

**SOLID WASTE MANAGEMENT**  
**Overview, Issues, Opportunities**  
**and**  
**experiences**  
**IN INDIA**

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# HOW INTEGRATED SOLID WASTE MANAGEMENT IS DONE?

- SEGREGATION (AT SOURCE)
- COLLECTION/ SEGREGATION
- SEGREGATED TRANSPORT
- SEGREGATED STORAGE/TRANSFER
- DISPOSAL (  
DUMP/LANDFILL/COMPOSTING/BIOGAS/RDF/  
INCINERATION/PYROLYSIS/GASIFICATION/PLA  
SMA)

**But recycling rates in  
Indian Cities are high**



**Thanks to the Informal Sector**

# STORAGE & TRANSPORT

- NEVER DONE IN SEGREGATED WAY.
- NO STORAGE OF WASTE IN SEGREGATED MANNER
- IN FACT SEGREGATED WASTE IS MIXED BACK FOR EASIER TRANSPORTATION.
- COMPACTION NEWLY INTRODUCED...REDUCES TRANSPORT COST BUT ONLY IN LARGE CITIES.

# PROCESSING & DISPOSAL

- CONCLUSIVE DISPOSAL IS ABSENT, EXCEPT AT FEW CITIES.
- ALL OVER INDIA THE WASTE IS DUMPED ON THE OUTSKIRTS OF CITY.
- THIS PRACTICE CONTINUES FOR YEARS TOGETHER
- SCORES OF ACRES OF LAND COVERED BY WASTE DUMP.

# WASTE DUMP-A TICKING TIME BOMB

- WASTE DUMP IS A SOURCE OF DISEASES, GROUND WATER & AIR POLLUTION.
- IT AFFECTS LIFE NOT ONLY OF ADJOINING POPULATION BUT ALSO OF PEOPLE FAR AWAY FROM IT.
- IT IS A SOURCE OF GREEN HOUSE GAS EMISSION DUE TO METHANE EMANATING.
- OCCUPIES HUGE PRODUCTIVE LAND & IF EXPLOITED PROPERLY IT IS SOURCE OF HUGE BUSINESS.





# Possible Costs for LANDFILL BASED MSW Disposal

- e. g. MSW generation 180MT/day.
- Landfill qty( $25\text{yrs} \times 330\text{days} \times 180\text{MT}$ ): 1485000MT
- Capital Cost as per norms( $\text{Rs.}500/\text{MTX}$  above): $\text{Rs.}74.25\text{Cr}$ .
- Operating costs @  $\text{Rs.}300/\text{MT}$  ( $300 \times 180 \times 330$ ):  
 $\text{Rs.}1.8\text{Cr}/\text{Year}$ .
- Land required for Landfill: ( $1\text{sq.mt}/\text{MT} \times 1485000$ ):  
148Ha OR 60Acres

# STATUS OF EXISTING METHODS OF MSW DISPOSAL

- COMPOSTING

- HOW DONE?
- WITHOUT SEGREGATION.
- WITHOUT PROVIDING ADEQUATE AREA.
- WITHOUT PROVIDING AERATION, CURING, WITHOUT CULTURES.
- USELESS COMPOST

- BIOGAS

- HOW DONE?
- WITHOUT SEGREGATION.
- WITHOUT ADEQUATE TIME TO DEGRADE
- WITHOUT PROCESS CONTROL.
- WITHOUT TREATING RESIDUAL LIQUID.
- RESULTS INTO POLLUTION

# FEW (LIMITED) SUCCESS STORIES

- SURAT MUNICIPAL CORPORATION
- PUNE MUNICIPAL CORP
- TRANSFORMING FROM FILTHIEST CITY TO CLEANEST CITY, BUT NO DISPOSAL UNIT
- PROMOTING SWACHH CAMPAIGN, THRU' RAGPICKERS ASSON.
- SEGREGATION & BIOGAS UNITS.
- CAPPING OF A DUMP

# FEW LIMITED SUCCESSFUL ATTEMPTS FOR DISPOSAL OF MSW

- TIMARPUR (DELHI)
  - LIMITED POWER FROM MSW
- PUNE
  - FAILED TO GENERATE POWER BUT MAKING RDF.
  - ONE MORE BIG BIOGAS UNIT ATTEMPTED.
  - MANY BIOGAS UNITS ON 5TPD MSW
  - BIOGAS & POWER GENERATION (LIMITED SUCCESS)
  - INCINERATION & POWER GENERATION
- SHOLAPUR
- JABALPUR
- GOA
  - 100 TPD MIXED WASTE (BIOGAS, COMPOST)



# TEN COMMANDMENTS OF MSW DISPOSAL METHOD

- ① MUST ACCEPT UNSEGREGATED WASTE
- ② MUST TOLERATE VARIATION IN COMPOSITION-MOISTURE
- ③ SHOULD NOT DEMAND SPECIFIC TYPE OF WASTE
- ④ ON ITS OWN SHOULD BE ABLE TO SEPARATE INERT MATERIAL LIKE METAL/GLASS ETC.
- ⑤ MUST BE ALL SEASON MODEL—NOT AFFECTED BY RAIN/WINTER ETC.

# TEN COMMANDMENTS OF MSW

## DISPOSAL METHOD

- ⑥ MUST OPERATE 24X7 ALL YEAR AROUND.
- ⑦ SHOULD NOT REQUIRE HUGE QUANTITY OF LAND AREA NEAR URBAN POPULATION
- ⑧ SELF REVENUE MODEL IN TERMS OF VALUABLE PRODUCT/BY-PRODUCT
- ⑨ FINANCIAL FEASIBILITY SHOULD NOT BE DEPENDENT ON CONCESSIONS (GRANTS/SOFT LOANS ETC.)
- ⑩ TECHNOLOGY SHOULD NOT BE HEAVILY RELIANT ON IMPORTS (SPARES/ REPLACEMENTS/ SKILLED MANPOWER ETC.)

# TECHNOLOGIES QUALIFYING 10 COMMANDMENTS

- PROCESSING

- Thermal Technologies
- i.e. INCINERATION
- RDF PRODUCTION & CO-PROCESSING (CEMENT PLANTS/POWER PLANTS/LARGE PROCESS BOILERS)
- PYROLYSIS BY PLASMA
- BIOGAS + VALUE ADD
- HTC OF BIODEGRADABLE

- NO PROECSSING

- LANDFILL ONLY AFTER GAS RECOVERY & ENERGY GENERATION
- (SHALL NOT BE ADOPTED FOR INDIA)

# LIMITATIONS IN WASTE DISPOSAL

# LIMITATIONS IN MUNICIPAL WASTE DISPOSAL

- SOLUTIONS ONLY FOR BIG CITIES
- NO TAKERS FOR SMALLER TOWNS & VILLAGES WITH INPUT QUANTITY RANGING FROM 5 TO 150TPD
- NO OR LIMITED TIPPING FEE DOES NOT ATTRACT BIDDERS.
- ENERGY POTENTIAL IS NOT ATTRACTIVE.



# LIMITATIONS IN BIODEGRADABLE WASTE DISPOSAL

- ENTIRE SMELL PROBLEM IS DUE TO BIODEGRADABLE.
- COMPOST & BIOGAS TAKE VERY LONG TIME.
- COMPOST REQUIRE LARGE AREA W.R.T. QUANTITY. NOT AVAILBLE IN CITIES/TOWNS
- BIOGAS IS ASSOCIATED WITH LIQUID DIGESTATE DISPOSAL
- DIGESTATE MOSTLY DISCHARGED TO SEWAGE AFFECTING SEWAGE TREATMENT.

# LIMITATIONS IN SEWAGE TREATMENT

- UNTREATED SEWAGE IS PROBLEM IN BIG CITIES (DUE TO INADEQUATE SPACE FOR EXPANSION, DESIGN UNSUITABLE FOR EXPANSION)
- COLLECTION IS PROBLEM IN TOWNS & VILLAGES. TREATMENT IS ABSENT.
- COST OF TREATMENT (OPERATIONS/MAINTENANCE) HIGH
- NO VALUE ADDITION. ALWAYS A COST CENTRE.
- NO WATER RECOVERY. NO VALUE ADDITIONS.

# SPECIALIZED WASTE PROBLEMS

- PLACES OF PILGRIMAGE & ROUTE OF PILGRIMAGE—WASTE COLLECTION/DISPOSAL IS BIG PROBLEM.
- TOURIST PLACES (ESPECIALLY HILLY AREAS)
- PLACES OF HIGH ALTITUDE/MOUNTANEERING.
- PLACES OF DEFENSE AIRPORTS.
- PLACES STRUCK BY CALAMITIES (FLOODS/EARTHQUAKES/Tsunami ETC.)

# LIMITATIONS IN DISPOSAL OF HYGINE AIDS

- COLLECTION, TRANSPORT & DISPOSAL OF SANITARY NAPKINS/PADS.
- COLLECTION, TRANSPORT & DISPOSAL OF DIAPERS.
- INVOCATION OF EXTENDED PRODUCT LIABILITY FOR MANUFACTURERS OF ABOVE PRODUCTS.
- CREATING SPECIAL PUBLIC AWARENESS CAMPAIGNS.
- MOBILE COLLECTION & DISPOSAL UNITS NOT AVAIALBLE

# PROBLEMS LEAD TO SOLUTIONS



NEED

IS MOTHER OF INVENTION





**If there is a will,  
There is a way.**

# OPPORTUNITIES IN MSW DISPOSAL

- DEVELOP SMALLER INCINERATORS
- DEVELOP RDF PRODUCTION TO ACCUMULATE RDF AT ONE BIGGER W2E UNIT.
- IDENTIFY SALE OF HEAT TO INDUSTRIAL UNITS INSTEAD OF MAKING ELECTRICITY.
- EXPLORE ABSORPTION CHILLING.
- HEAT TREATMENT & OTHER FURNACES.
- EXPLORE ALTERNATIVE THERMAL TECHNOLOGIES.
- **SPECIAL CAMPAIGN TO REMOVE WASTE DUMPS & RECLAIM UNDERLYING LAND.**

# OPPORTUNITIES IN BIODEGRADABLE WASTE DISPOSAL

- EXPLORE ALTERNATIVE TECHNOLOGIES FOR CONVERSION OF BIODEGRADABLE WASTE, AVOIDING STORAGE OVER LONG PERIOD.
- EXPLORE FOR QUICK CONVERSION IN FEW HOURS WITH VALUE ADDITION.
- EXPLORE TECHNOLOGIES TO EXTRACT BIODEGRADABLE FROM MIXED WASTE.
- EXPLORE DRY DIGESTION TO AVOID WATER USAGE.
- EXPLORE TECHNOLOGIES WITH ADOPTION TO CAPACITY INCREASE & SMALLER FOOTPRINT.
- EXPLORE IN-VESSEL COMPOSTING FOR TOWNS/VILLAGES.

# OPPORTUNITIES IN SEWAGE TREATMENT

- TRADITIONAL SEWAGE TREATMENT REQUIRES HUGE ENERGY FOR AERATION & HUGE SPACE/M<sup>3</sup> OF INPUT LOAD.
- EXPLORE ALTERNATIVE TECHNOLOGIES WITH LESSER ENERGY & COMPACT FOOTPRINT.
- EXPLORE WATER EXTRACTION
- EXPLORE POSSIBILITY OF PHOSPHATE EXTRACTION & SALE POSSIBILITY.

# SPECIAL SOLUTIONS FOR SPECIALIZED WASTE PROBLEMS/PLACES

- EXPLORE COLLECTION TECHNIQUES WITHOUT HUMAN TOUCH.
- EXPLORE QUICKEST CONVERSION PROCESSES
- EXPLORE SMALL FOOTPRINT TECHNIQUES.
- WATER LESS TOILETS/LOOS.
- HILLY AREA BEING SATURATED WITH SOAK PITS, FIND ALTERNATIVE METHOD.
- CENTRALIZED DISPOSAL UNITS AT MOUNTAINEERING CAMPS.
- RADICAL DISPOSAL UNITS FOR AIRFORCE STATIONS.

# OPPORTUNITIES IN DISPOSAL OF HYGIENE AIDS

- CREATE MOBILE DISPOSAL UNITS FOR CONCLUSIVE DISPOSAL.
- CREATE STATIONARY DISPOSAL UNITS FOR LARGE LADIES DWELLINGS.
- DEVISE CAMPAIGN FOR PUBLIC AWARENESS TO USE ABOVE.
- ENGAGE THE MANUFACTURERS FOR EXTENDED PRODUCT LIABILITY

# CONCLUSIVE DISPOSAL REQUIRES TECHNOLOGY INTERVENTION FOR BETTER ENVIRONMENT



THANK YOU VERY MUCH FOR  
PATIENT HEARING

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