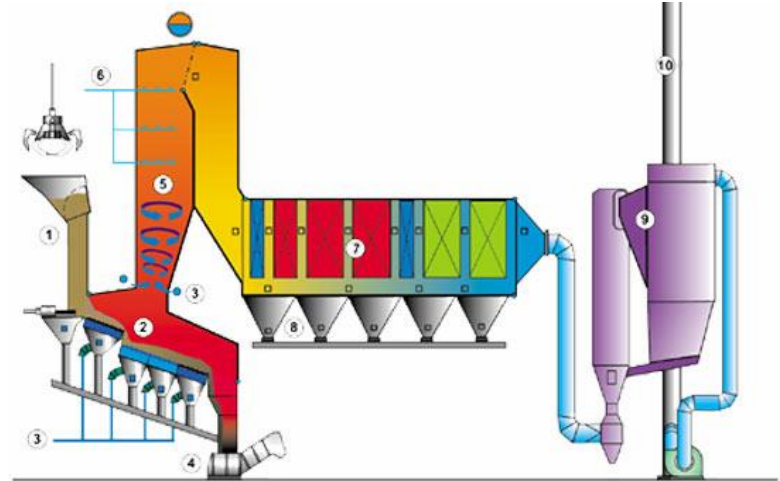
- **House-to-house** collection of MSW
 - Collection on regular pre-informed timings
 - Scheduling by using bell ringing of musical vehicle (without exceeding permissible noise levels)
 - Community Bin collection (Central Bin)
- **Bio-medical wastes and Industrial Wastes** shall not be mixed with municipal solid wastes and such wastes shall follow the rules separately specified for the purpose
- **Horticultural** and **Construction** or demolition wastes or debris shall be separately collected and disposed off following proper norms.
- **Waste** (garbage, dry leaves) **shall not be burnt**

Processing of MSW

- Mixed waste containing recoverable resources shall follow the route of recycling.
- The biodegradable wastes shall be processed by Composting, Vermi-composting, Anaerobic digestion or any other appropriate biological processing for stabilization of wastes.
- Waste to Energy (Incineration) & RDF (Refuse Derived Fuel) can also be used for processing wastes in specific cases.
- Municipal authorities shall adopt suitable technologies to make use of wastes so as to minimize burden on landfill.

Large Cities – Power from MSW

- Suited for MSW of 500 TPD & above
- 100 TPD of MSW generates about one MW of electric power
- The cost of plant is about Rs. eight to ten crores (???) per MW of electricity.



The issue is that the Indian MSW has low calorific value of 1100 Kcal per kg owing to nature of waste and picking of high calorie recyclable material earlier by rag pickers.



Disposal of MSW - Land filling

Disposal

Disposal means final disposal of municipal solid wastes so as to prevent contamination of ground-water, surface water and ambient air quality

Landfilling:

Land filling shall be restricted to non-biodegradable, inert waste and other waste that are not suitable either for recycling or for biological processing.

- The objective is to reduce burden on landfill.
- Land is a scarce resource.

Schedule I Implementation Schedule

Seria I No.	Compliance Criteria	Schedule
1.	Setting up of waste processing and disposal facilities	By 31.12.2003 or earlier
2.	Monitoring the performance of waste processing and disposal facilities	Once in six months
3.	Improvement of existing landfill sites as per provisions of these rules	By 31.12.2001 or earlier
4.	Identification of landfill sites for future use and making site (s) ready for operation	By 31.12.2002 or earlier

**SOLUTIONS HAVE TO
CUSTOMIZED**

Characteristics of MSW in Indian Cities

- MSW generated in India is heterogeneous in density, size and composition
- Characterized by seasonal variations, fluctuations based on festivals and special occasions
- Density of MSW = 0.4 – 0.5 tons/m³
 - *On compaction the density becomes 0.75 tons/m³*
- Low calorific value (Appx 1100 Kcal per kg)

Indian MSW: Typical Composition

Recyclables				Total Compostable Matter	Inerts
Paper	Rubber, Leather & Synthetics	Glass	Metals		
4	0.75	0.75	0.5		
6 %				46 %	48 %

Source: NEERI Research & Experience

After processing, 100 kgs of raw MSW yields:

1. Inerts = 35 kgs
2. Compost = 20 kgs
3. Recyclables = 5 kgs

Rest is Moisture & Gas

Sources of MSW

- Households
- Flats/Multi storied apartments, societies etc.
- Hotels & Restaurants
- Shops/Office/Institutions
- Community Establishments
- Health Care Institutions
- Market yards
- Slums
- Road sweepings
- Construction Waste

Integrated Sustainable Waste Management

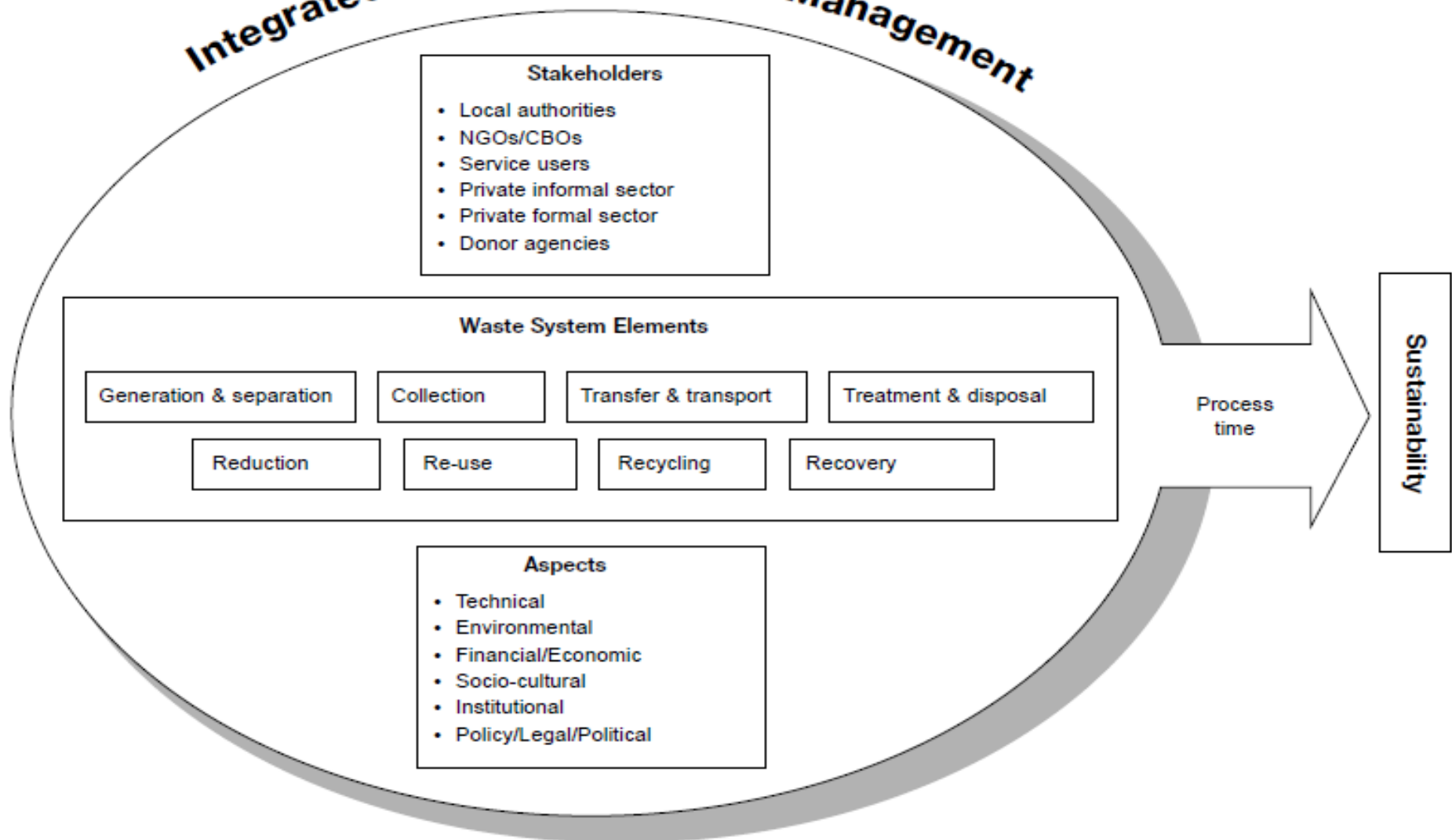
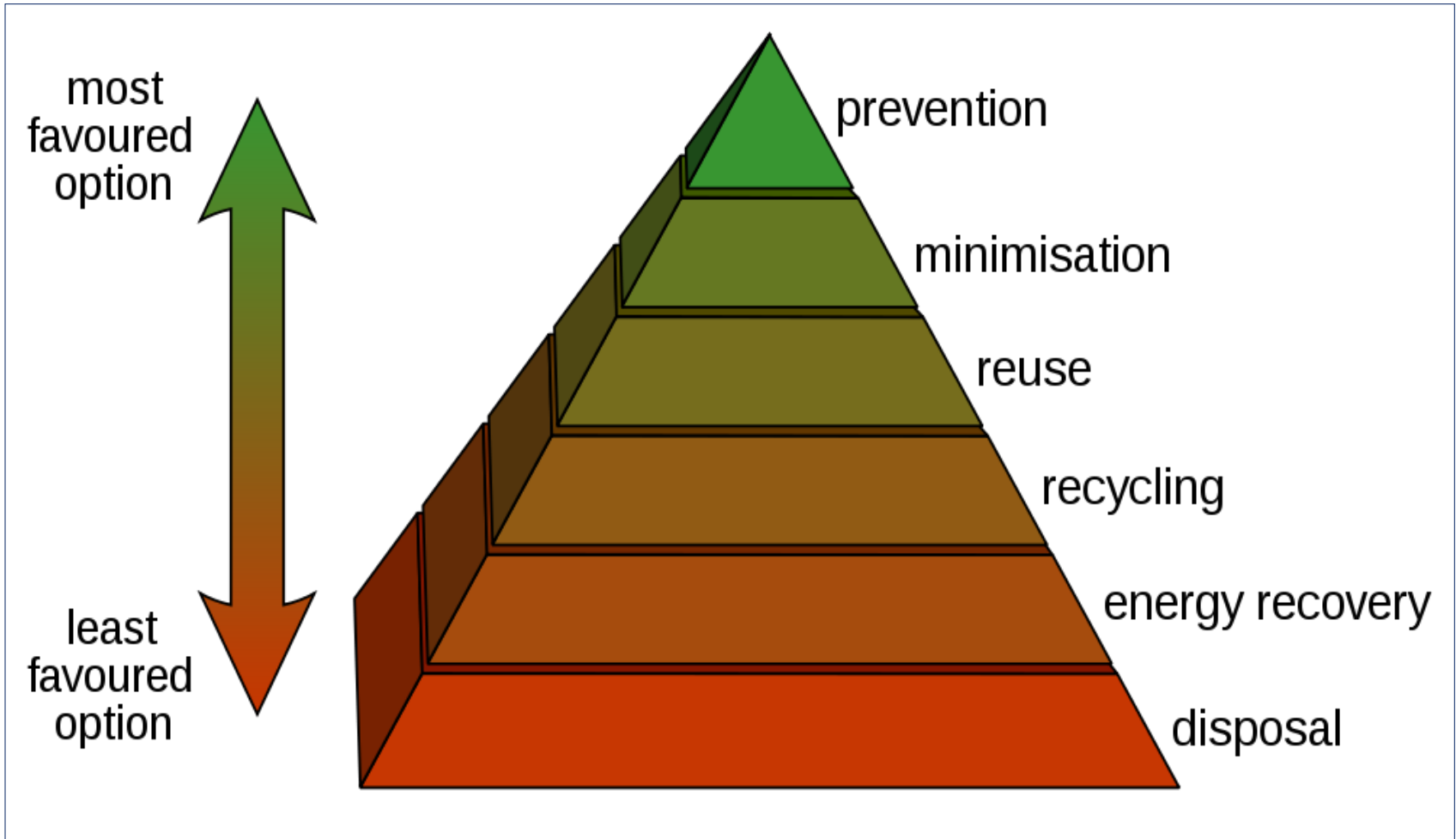


Figure 2. The ISWM model

Waste Management Hierarchy



Integrated Municipal Waste Management Cradle to Grave approach

Collection & Transportation

- House to House Collection
- Transportation & Bin Storage
- Secondary Collection and Transportation



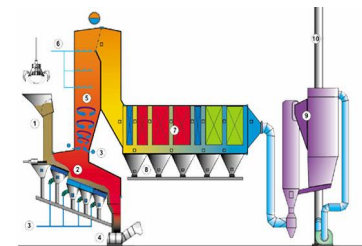
Processing at Site

- Composting
- RDF (Refuse Derived Fuel)
- Waste-to-Energy



Disposal at Site

- Land filling



MSW Processing – Composting (Windrow)

Windrows - Turning operation in progress



Composting - Windrow



Compost Processing Plant



Processing for Wet Organics

Market Waste / Wet waste Processing by Vermi- composting



Waste to Energy

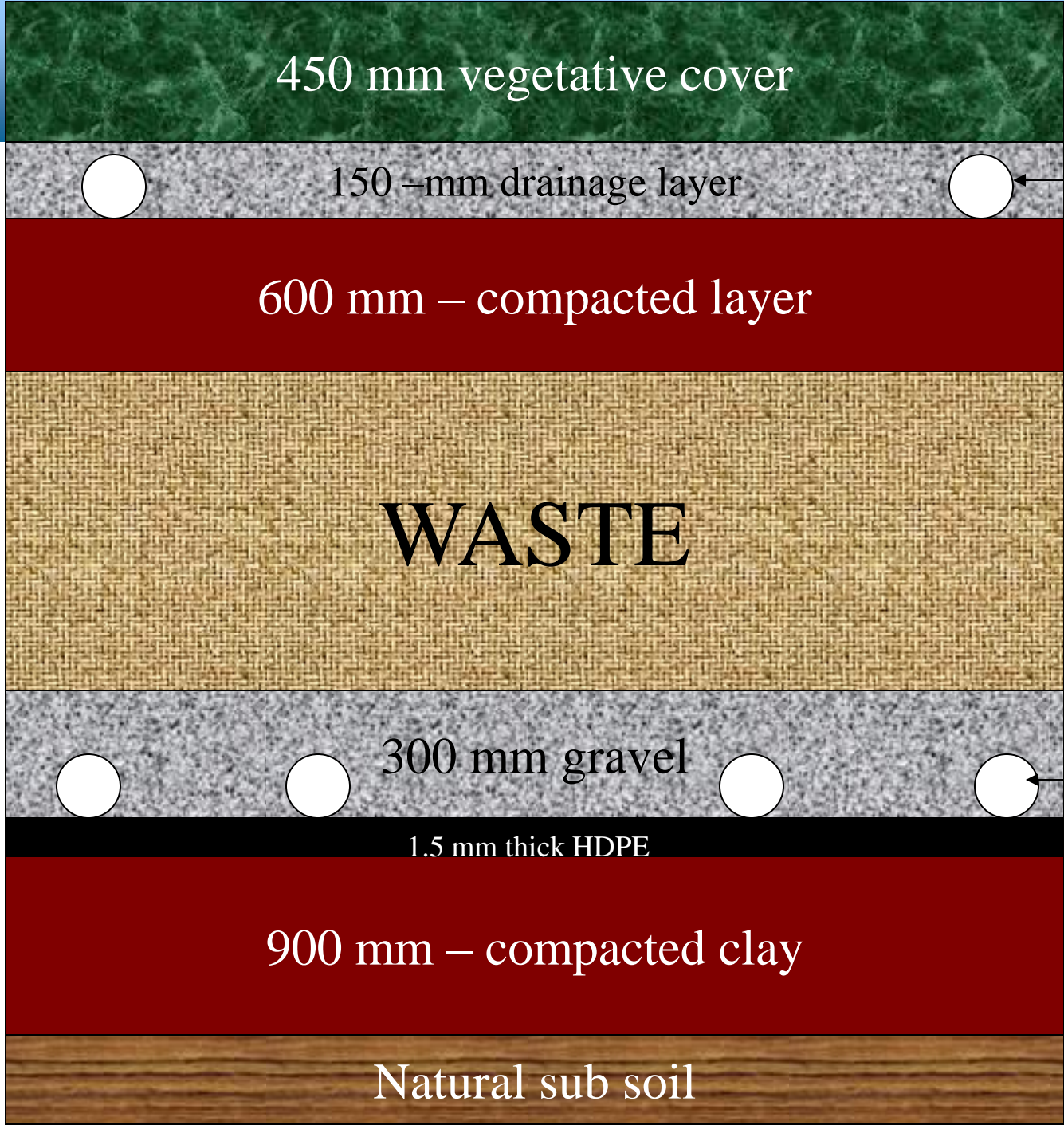
- **Composting** - Due to a lack of source segregation, the yield of composting plants is 7% making it economically unfeasible. Rejects from these plants are more than 50% of the input waste, which require a huge landfill capacity.
- **Bio-methanation** – Lack of source segregation??
- **Waste to Energy** is the conversion of *non-recyclable* waste materials into electricity, useable heat, or fuel through a variety of processes, including *Combustion*, *Pyrolysis*, *Gasification*, *Anaerobic Digestion* and *Landfill Gas Recovery (LFG)*.

Waste to Energy

- WTE – Reduces volume and weight (>80%) – less pressure on land; low GHG potential, less transportation costs, power generation etc.
- Combustion route – incineration is a popular option in Europe, Australia, Singapore, Japan, China and partly in US.
- About 150 WTE plant in China alone.
 - Target - 30 % of MSW through WTE
 - Compelling incentives – tipping fee, favorable power tariffs, tax subsidies etc

Making of A Landfill - the final disposal





100 mm
HDPE leachate
collection pipe

Landfill Layers
Vertical Section

100 mm
HDPE leachate
collection pipe

Making of A Landfill

Landfill – Closed & Capped



Leachate contaminating water bodies



Experiences

- Many successful initiatives in segregation, collection transportation, treatment and disposal
 - Hyderabad, Delhi, Ahmedabad, Surat, Chennai, namakkal etc.

CHANDIGARH

Performance Indicator	Benchmark	Status	Reliability
Household Level Coverage	100%	96.22%	C

Population 2001	900635
Area in Sqkms	114

Solid Waste Management Observations

All urban slums/ colonies/ villages (9 out of 22 with MCC) given on sanitation contract through outsourcing.

House to house removal made available at free of cost.

- The awareness : by way of rallies, Poster Competitions, Debates etc. to ensure “**litter free**” and proper segregation of “**wet/ dry waste**”.

- Involvement of NGOs/ RWAs/ individuals

SURAT

Performance Indicator	Benchmark	Status	Reliability
Household Level Coverage	100%	90.3%	A

- All the garbage vehicles equipped with proper alarm system go to every door step regularly at scheduled time.
- Facility of morning and evening shifts. which operates for 365 days in a year.
- Creating Public Awareness through campaign is the part of contractor's scope of work.
- Centralized complaint management system with modern communication facilities.

Population 2001 **28,77,241**

Area in Sqkms **326.525**

- Provision for segregated waste collection (Dry & Wet).

CASE DISCUSSION ON SURAT

- Selection of kind of vehicle based on width of road.
- Coverage of number of units in each route - 1,000 to 3,000.
- Creating public awareness on garbage management.
- Several meetings with area under control of concern ward office is also held to improve the collection system.
- Vehicles reach concern ward office to get confirmation regarding route monitoring. Ensured timely collection of waste from every house / shop on everyday.
- Drivers and “Swachchhta Mitra” are provided with uniforms & identity cards.
- Concession period - Seven years keeping in mind the useful life of vehicle.
- All the garbage vehicles equipped with proper alarm system

Contd.....

- Complain redressal system developed at each ward office where a unit holder make a complain regarding non-coverage of any society / unit.
- Phone numbers of the supervisory staff communicated to the area
- All the capital investment done by agencies
- The mode of payment on weight basis, which is also an attractive aspect for agency, to work with effectiveness.
- User charges are imposed from 2007-08 .

CASE DISCUSSION ON PIMPRI-CHICHWAD

Performance Indicator	Benchmark	Status	Reliability
Eff. in Collection of Solid Waste	100%	99%	B

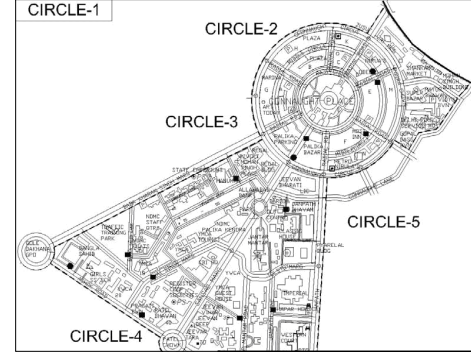
Solid Waste Management Observations

- GIS based vehicle Tracking System for collection & transportation of garbage.
- SWM services provided in all slums and new housing projects.
- Capacity enhancement of plastic to fuel project for eco friendly disposal of plastic waste

Population 2001	10,06,622
Area in Sqkms	170.56

New Delhi

- New Delhi Municipal Corporation
- Waste: 300 TPD
- Scope: Secondary Collection and Transportation of Municipal Waste from 12 circles of NDMC area to the dumpsite
 - Modifications of Masonry Dust Bins
 - Segregation at Garbage Stations
 - Undertake awareness campaign
 - Complaint handling cell
- Period of Operation: BOOT for 8 Years
- Revenue Model: Transport Charges @ Rs. 468 per ton (3% increase every year)
 - Advertisement Revenue from Dhalaos
- Commissioned: September, 2007



Connaught Place
Mandir Marg
Gole Market
Parliament House
Bengali Market
Pandara Road
Lodhi Colony
Jor Bagh
Chanakya Puri
Sarojini Nagar
Moti Bagh
Kidwai Nagar



Before



After



Ahmedabad

Primary Collection through RWAs @rs10/HH no municipal staff

Secondary collection and transportation private contractor (PPP) @
Fixed cost per container trip Rs.395 for central zone & Rs.365 for
other zones.

- ❖ Variable cost per km running is Rs.7/- only.
- ❖ 5% increase per year in variable cost.
- ❖ Establishment of necessary infrastructure carried out by contractors.
- ❖ Daily Appx. 200 trips by Antony Waste Handling Cell Pvt. Ltd. & 100 trips by Ramky Enviro Engineers Ltd.
- ❖ Contract time period – 5 years.
- ❖ NGO/Private Sector Participation Could Result In Savings In Cost To The Extent Of 50% And Improve Efficiency.

Sanitation Photos - Night



Sanitation Photos - Night



CASE DISCUSSION ON NASHIK

Performance Indicator	Benchmark	Status	Reliability
Extent of Segregation of MSW	100%	34.68	B

Solid Waste Management Observations

Population 2001	10.77 Lakhs
Area in Sqkms	259

- Door to door collection started since 1998.
- Successfully running under PPP to date.
- Bin-less city.
- Source segregation in 8 wards with the help of rag pickers.
- Specially designed vehicles having two compartments for dry and wet waste used for MSW transportation

Other Experience: Wealth out of waste : Hyderabad

- WoW work in very close cooperation with RWAs.
- RWAs provide a volunteer and ITC attaches a supervisor.
- Number of street meetings organized to encourage to sell their dry waste.
- Role of IEC - pamphlets and kiosks on “how to segregate” to the households.
- Dry waste storing bags specially prepared are distributed to citizens printed with a serial number, and the phone numbers to contact.
- The bag contains printed information over them about how to use the bags and what to store inside.
- Every family has to keep the member.



Processing, treatment and disposal

Coimbatore SWM - PPP

- Triggered by JnNURM
- From Transfer station till disposal at SLF including Processing and closure of dump sites – Rs. 69 Cr
 - Grants to the extent of 70 % - Rs. 48 Cr
 - Balance capital (30%) to be brought by Private developer i.e. about Rs. 21 Cr
 - Tipping fee

View of the compost plant at Vilapil



Windrows in compost plant



swm benchmarking

Inside view of the compost plant



Initiative: PPP enabled Solid Waste Management, Rajkot

- RMC and Hanjer Biotech Energies Private Limited established waste processing plant on the Built Own Operate (BOO) basis
- RMC acquired land of 100 acre waste land for sanitary landfill site and Waste Processing Plant (Collector office) on 20 year lease.

Role of Hanjer Biotech Energies Private Limited. (HBEPL)

- Installation & Commissioning of Waste Conversion & Processing Plant.
- Entire liability of the equipments of Waste Conversion Processing .
- All products as output of the Waste Conversion & Processing Plant are assets of HBEPL.
- To construct building structure, installation and commissioning of plant.
- Sale/Marketing of products and byproducts and generate revenue.
- Entitlement to mortgage plant, machinery & structure.

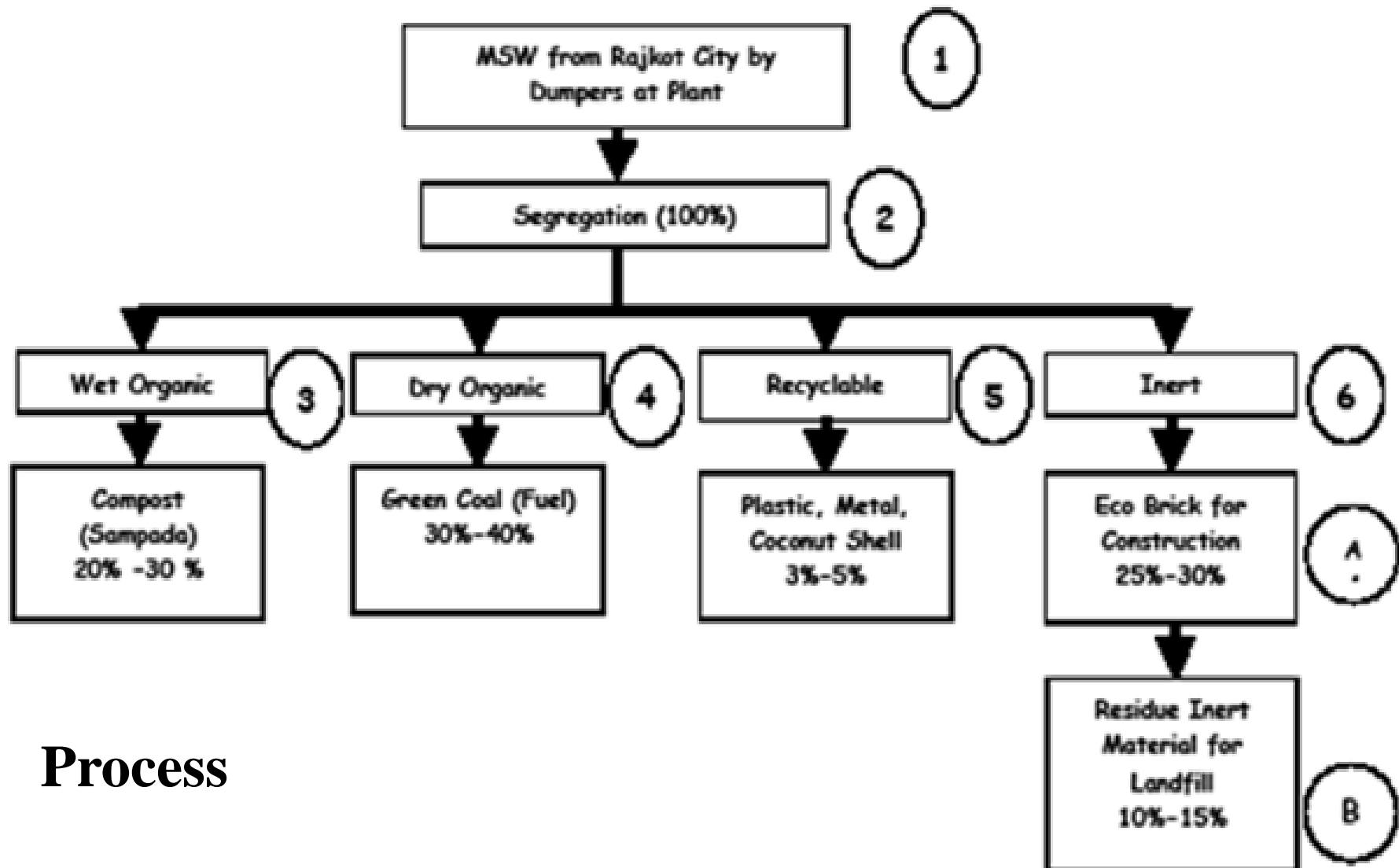
Role of RMC

- To lease 12 hectares land for setting up of processing plant & warehouse
- facilities for the period of 7 years.
- No financial assistance from RMC to HBEPL
- To deliver 300 Metric Tons per day of fresh garbage to plant.
- To provide following utilities
- Motorable access Road upto entrance of premises
- Water & electricity requirement
- Proper disposal of reject as outcome of the treatment.
- Proper disposal of mixed heterogeneous rejected waste not required by the Waste Processing plant.

Waste processing is done in a six staged process

- Initialization, Segregation, Wet Organic Waste.
- Dry Organic Waste, Recyclable Waste, Inert Materials.
- The results made waste plant first of its kind in country
 - a fully Integrated Waste Processing Plant.
- The entire waste of 300 MT of MSW is processed into
 - Bio Fertilizer : 40 MT
 - Fluff (Green Coal) : 70 MT
 - Eco – bricks : 15000 nos.
 - Recyclable : plastic metals and others





Process

Initialization

Segregation:

- **Wet Organic waste** : 20- 30 % . After 40 days wet waste gets transformed into organic compost.
- **Dry organic Waste:** 30- 40% Utilized for making green coal or fluff
- **Recyclable Waste Inert Material:** This waste comprises of about 3% to 5% of total waste and such waste is sold by HBEPL.
- **Inert Material:** Innovative technology has led to use of most of MSW, only 10- 15% goes to sanitary landfill.

OUTCOME

The results has been very encouraging and which has made waste plant first of its kind in country. It is first of fully Integrated Waste Processing Plant. The entire waste **of 300** MT of MSW is processed into

Bio Fertilizer : 40 MT

Fluff (Green Coal) : 70 MT

Eco – bricks : 15000 nos.

Recyclable : plastic metals and others

MSW Treatment Plant -1

- State capital - population of about 8 Lakhs; Estimated Waste Generation - of about 300 tons per day
 - 375 gm/ capita/ day
 - Various studies done to verify this estimate
- City Municipal Corporation (CMC) identified about 4 Ha of land in an adjacent rural area, 15 km away, for setting up a composting plant and a land fill
- Called for bids, and selected a Developer who had to
 - Pay lease rental of Rs. 1/- p.a./ sq.m of land area leased for 30 years
 - Within 18 months achieve mechanical completion, and a further 3 months to achieve full load capacity of 300 TPD;
 - CMC would have to provide 300 TPD ($\pm 5\%$) of MSW at the Composting Facility;
 - CMC defaults on the supply of MSW for 10 days at a stretch, it would pay the Developer a penalty of Rs. 49,000/- per day; and
 - Developer to pay CMC a royalty of 2% of the basic sale price of compost

MSW Treatment Plant -2

- SWM collected – stored in 4-5 transfer stations. Then loaded on tippers to take to the treatment plant
 - CMC **not** to supply building debris, industrial and toxic waste, hospital waste, bio-medical waste - Developer could reject deliveries containing such waste
 - Delivery to the SWM treatment facility was an obligation of the CMC
 - Weighed at site by Developer and CMC together
 - The CMC expected that its entire SWM disposal problem would be solved, and instead of spending money, it would make money on the deal
 - The 4 Ha land was in an undulating terrain, with a small stream at the valley bottom
- Capital investment financed by loans from a bank @ 15% interest, for 7 years
 - Estimated that the entire compost could be sold at between 4000-6000 Rs/ Ton
 - Estimated that around 25% of the SWM could be turned into compost
- Informal meetings between the Developer, Horticulture Department, CMC, Agriculture Department, indicated that the compost would be easily taken up by these departments for their parks, gardens, and rubber plantations
 - The Developer itself was a local company that had agri-based business, and could also take up the compost generated

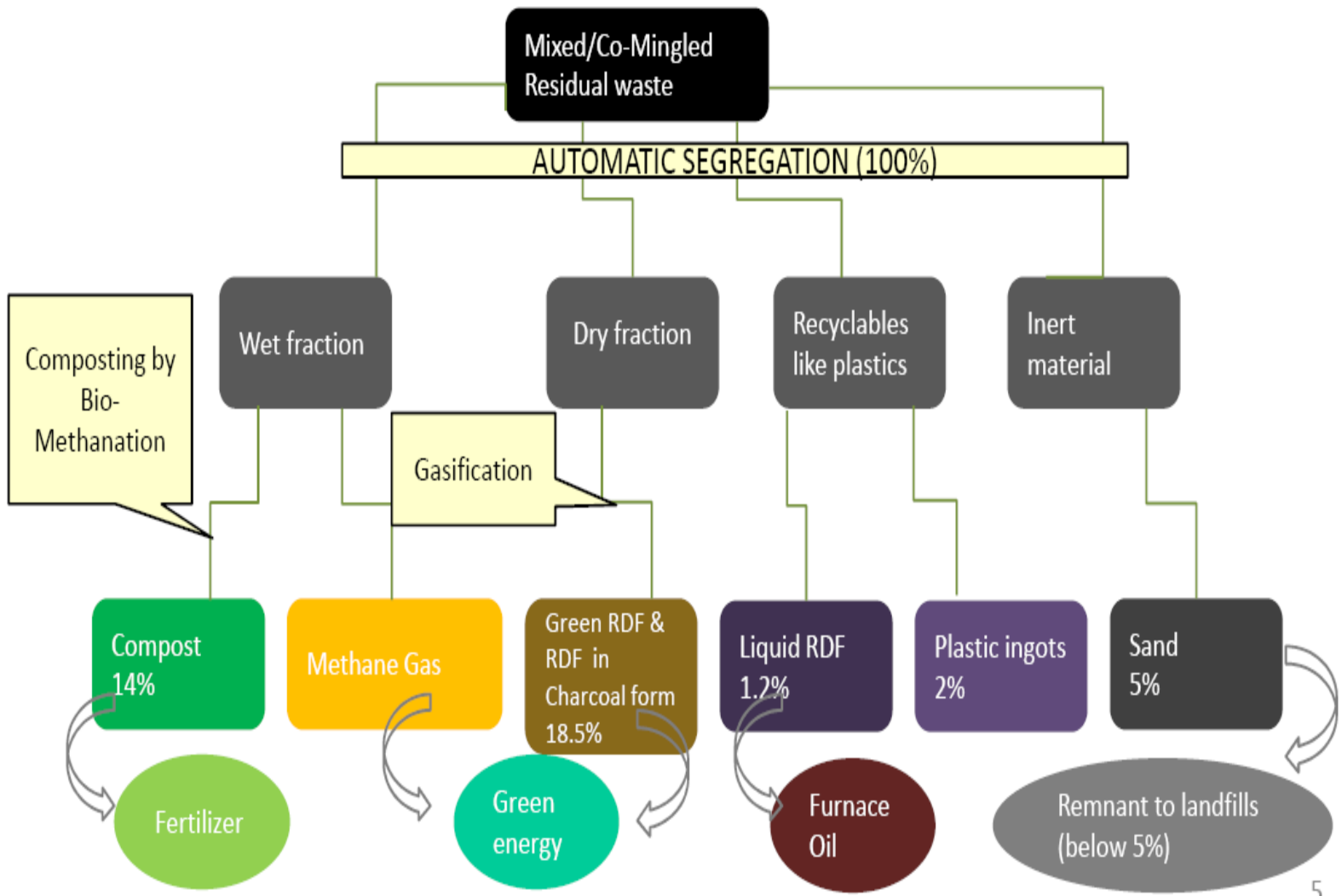


Rajkot

- 300 TPD capacity, operated by Hanjer
- No capital or tipping fee support from ULB
- ULB provided only land and support infrastructure
- Integrated facility producing compost, RDF, plastic ingots and sand
- Capital and O&M cost met from revenues



Green Technology for Green Products: 100% Segregation of Mixed waste



Tipping Fees - Concept

- In PPP mode, the waste management is outsourced to private 'Operators' who are given 'Concession' by the government for periods ranging from 2 years to 25 years
- The operators are selected on BOO, BOOT basis
- In order to recover their investments, the Operator charges 'Tipping Fees' from the Municipality / Waste generators.
- The Tipping Fees is money charged per ton of waste transported / treated / disposed.
- Globally the scientific waste management is done on 'Tipping Fees'.
- The world experience demonstrates 'Tipping Fees' as sustainable model.

MSW Management - PPP

- The experience shows that PPP model can be successful & sustainable over time on 'Tipping Fees' payable to Operator.
- The Operator takes into consideration the following revenue streams for working out the Tipping fees in MSW sector
 - Sale of Recyclables
 - Sale of Compost (Marketing is a big issue though)
 - Sale of Power
 - CDM Revenue
 - Grant / Subsidy / Capital Cost Sharing
- Every month 15 - 20 bids are coming out in the country for engagement of private Operators in MSW management.

Procedure for Getting Private Partner (PPP)

1. **DPR:** Preparation of Detailed Project Report – through a technical Consultant
2. **Financial Structuring** - Assess economic feasibility of Project in PPP mode
3. **EOI** (Expression of Interest) – Short Notice to solicit interest of private players (Bidders)
4. **RFQ** (Request for Qualification) – To further shortlist Bidders as per Technical & Financial requirement of ‘Urban Local Body’ - the bidders who will qualify to submit response to RFP
5. **RFP** (Request for Proposal) – To get ‘Technical’ & ‘Financial’ proposal from pre-qualified bidders.
6. **Select** the responsive Bidder at least (workable) cost.
7. **Issue** ‘Letter of Award’
8. **Sign** ‘Concession Agreement’ or ‘Contract’

Note: The Steps (2) to (8) above can be outsourced to a Transaction Adviser (TA)

How to procure 'Transaction Adviser' (TA) ?

- The state governments requested Government of India (Department of Economic Affairs, Ministry of Finance) to create a Panel of competent TAs – so that the state governments can directly engage them for helping them in PPP projects.
- GOI, in August 2007, has notified list of 11 TAs (www.pppinindia.com)
- The government departments including Urban Bodies can select one from them after getting their financial quotes for the specified jobs to be handled by the TA.
- The 'India Infrastructure Project Development Fund' (IIPDF) assists in meeting 75% cost of such TA procurement.
- Most state governments have set up PPP Cells with a Nodal Officer (generally Finance Secretary) to help the government entities to develop and execute PPP projects.

MSW Management– Other Approaches

- **Swiss Challenge Approach (Bold & Aggressive)**
 - “Swiss Challenge” approach like in AP IDEA (Andhra Pradesh Infrastructure Development Enabling Act, 2001)
 - It substitutes the need for ‘Consultant’ – but it needs careful handling.
- **Cluster Approach (Size Matters)**
 - The state government to encourage cluster approach for a group of municipalities to select a common Operator – ‘Economies of Scale’ & make business sense for the private Operator.
 - The suggestion is to have a project with 300 TPD (tons per day) or more.
- **Capital Grants (Need of the hour)**
 - The capital support to ULBs e.g. JNNURM etc, to that extent, will reduce the capital expenditure required for creation of integrated MSW management Facility.
 - The private Operator, with initial capital subsidy, will charge lesser Tipping Fees, which results into lower cash flows from the ULBs during the concession period.

MSW - Roadmap to effective PPP

- Let us remember that wholesale privatization in one go is not the answer to MSW management
- The privatization process needs to happen in steps
- It makes sense to privatize high technology, capital intensive operations first and gradually move towards labour intensive operations where local knowledge and acclimatization is essential.

● **The general trend towards privatization, in order, is as follows:**

Disposal at Site

- ▶ Remediation of existing Dump site and freeing of land for scientific operations (This is the trump card to reclaim land !)
- ▶ Land filling – Construction & O&M of Engineered Secured Landfill.

Processing at Site

- ▶ Composting
- ▶ RDF / Waste-to-Energy

Collection & Transportation

- ▶ Secondary Collection and Transportation
- ▶ Primary Collection & Street Sweeping