

Waste to Energy: Policy Issues, Options and Prospects in India

Presentation by
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at
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Status of Solid Waste Management

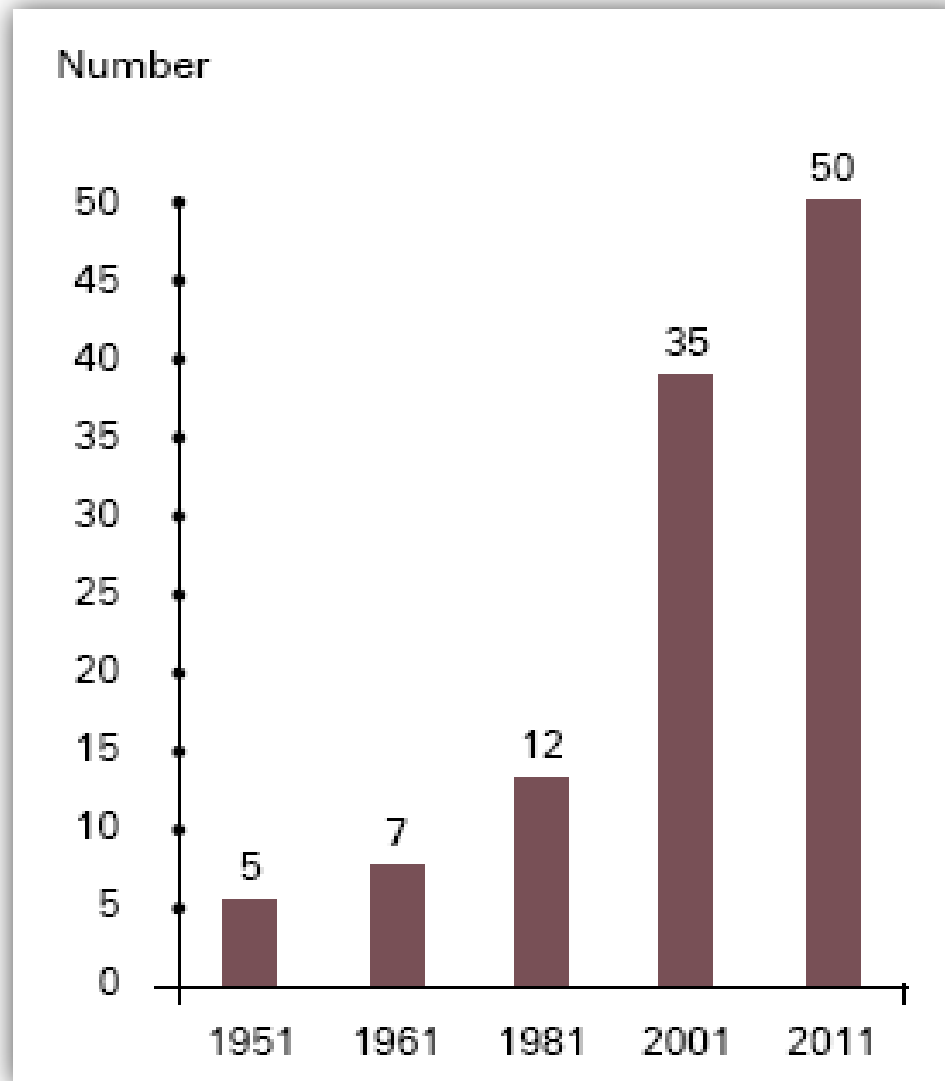
- ▶ MSW Rules 2000 in Place.
- ▶ Applicable to every Municipality
- ▶ Proper Collection, storage, transportation, Processing & Disposal to Sanitary Landfill is mandatory
- ▶ **Disposal of residues after processing of Municipal Waste in to Sanitary Landfill is mandatory**
- ▶ Open Burning prohibited

A Report Card based on Municipal Solid Waste Rules 2000 in India

• Primary collection	38 per cent
• Segregation of recyclables	33 per cent
• Street sweeping	72 per cent
• Transportation	52 per cent
• Processing	9 per cent
• Disposal	1 per cent

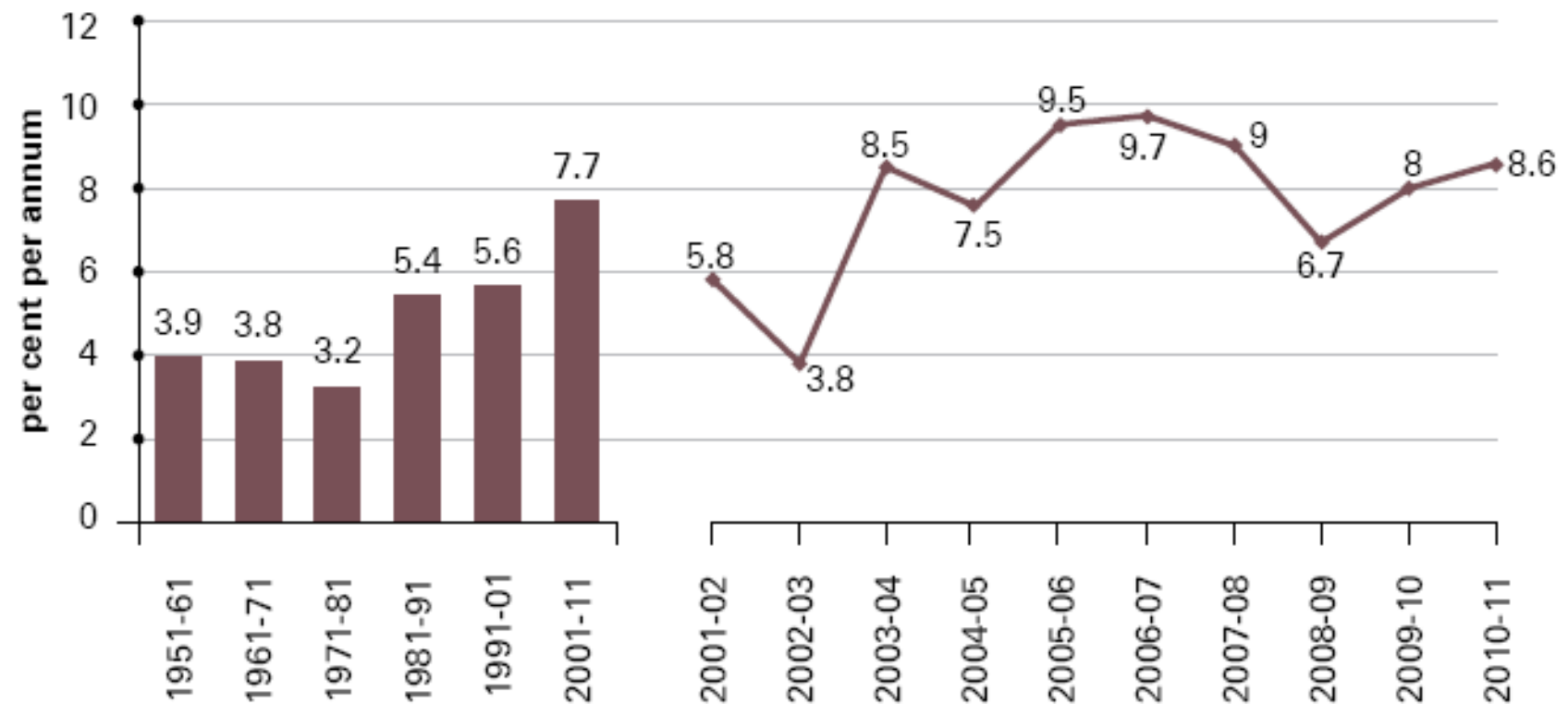
Source: World Bank (2006) and Zhu et al. (2008).

Growing Urbanization



GDP Growth Profile

GDP Growth at Constant Prices*



* Up to 2003-04, growth rates are of GDP at 1999-2000 prices; afterwards they are at 2004-05 prices; growth rate for 2010-11 is 'quick estimate'.

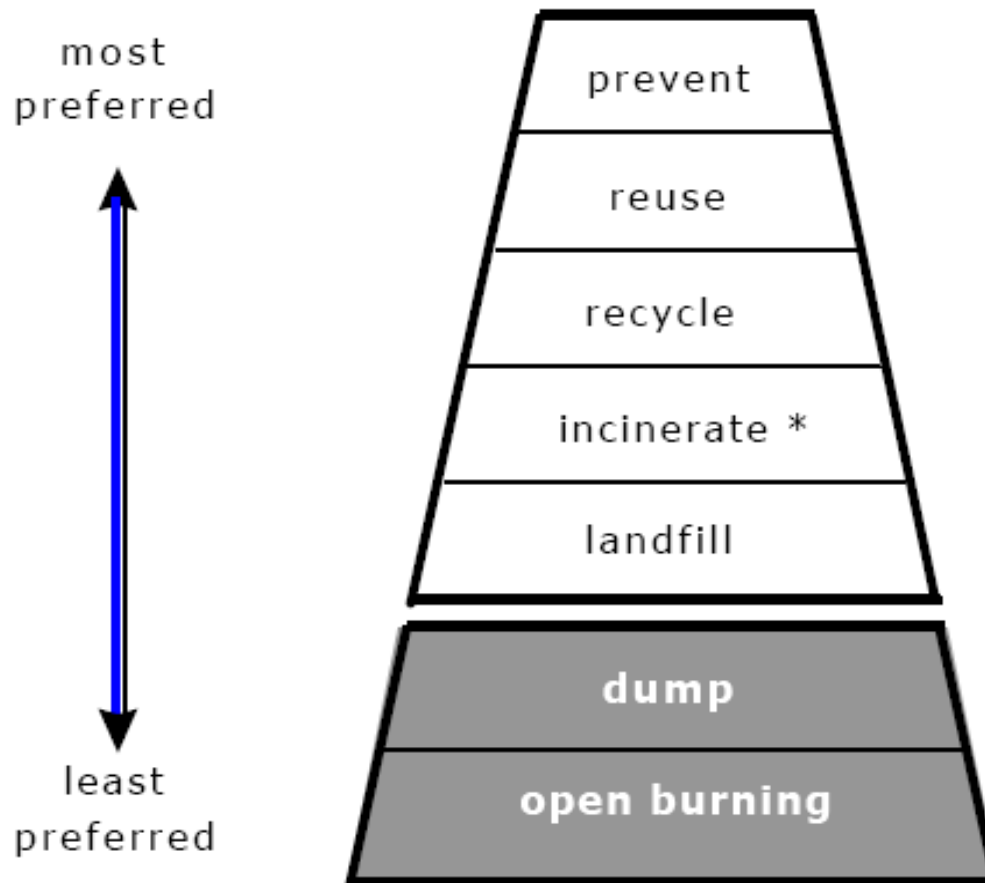
Source: Central Statistical Organisation (CSO).

Landmark Dump Sites of Urban Cities

Pointer to the Raising Dilemma



Hierarchy of SWM for Indian Metros



* with energy recovery

Waste to Energy

Waste to Energy is essentially an application of sound, proven combustion engineering principles to reduce & sanitize the residual solid waste – after recycling and bio-composting the biodegradable component of the waste – after pre sorting- to recover the energy



Global Scenario

- About 900 WTE Plants
- Process 0.2 Bn tons of waste /annum
(2,22,222 tons/annum @600 TPD average)
- Predominant technology- Reciprocating Grate

Source : Pike Research- USA

Development of W2E Projects

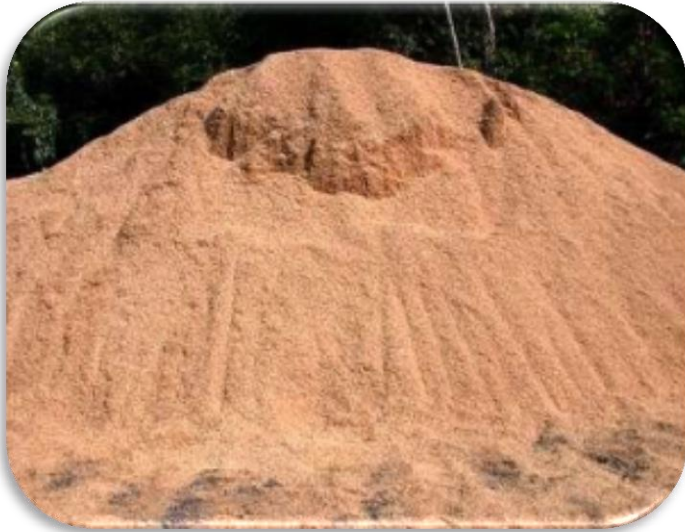
W 2 E discourse transcend diversely ...,

1. Environmental concerns on emissions
2. Failures of past
3. Suitability of Indian waste
4. Capital costs
5. Disincentive for recycling
6. Depriving waste collectors of their meager income

Heat Value Assessment

- Unlike Coal, Lignite, Biomass etc, Municipal waste is heterogeneous.
- The heat value of Municipal waste is a summation of the heat values of the respective weight fractions of its components
- The extensive characterization study of Municipal Waste of a city shall be the corner stone for assessment of the heat value
- Characterization & composition data to be used for computation of the heat value of Municipal Waste as above

Homogenous & Heterogeneous Fuels



Technical Guidance Report – World Bank

Table 2.4 Example of calculation of lower calorific value from analysis of waste fractions and H_{awf} values from literature

<i>Mass basis</i>		<i>Fraction basis</i>				<i>Calorific values</i>	
<i>Fraction</i>	<i>% of Waste</i>	<i>Moisture W %</i>	<i>Solids TS%</i>	<i>Ash A%</i>	<i>Combustible C%</i>	<i>H_{awf} kJ/kg</i>	<i>H_{inf} kJ/kg</i>
Food and organic waste	45.0	66	34	13.3	20.7	17,000	1,912
Plastics	23.1	29	71	7.8	63.2	33,000	20,144
Textiles	3.5	33	67	4.0	63.0	20,000	11,789
Paper & cardboard	12.0	47	53	5.6	47.4	16,000	6,440
Leather and rubber	1.4	11	89	25.8	63.2	23,000	14,265
Wood	8.0	35	65	5.2	59.8	17,000	9,310
Metals	4.1	6	94	94.0	0.0	0	-147
Glass	1.3	3	97	97.0	0.0	0	-73
Inerts	1.0	10	90	90.0	0.0	0	-245
Fines	0.6	32	68	45.6	22.4	15,000	2,584
Weighted average	100.0	46.7	53.3	10.2	43.1		7,650

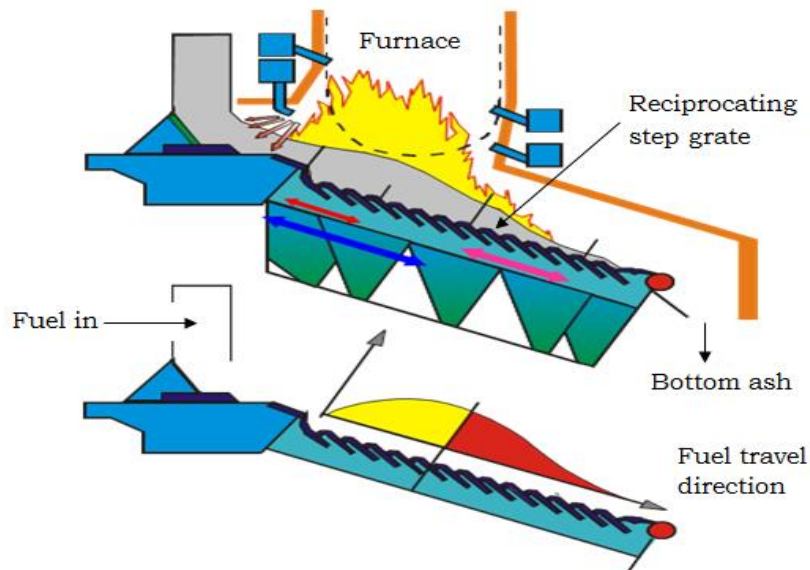
Estimate of Delhi MSW

MCD Waste analysis- Rohini Zone				
Sl.No.	Component	% as per characterisation	H(inf) Kcal/kg	
1	Organic/ Food / Kitchen Waste	30.7	455.82	139.94
2	Garden Waste	6.5	455.82	29.63
3	Paper	8.1	1539.42	124.69
4	Plastic	13.8	4819.82	665.14
5	Wood	1.7	2227.34	37.86
6	Card Board	1.9	1539.42	29.25
7	Tyres	1.4	3412.92	47.78
8	Leather	0.9	3412.92	30.72
9	Coconut shell	4.3	2227.34	95.78
10	Thermocoal	0.5	3412.92	17.06
11	Cloth / Rag	14.9	2821.34	420.38
12	Jute	1.1	616.54	6.78
13	Stone	2.1	-58.49	-1.23
14	Silt and inert	6.7	-58.49	-3.92
15	Ceramic	0.8	-58.49	-0.47
16	Debris	2.7	-58.49	-1.58
17	Metal	0.8	-35.10	-0.28
18	Glass	0.5	-17.55	-0.09
19	Others	0.8	0.00	0.00
				1637.44

Calorific Value of Indian MSW – D. B. S. S. R. Sastry

Proven Grate Technology for W2E

- Reverse acting Reciprocating grate with inclination to allow sliding of waste on its own is selected.
- Ram Feeders to push the waste positively on to the combustion zone.
- Grabs to mix the waste to homogenize and feeding rather than Overhead silo mode of storage to avoid bridging.

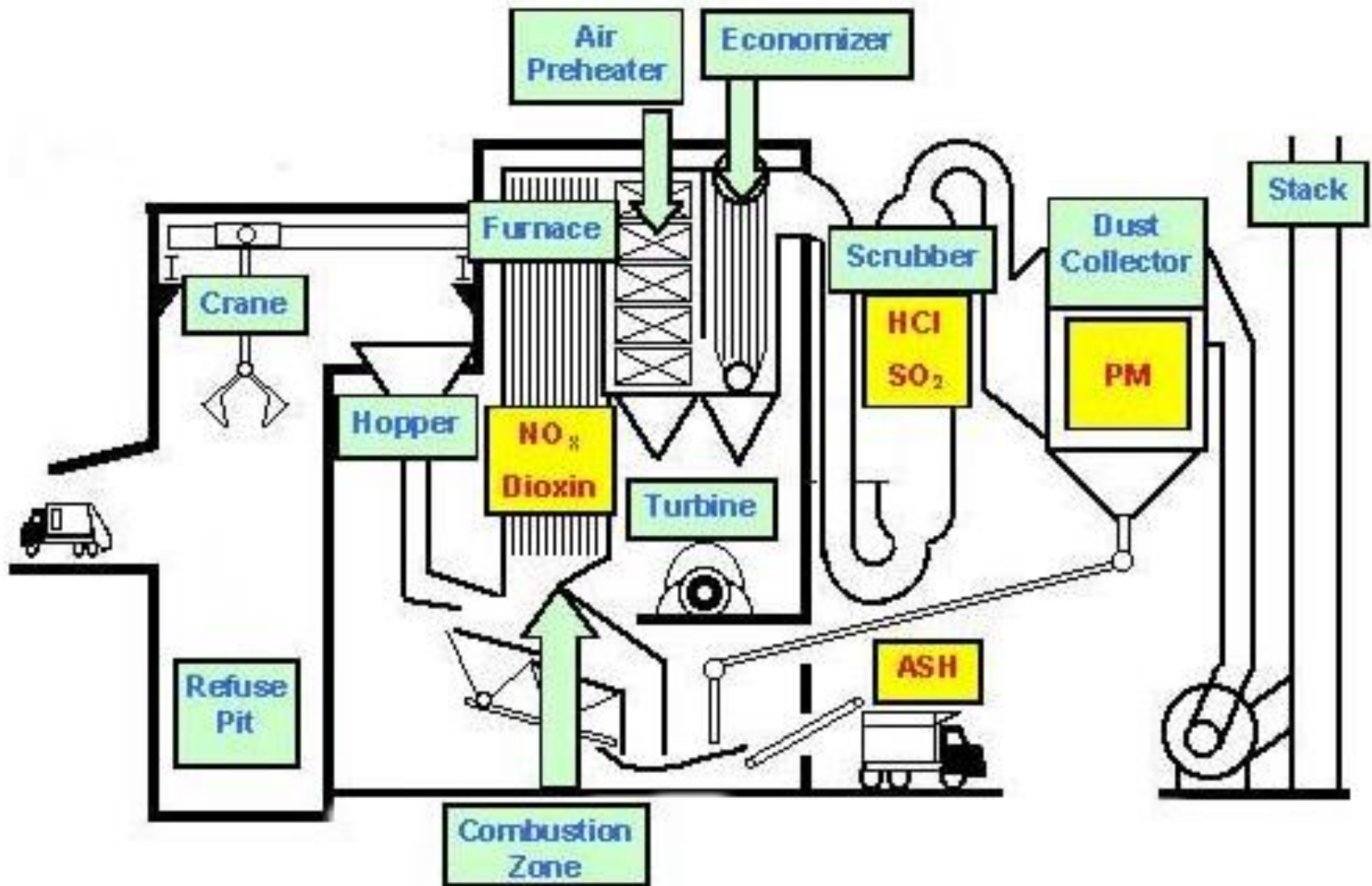


Good Combustion Principles

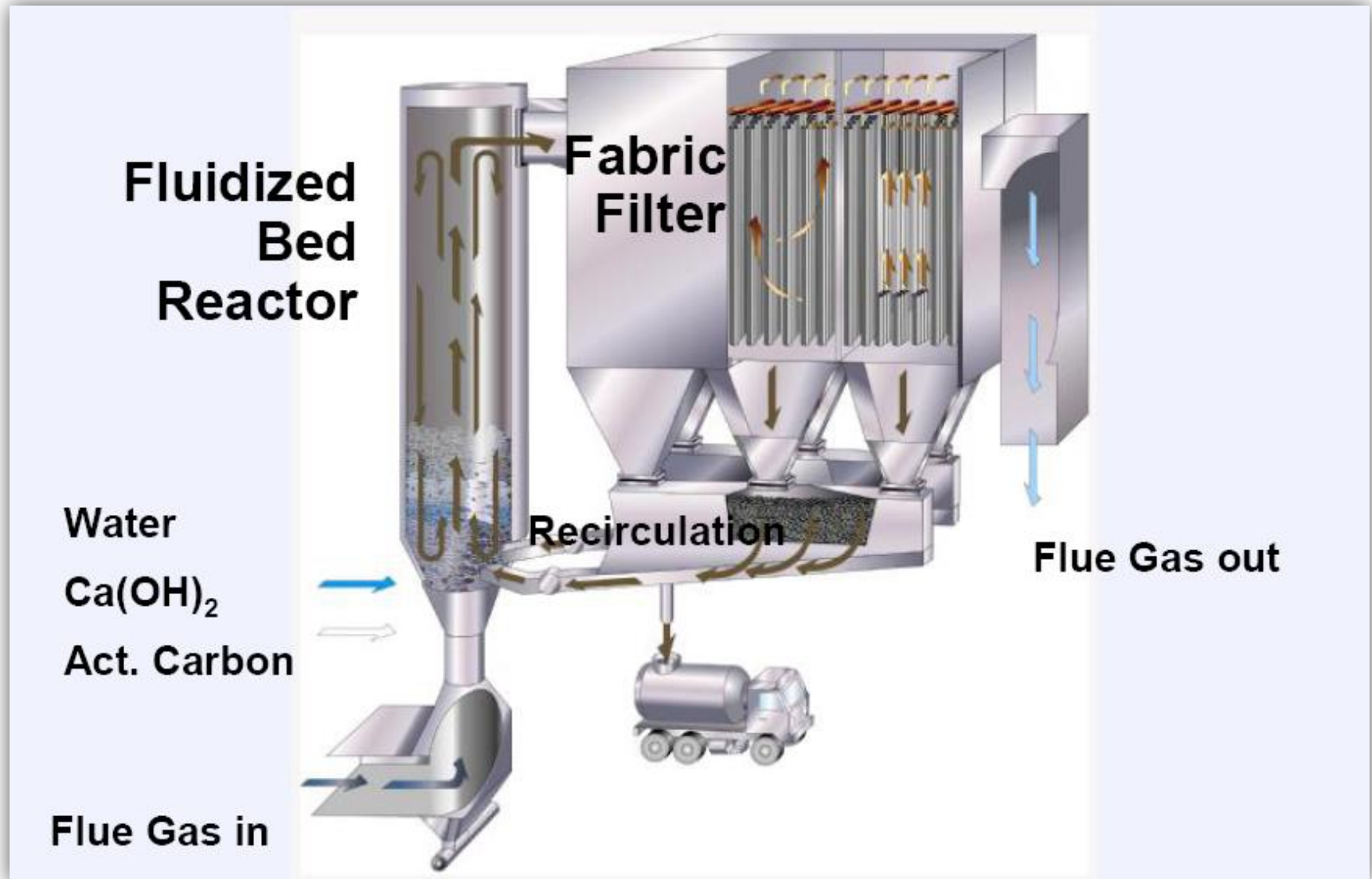
(Good Combustor Practices)

- Residence time for the combustion product of 2.5 seconds at > 850 Deg C for thermal destruction of fugitive emissions.
- Excess Oxygen atmosphere in furnace with balanced draft.
- Back End temp of Flue Gas is 210-220 Deg C for the effectiveness of the Flue Gas Treatment Scheme.
- Preheating the combustion air to accomplish *in-situ* drying of waste in the drying zone in the furnace.
- Fly ash will be disposed off into SLF which should be an integral part of the SWM Project.

Schematic Diagram of Flue Gas Distribution System



Flue Gas Treatment Scheme



Flue Gas Treatment Scheme

W2E projects to have complete Flue Gas Treatment Scheme comprising:

1. Lime treatment
2. Activated Carbon injection
3. Bag Filter
4. Ammonia injection

Emission Regulations for W2E Projects

Description	Value
Particulate Matter (PM)	< 50 mg/Nm ³
SO ₂	< 260 mg/Nm ³
HCl	< 50 mg/Nm ³
Dioxins & Furans	0.1 TEQ ng/Nm ³
NO _x	< 450 mg/Nm ³
Stack Height	60 m

Policy of W2E to include:

- Use of W 2 E to be consistent with the hierarchy of the SWM
- Technology should conform to Best Practices regarding environmental performance, economics, technical performance and public health issues and affordable by the society
- Should be designed to maximize heat & energy recovery
- Should incorporate continuous monitoring systems for emissions
- Should support beneficial use of the ash to minimize landfill burden
- W 2 E based on mass burning most suitable for cities generating MSW > 500 TPD and must for >1000TPD

Conclusions

- The **existing** system for processing and disposal of MSW is **highly inadequate** and needs a through **review** so as to decide even continuity of the current projects.
- We must evolve solutions that are based on use of **environmentally sound technologies and their applications matching with specific requirements** and situations as prevailing locally.
- The best way forward is to go for **“Waste to Energy”** for local body generating MSW @ 600 TPD or more. **Technology based on mass burning** (with or without segregation) using grate technology capable of operating at low calorie fuel such as MSW.

Conclusions

- **100% compliance of environmental regulations** as envisaged in MSW Rules, 2000.
- **Minimum land requirement.** Possible to use existing dump site without going for acquisition of green field lands.
- **The 50% capital subsidy will reduce tariff** for processing and disposal MSW and will not cause extra burden to the citizens.
- **Subsidy can be recovered** through profits from sale of power
- The operations of processing and disposal of MSW shall be on **BOT basis**. Expected life of the assets created should be of about 20 years.

Conclusions

- The vendor can operate the facility for a period of 7 years and recover investment and profits @ **15% IRR and 14% interest** and then transfer to local body for continued operations of about 13 years.
- Power evacuation into local body and **PPA between local body and power user/consumer**.
- The **accumulated waste** should also be processed and the reclaimed land should be utilized for installation of the new waste processing plant.
- **Corporate Guarantee** of project cost must be provided by the technology provider and the vendor

Thanks!!

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