Public Private Partnership
In
Waste Management
- Experience & Key Issues

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Environment Protection - International Realization

- The United Nations, on 5th June 1972, organized an international conference on Human Environment at Stockholm, Sweden.
- This was first comprehensive international attempt to articulate sustainable development – Environment protection in view of growing world population and economic growth.
- The conference recognized the need for specific international and national actions to ensure that economic growth takes place with due regard to environmental protection and natural resources conservation.
- The United Nations Environment Program (UNEP) was created in this conference.
- The opening day of the conference, June 5 was declared as the World Environment Day.

India – Environment Legislation

- The Constitution of India provides the bedrock for environmental legislation in the country.
- According to the Indian Constitution, the areas of responsibility between the Central and State Governments have been defined in Central, State, and Concurrent Lists (VII Schedule).
- 'Environment' does not figure in any of these lists.
- The Parliament has enacted environment related laws based on the Articles 252 and 253 of the Constitution.
  - **Article 252**: Power of Parliament to legislate for two or more States by consent and adoption of such legislation by any other State.
  - **Article 253**: Legislation for giving effect to international agreements.

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.

GOI Ministry: Ministry of Environment & Forests

Environment Protection Act, 1986 (Section 15)

the fear of law….

Whoever fails to comply with or contravenes any of the provisions of this Act, or the rules made or orders or directions issued there under, shall, in respect of each such failure or contravention, be punishable with **imprisonment** for a term which may extend to five years with **fine** which may extend to one lakh rupees, or with both.

And in case the failure or contravention continues, with additional fine, which may extend to five thousand rupees for every day during which such failure or contravention continues after the conviction for the first such failure or contravention.

Solid Waste

- Industrial Waste (Hazardous Waste)
- Hospital Waste (Bio-medical Waste)
- Domestic Waste (Municipal Solid Waste)

Waste Pollutes Environment – i.e. Air, Water & Soil

India – from 'Developing' to 'Developed' nation

- India is midst of tremendous infrastructure & industrial growth.
- Greater growth means greater waste generation.
- The growing waste is impacting Environment (Air, Water, Soil) like never before.
- We need proactive approach to create 'Waste Management Infrastructure' for scientific management of waste.
- Waste management infrastructure is a 'must utility' in Master Plans of all developed cities across the world.
- India has to do lot of catching up to be truly called modern country.

PPP in Waste Management

- As per law, the onus of treating & safe disposal of the waste is with the generator of waste.
- This legal obligation covers all waste generating establishments – both public & private in the country.
- This means all industries and hospitals have to treat the waste they generate.
- But they are not specialised in waste management.
- The private sector steps in to collect & treat the waste produced by Industries, Hospitals & Municipalities.
- The private sector, in partnership with the government, establishes 'Common Waste Storage, Treatment & Disposal Facilities' for scientific management of the waste (TSDF).
- The PPP (Public–Private–Partnership) in waste management is the best solution for scientific waste management.

Why PPP in Waste Management ?

- The worlds experience demonstrates that government agencies cannot manage waste.
- Waste management is a 24x7, highly specialised and zero tolerance service – which is best provided by private sector 'Operator'.
- The government agencies select the competent private Operator through a transparent, competitive bidding process.
- The government provides suitable land to the Operator for the establishment of Common Waste Storage, Treatment & Disposal Facility.
- The government signs a long term 'Concession Agreement' with the Operator for providing the service.
- The Private Operator brings in Capital, Technology and Manpower to establish and operate the common Facility (TSDF) as a commercial entity.

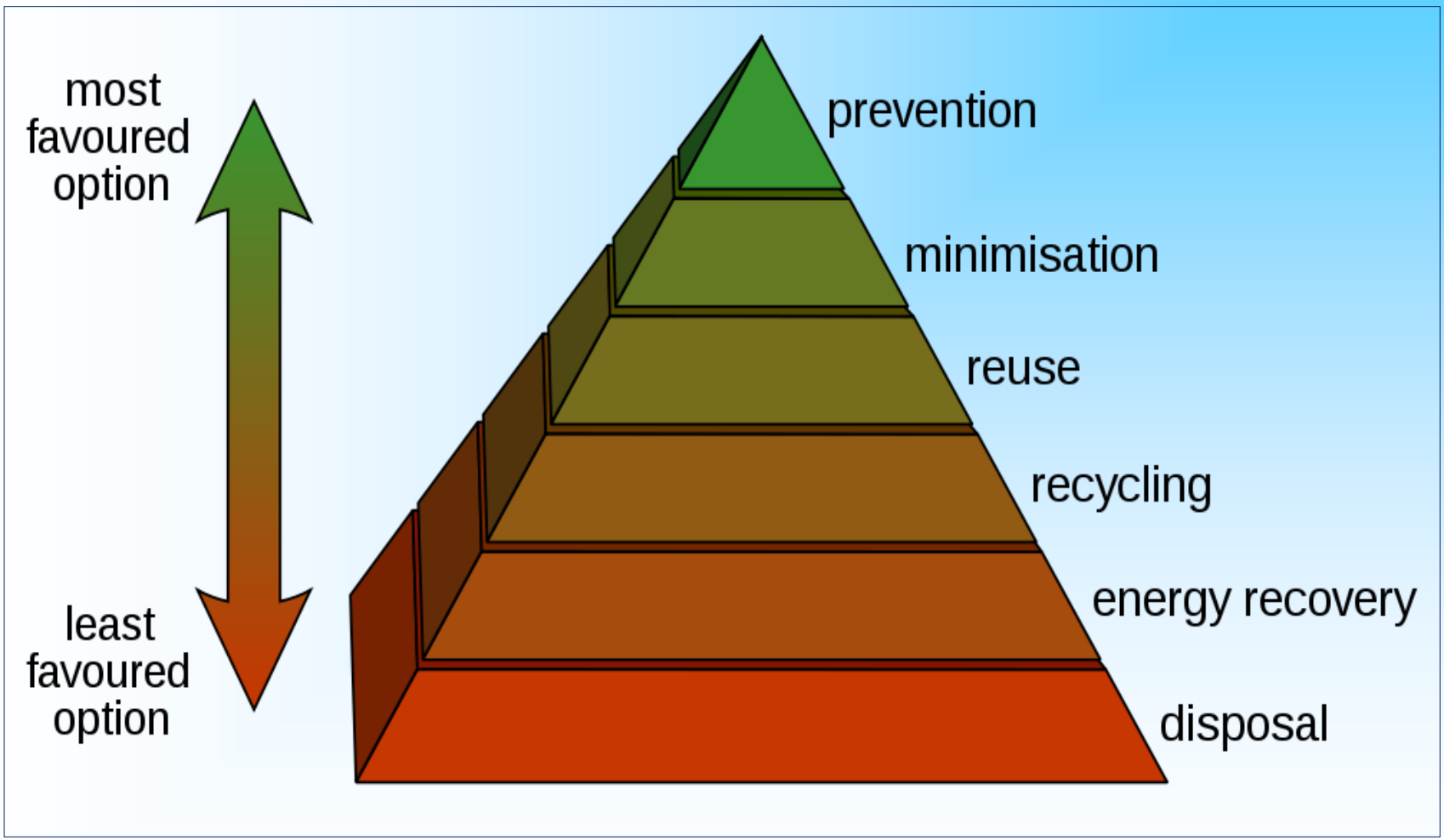
Why PPP in Waste Management ?

- The Operator collects the waste from the doorsteps of the waste generators and treats & disposes the waste in the Common Facility.
- The Operator charges 'Tipping Fees' (fees per ton of waste) from the individual waste generators for providing the service. This is 'Polluter Pays' principle.
- The Operator recovers his investment & operational expenditure over the period of Concession Agreement.
- The PPP in waste management is a 'win-win-win' proposition for the Waste Generator, the Government and the Operator.
- Of course the greatest winner is the 'Environment'.
- We will have sustainable growth & development only when we manage our waste and protect environment.

Concept of Waste Management

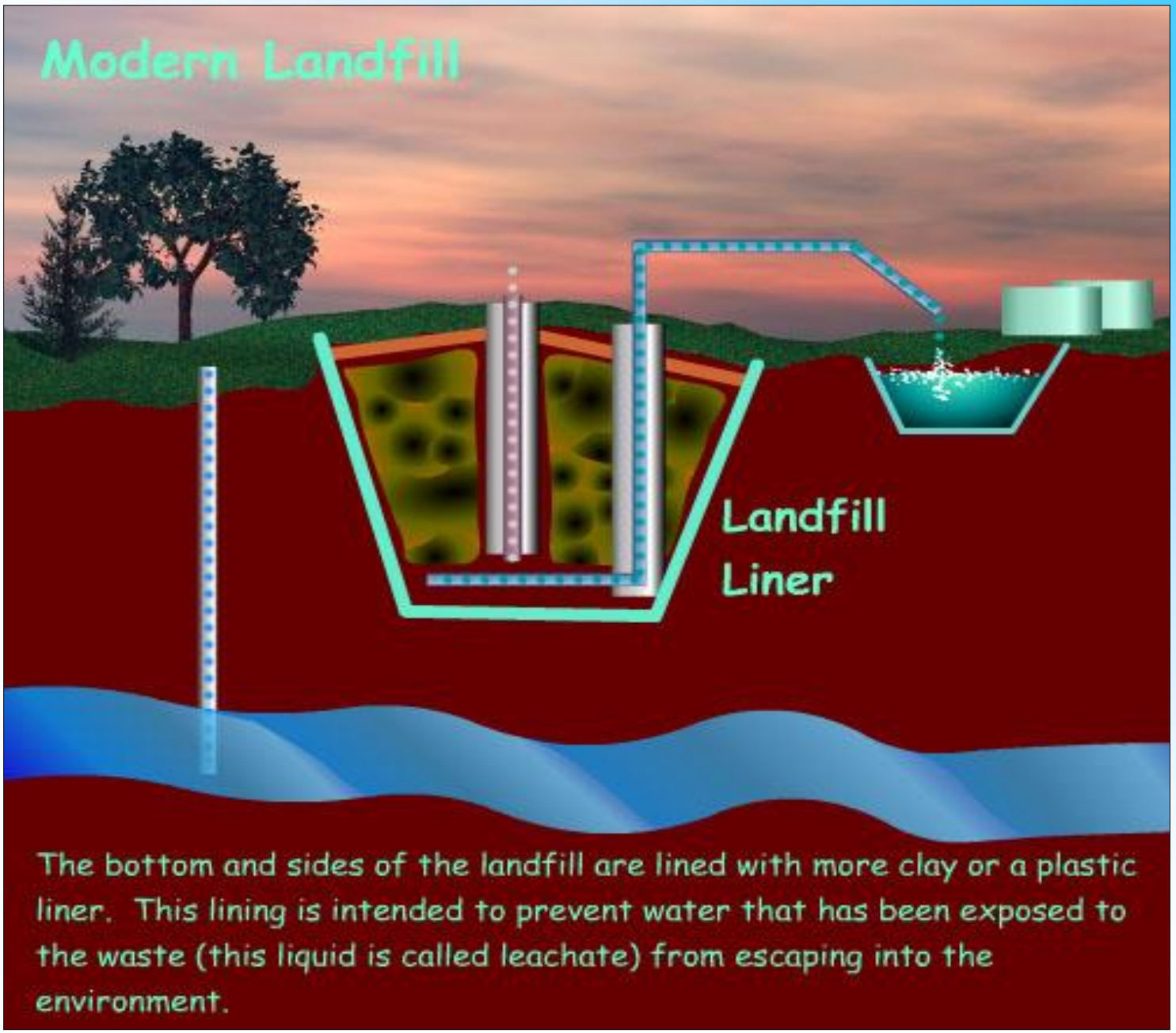
- Waste Management
  - Reduce
  - Reuse
  - Recycle / Recover
  - Dispose
- All waste material, after exhausting the options of recycling and recovery, needs to be safely disposed. The Disposal is done (scientifically) in two ways namely:
  - **Bury** (Engineered Landfill)
  - **Burn** (Incinerator)
- Waste management has to be done without causing any damage to Environment (Air, Water & Soil)

Waste Management Hierarchy



Bury (Engineered Landfill)

- The waste material is deposited in engineered landfills.
- This is a waste containment system which separates the waste from surrounding environment – air, water & soil.
- It prevents Leachate (waste liquid) from percolating and contaminating the sub-surface water.
- It controls gaseous emissions.


Modern Landfill
Landfill
Liner
The bottom and sides of the landfill are lined with more clay or a plastic liner. This lining is intended to prevent water that has been exposed to the waste (this liquid is called leachate) from escaping into the environment.

Making of a Landfill - the final disposal

Landfill in making

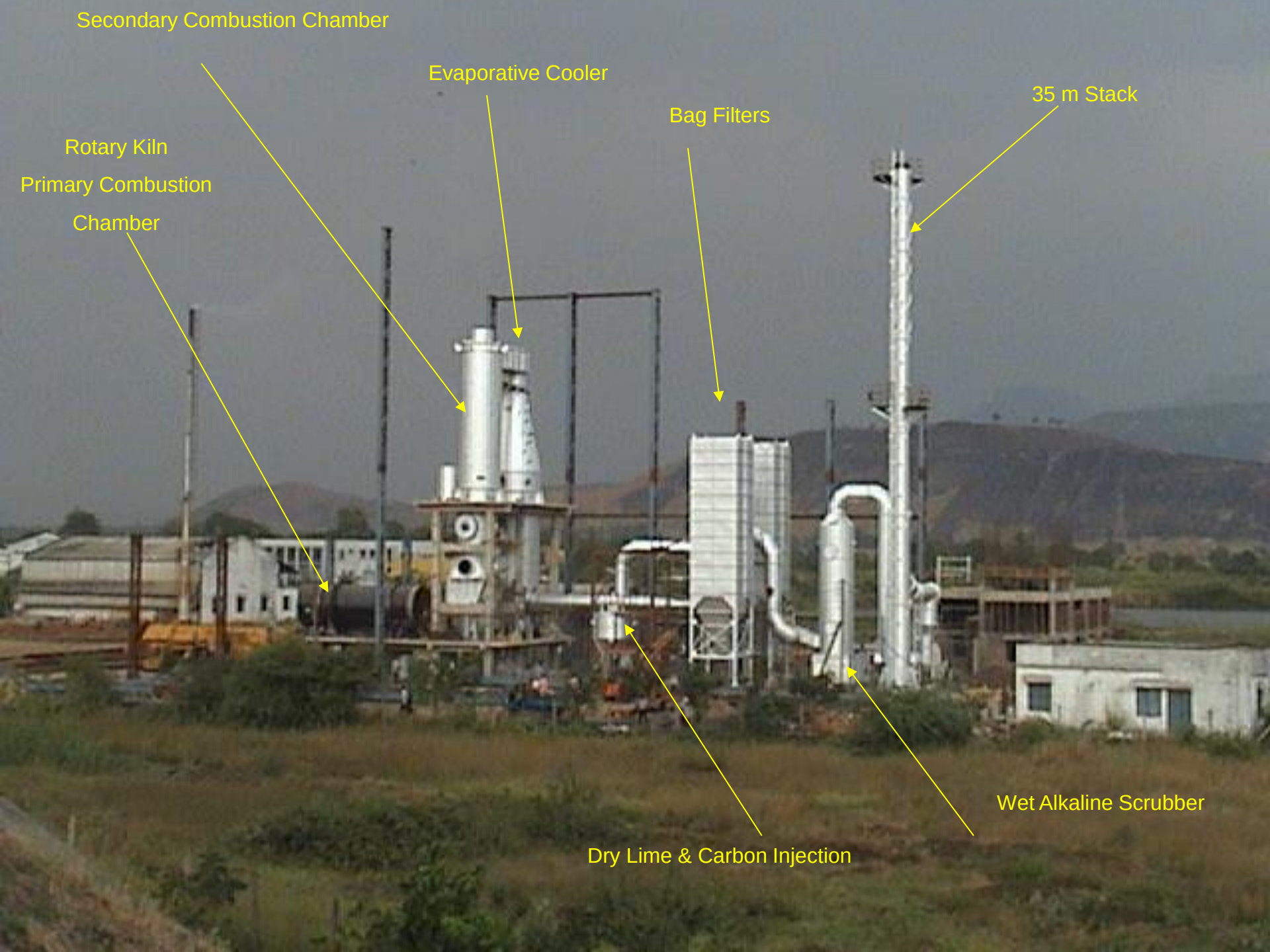
Closure & Capping of a Landfill

Burn (Incinerator)

- The waste material is scientifically burnt in an Incinerator.
- Incineration is high temperature, thermal oxidation process.
  - The toxic ash is collected safely.
  - The acidic gases, formed due to combustion, are neutralised.
  - The particulate matter is captured.
  - Carcinogenic gases, like dioxin formation, are avoided.

Incinerator

(Burning of Waste under controlled conditions)


Secondary Combustion Chamber
Evaporative Cooler
35 m Stack
Bag Filters
Rotary Kiln
Primary Combustion
Chamber
Wet Alkaline Scrubber
Dry Lime & Carbon Injection

Industrial Waste Management

Corrosive

Reactive

Ignitable

Toxic

Industrial Waste Management

- In India, there are about 40,000 nos. of industrial waste generating units.
- These industries generate 7 million tons of waste annually.
- However only 50% of this waste is scientifically managed through Common Facilities (TSDFs).
- The rest is either stored and most of it is illegally thrown in the environment adversely affecting Air, Water & Soil and causing immense Safety, Health & Environment problems.
- The state Pollution Control Boards have to deal with the erring industries strictly.
- There is need to establish more TSDFs (Common Storage, Treatment and Disposal Facilities) in uncovered areas.

Industrial Waste Management – Successful PPP

- The department of Industries/PCBs facilitate establishment of a TSDF in PPP mode through competitive bidding.
- The government allots land (around 100 acres) on nominal lease to the successful Operator.
- The Operator establishes the TSDF and operates it.
- The Concession Period is typically 25 years.
- Generally one TSDF caters to all industries in the state.
- The Operator collects waste from the doorsteps of industry, transports to the TSDF for treatment & disposal.
- The Disposal option is Incineration or Land-filling depending upon waste type.
- The Operator charges tipping fees (Charges per ton) from the waste generators.
- The 'tipping fees' is logically decided/revised by the Operator, PCB, Industries department and the Industry Associations.

TSDF – Google View

TSDF – Closer View

Biomedical Waste Management

Biomedical Waste

- Biomedical waste is generated by healthcare establishments, research facilities and laboratories.
- India is witnessing increased generation of BMW because of:
  - expanding population & access to health care
  - changing epidemiological profile
  - modern medical practices
  - practice of 'disposables'
- The BMW has high potential for diseases transmission and carries a higher potential for infection and injury compared to any other type of waste.
- Illegal picking of BMW for recyclables causes needle injury & infection, tetanus, sepsis, hepatitis, HIV, AIDS etc.
- The safe and effective management of biomedical waste is not only a legal necessity but also a social responsibility.

BMW – Generation & Safe Handling

- India generates 500 tons of BMW per day of which only about 70% is managed scientifically.
- The rest mixes with municipal solid waste and the infection gets multiplied and spreads all over.
- The scientific management of the BMW is done by the private Operator, who establishes and operates the Common Facility.
- The government (Department of Health & Pollution Control Board) are responsible for the selection of the Operator through the competitive bidding process.
- The bidding parameter is the cost the Operator will charge 'per registered bed of the hospital' per day.
- Today the average rate is Rs. 6.50 per registered bed per day.
- We have around 190 Common Facilities in India to mange BMW.

BMW – Duties of Operator

- Typically the Operator gets a 'Concession' for 5 years to manage the BMW of all health care units within a defined geographical jurisdiction.
- One common Facility requires at least 7500 beds within its jurisdiction to be economically viable.
- The common Facility requires one acre land area.
- Typically we need one common Facility for a large district. If districts are small then one Facility caters to group of districts.
- The waste is segregated in the hospitals in colour coded bags.
- The Operator collects the segregated waste from the hospitals & transports to the Common Facility.
- The Common Facility has equipments like Incinerator, Autoclave, Shredder etc for treatment of the BMW.

Hospital Waste in Colour Coded Bags

Bag / Container	Type of Waste	Method of Treatment (Common Facility)
Yellow Bag	Human anatomical waste, Animal tissues, Soiled waste, Discarded medicine	Incineration
Red Bag	Disposable items such as syringes, blood bags, urine bags, IV tubes, tubings, catheters, gloves, aprons etc.	Autoclaving followed by Shredding
Blue Puncture Proof Container	Sharp wastes – needles, syringes, scalpels, blades, lancets, broken ampoules	Autoclaving followed by shredding and disposal in Landfills.

BMW Management Equipment

Colour Coded Bins

BMW Transportation

Incinerator

Autoclave

Shredder

Municipal Solid Waste Management

Waste Segregation is Key to Waste Management

MSW – Challenge before the nation

- Urban India generates 1.6 lakh tons of municipal waste every day.
- So far around 10% of MSW is scientifically managed.
- Governments & Municipalities are obliged to ensure scientific management of MSW as per Rules.
- All Urban Local Bodies (ULBs) were supposed to comply with the MSW Rules by December, 2003.
- The ULBs have challenges of commercial & technical capability, funds, land etc.
- GOI (Ministry of Urban Development) is supporting ULBs with capital grant under JnNURM etc.
- Major ULBs have entered into PPPs with private Operators for MSW management:
  - Collection & Transportation
  - Processing & Disposal

Municipal Solid Waste - Components

- Recyclables (Paper, Plastic, Glass, Metal etc) 20%
  - Informal unhygienic system operates & most of Recyclables are recovered.
- Organic Matter (Green Waste) 50%
  - Dead organic matter decays with oxygen (Aerobic) and without oxygen (Anaerobic) – causes damage to environment.
  - The decay of organic matter needs to be controlled by human intervention.
  - The organic matter is processed & stabilized – Converted into Compost, Bio Gas (Bio-methanation).
- Inerts (Silt, Ash, Rejects of Composting) 30%
  - Deposited in Sanitary Landfill.

Waste Segregation is Key to Waste Management

Municipal Waste Management

1. Municipal waste is collected from households & establishments and transported to the Site for processing & disposal.
2. Various Processing Options are:
   - Composting, Bio-Gas, RDF (Refuse Derived Fuel), Waste-to-Energy
3. Disposal Option
   - Scientific Landfill

- The Private Operator charges Tipping Fees from the ULBs. The Tipping fee is Charges per ton of Waste:
  - Collected & Transported
  - Processed & Disposed

MSW Dump Reclamation – Potential for Carbon Credits

(Success Story – Gorai, Mumbai)

Gorai – Dec, 2006

Gorai – June, 2009

- **Gorai Dumping Ground**
  - Spread over 50 acres land in western suburbs of Mumbai
  - Accumulated 23 lakh tons of waste between 1972 - 2007
- **Mumbai Corporation capped it in Aug 2009**
  - Stinking mountain of garbage turned into contoured landscape hill
  - Project cost = Rs. 50 Cr.
- **CDM Benefit to Mumbai Corporation**
  - It earned Rs. 72 crores through Carbon Credit deal.

Composting – Material Balance

- 100 Tons Raw Wet MSW Composition:
  - Organics= 50 Tons
  - Recyclables= 20 Tons
  - Inerts= 30Tons

- Post Aerobic Composting:
  - Compost = 08 Tons
  - RDF (Including Plastic*) = 35 Tons
  - Landfill Material = 25 Tons
  - Loss (Moisture, Gas, Leachate) = 32 Tons

* Plastic is 4 Tons

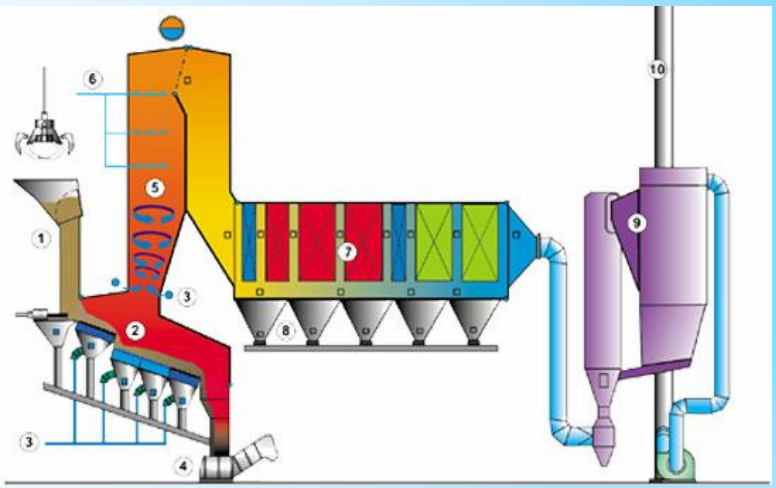
India MSW Incineration

- Due to a lack of source segregation, the yield of composting plants is only 8% making them economically unfeasible. Rejects from these plants are more than 50% of the input waste, which require a huge landfill capacity.
- In India the MSW is not segregated- making 'Biomethanation' impossible and 'Composting' difficult with low yield.
- Incineration is an efficient way to reduce the burgeoning waste volumes (58 million tons per annum) and demand for scarce landfill space.
- WTE replaces 'base load' coal and gas fired power plants – saving fossil fuels and emissions thereof.
- Incineration provides the best way to eliminate methane gas emissions from waste management processes. It generates clean renewable energy.
- With skyrocketing urbanisation and ever increasing waste (with ever increasing heat content), the time for WTE is now for future sustenance.

India MSW – amenable for Incineration

- 41 India cities have more than 10 lakh population amounting to 54,000 TPD of MSW– thus have WTE potential of 720 MW in the near future.
- The combustibles amount to around 40% of raw weight of MSW.
- LCV (Lower Calorific Value) is the heat value of the raw MSW expressed in KCal/kg or KJ/kg (1 Cal = 4.184 KJ)
- The MSW must have LCV of 6000 KJ/kg – to qualify for WTE process.
- The LCV values of Indian Cities are: Mumbai = 8000 KJ/Kg, Delhi = 7000 KJ/Kg, Bangalore = 6070 KJ/Kg, Hyderabad = 6000 KJ/Kg
- Waste to Energy means– burn MSW to heat water, produce steam, which runs Turbine to produce electricity
- Typically in India 80 TPD of waste generates = 1 MW of Electricity.

India – Cost & Economics of WTE Plant



- The cities with MSW of 500 TPD or more are suitable for WTE projects.
- The capital cost of establishing a WTE Plant is over Rs. 14 crores per installed MW capacity (thanks to dollar escalation!)
- The annual Operating Cost of WTE Plant is 10% of the Capital Cost.
- Proven successful models in the world– a combination of 'Tipping Fee' & 'Preferential Tariff' – to be the guiding principle for India.
- 'Model Concession Agreement' for MSW management including WTE need to be developed – Ministry of UD & MNRE

AEB, Amsterdam, WTE Plant – World's Best!

WTE – Where Beauty meets the Beast !

Spittelau WTE Plant, Vienna, Austria

PPP in MSW – Yet to mature

- The PPP in MSW is yet to attain maturity compared to Industrial & Medical waste.
- There are many unscrupulous players in the private sector who compromise with quality & environment.
- The Municipal Commissioners & Private Concessionaires are both in the learning curve.
- MSW management has not stabilised as a business – where many dare not stake their money.
- We need loads of education, training & public awareness.
- MSW Business has numerous instances of Murphy's Law which states that – if anything that can go wrong will go wrong!
- However, when the going gets tough – the tough get going.

Success of PPP in Waste Management Sector – Key Factors

- Political will at the highest level and commensurate administrative action.
- Clarity on purpose and objectives of PPP.
- Leadership & committed administration.
- Enforcement by 'Pollution Control Boards'.
- Respect 'Concession Agreement' by Public & Private partners.
- Treat private Operator as a partner (Bedrock of PPP).
- Timely Tipping Fees payments to the Operator.

Cheers !

&

Thanks for your attention