Status of waste to energy projects in India

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October 25th 2022
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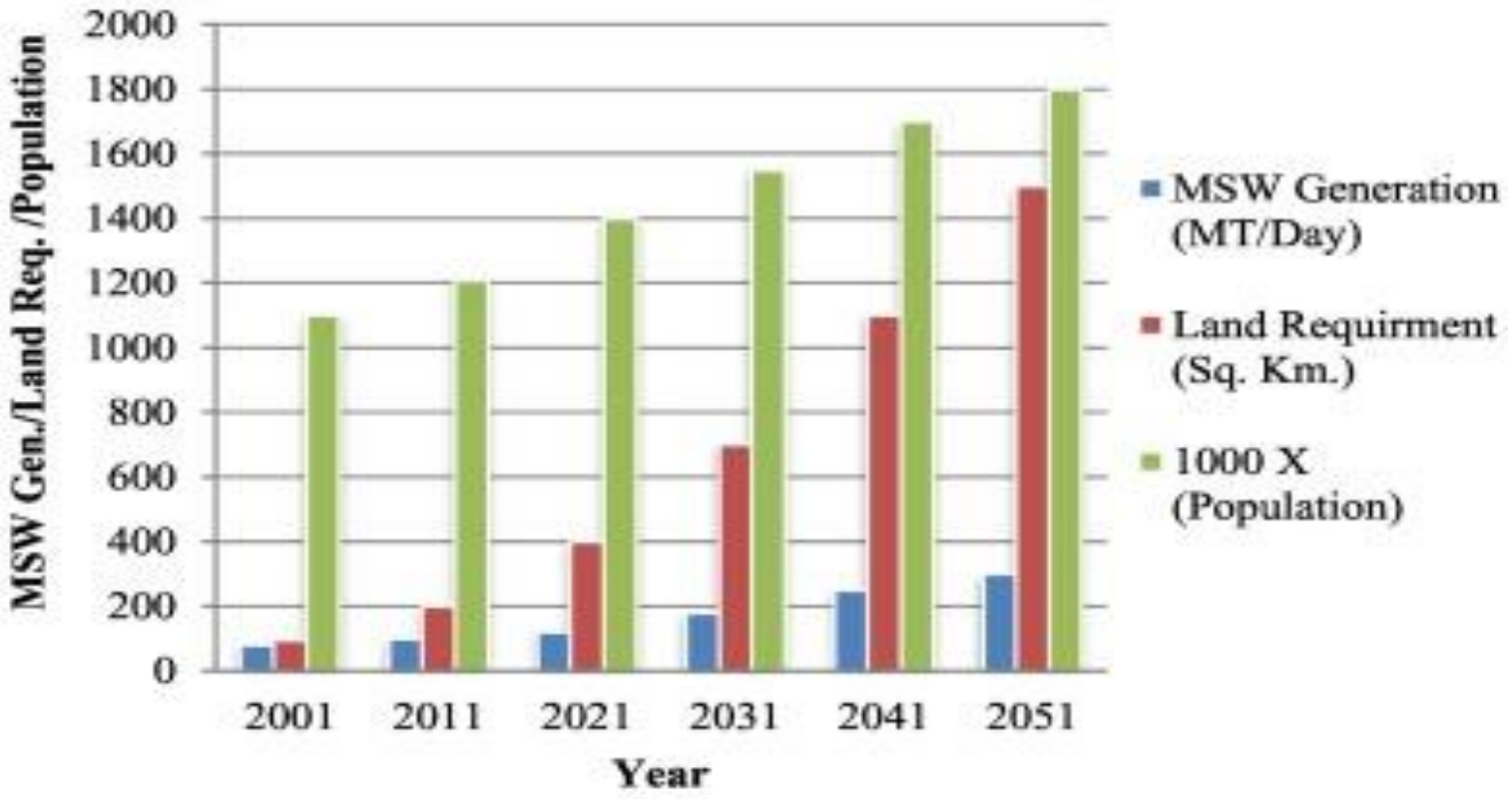
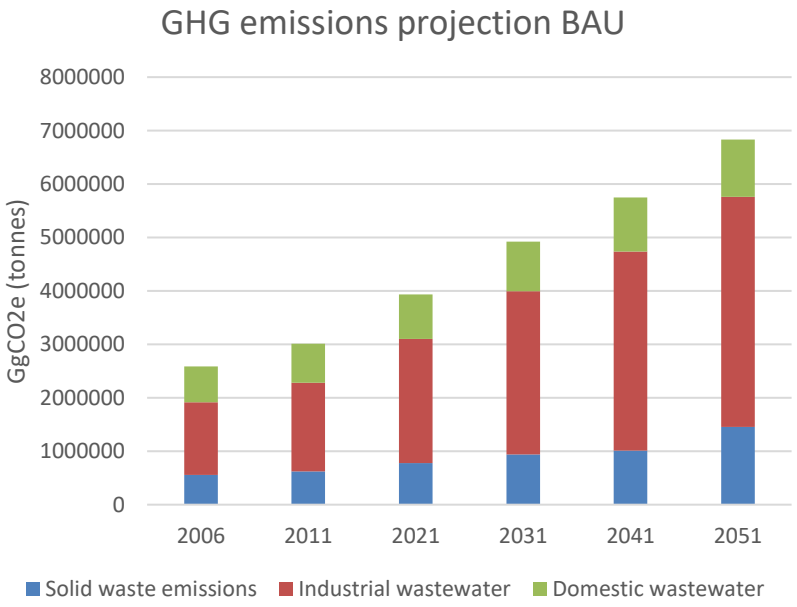
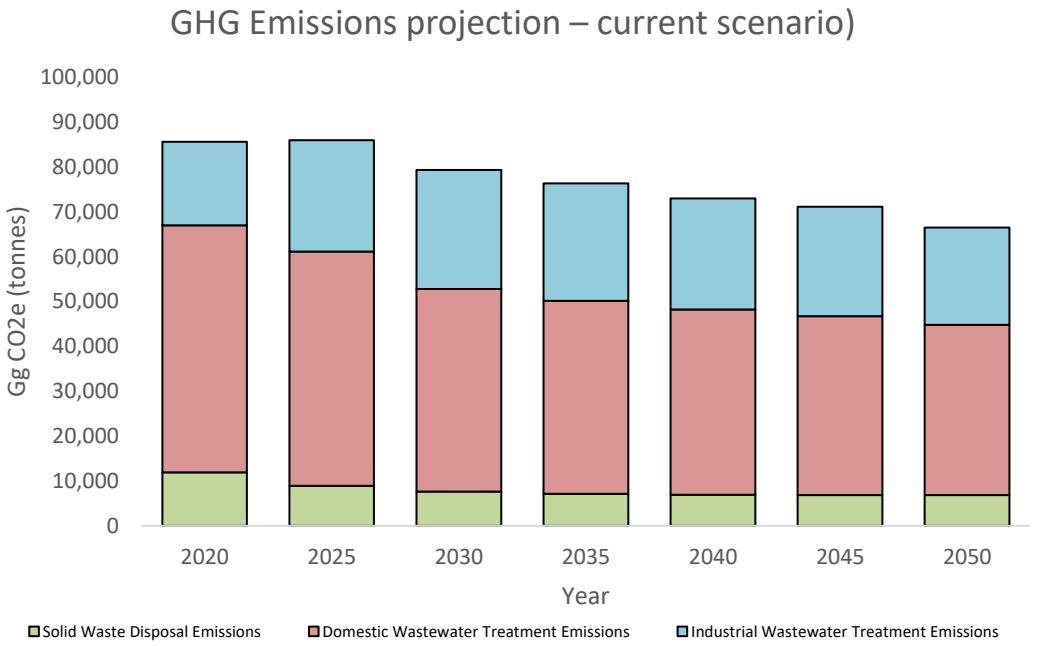
Municipal Solid Waste Generation Trends in India



Kumar & Agrawal, 2020

GHG Emissions for Waste Sector in India





TERI estimates based on IPCC;
Reduction largely due to recent Government Initiatives

GHG: Greenhouse Gas Emissions

Guiding Legislation - SW Rules, 2016

- Mandates local body and institutions for primary collection, storage, transportation, processing and disposal
- Emphasizes on need for segregation at source
- Bans organic waste to be disposed in landfills
- Promotes recycling and organic waste processing
- Prescribes use of combustible waste - RDF (CV at 1500 Kcal/kg or more) as raw material or as a source of energy in industrial processes or co-processing

RDF: Refuse Derived Fuel

MSW characteristics in Indian cities

Parameter	Unit	Range
Compostable	%	30 – 55
Recyclable (Plastics, Paper, Metal, Glass etc)	%	5 – 15
Inter including construction & demolition waste	%	40 - 55
Carbon/Nitrogen (C/N)	Ratio	14 – 53
Moisture	%	17 – 65
Calorific Value	kcal/kg	800 – 1200

Challenges for using MSW as feed in waste to energy

- Variability in composition
- High moisture content, can also cause fouling of equipment if inert is high
- Use of un segregated waste can also lead to emission of toxic heavy metals
- Low calorific value suitable more for biochemical conversion than thermal conversion

Waste Solutions for Circular Economy in India

- Setting up of Material Recovery Facility and processing the sorted waste through
  - Aerobic Composting
  - Recycling
  - **Biomethanation**
  - **RDF for co-processing in cement kilns**

RDF: Refuse Derived Fuel

Cumulative capacity on waste to energy project in India

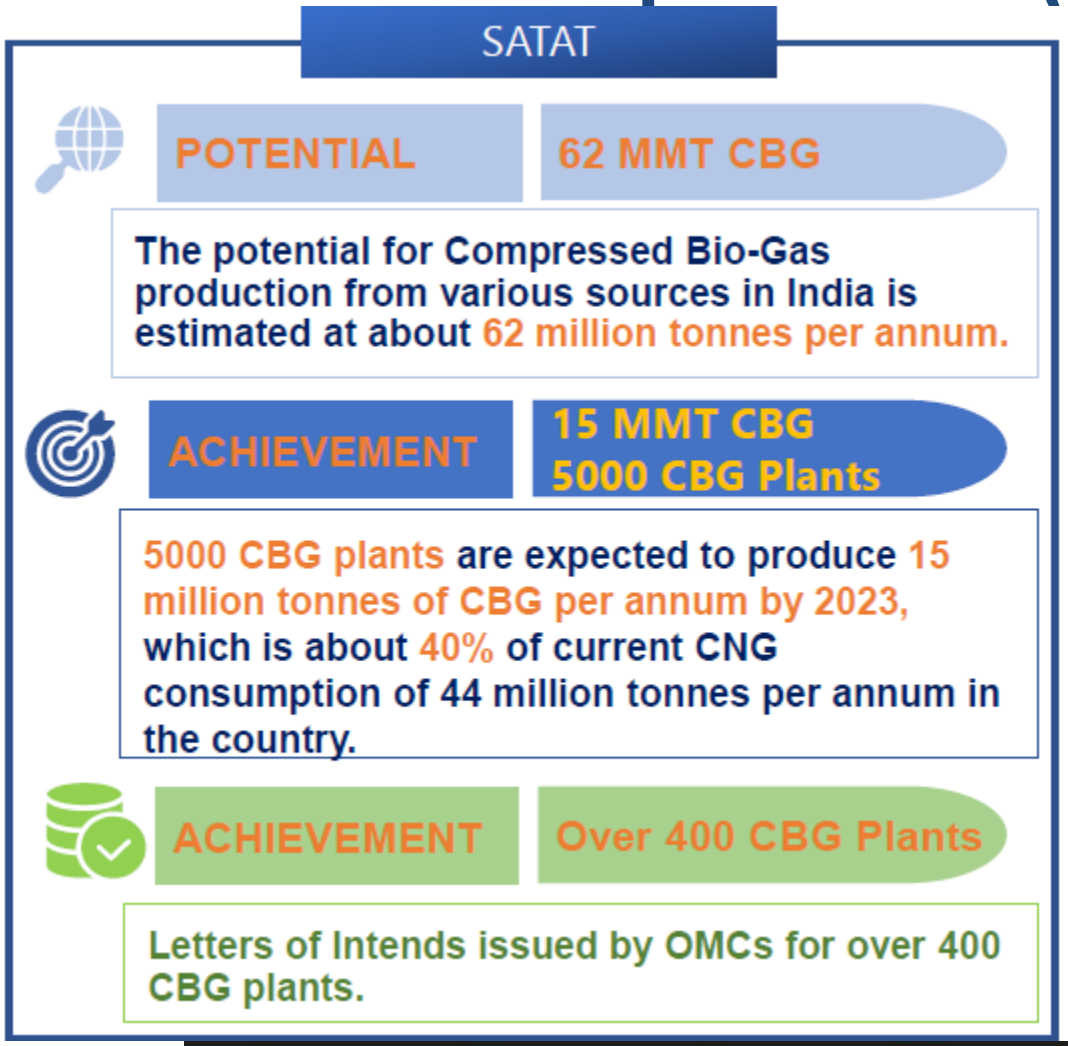
POTENTIAL **5690 MWeq**

Estimated potential of energy recovery from urban and industrial organic waste only.
Agricultural waste also provides huge opportunity.

Sl. No.	Output product	Cumulative capacity
1	Biogas	7,43,508 m3 per day
2	Bio-CNG/CBG	97,199 kg per day
3	Power (Grid & Offgrid)	291.34 MW

MNRE Annual Report 2020-21

Sustainable Alternative towards Affordable Transportation (SATAT)

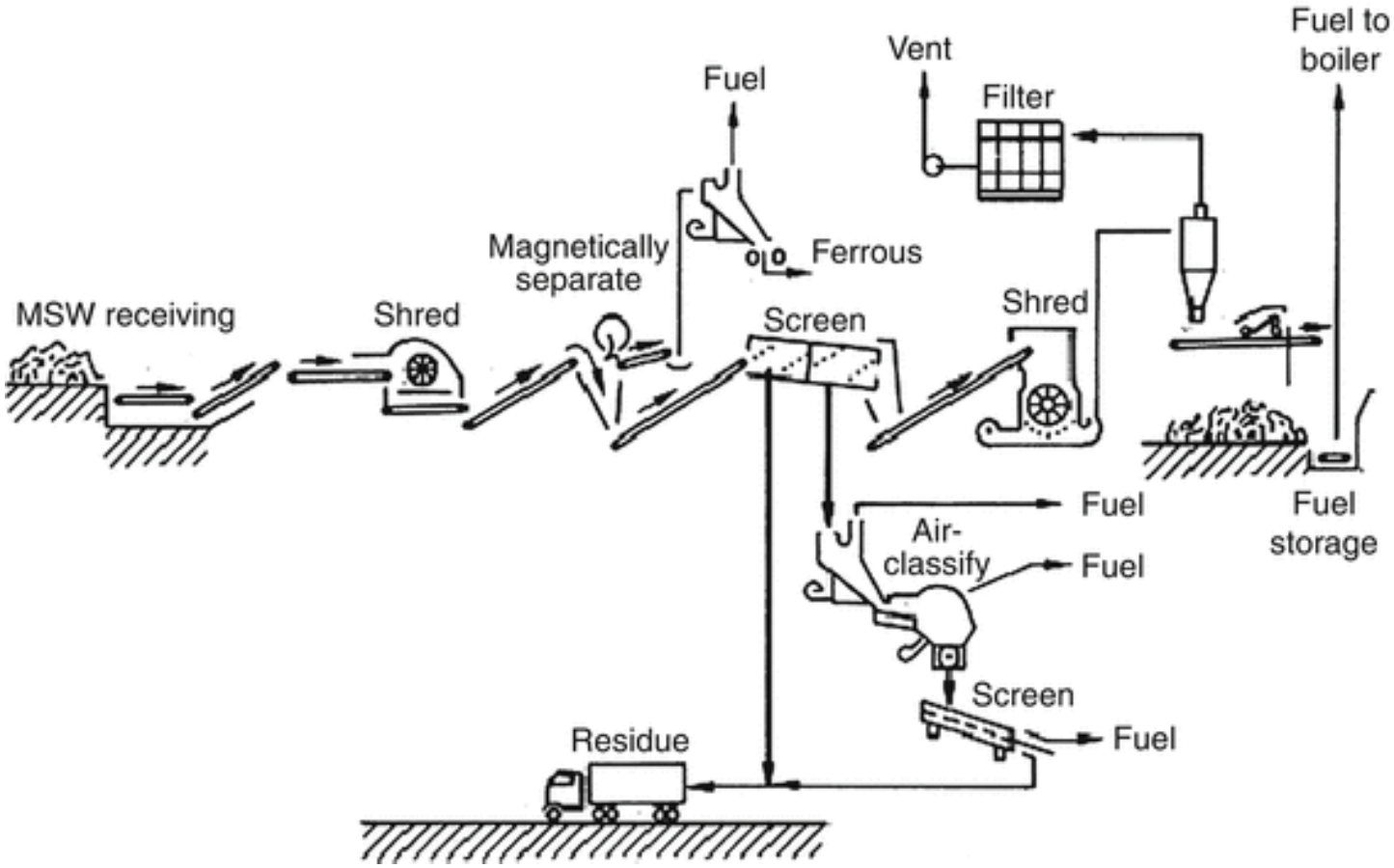


GEF/UNIDO

SATAT

- Changes the viability of setting up waste based biogas plants in India
- Setting up of CBG plants with support of oil companies in India
- As of now 37 plants have been commissioned
- Around 9000 tonnes of CBG sold

RDF Pre-processing



Springer link

RDF: Refuse Derived Fuel

Advantages of Co-processing in Cement Kilns

- High flame temperature (1400-1500^{o}C) – ensures complete destruction of harmful pollutants
- High residence time >5 sec in oxygen rich atmosphere - ensures complete destruction of organic compounds including dioxins and Furan
- Total neutralization of acid gases, sulphur oxides and hydrogen chloride- by the active lime in the kiln load.
- The biggest advantage is that co-processing leaves no residue to be land-filled.

Drivers for RDF Uptake

For Cement Plants

- Low carbon Growth – Non Fossil fuel based fuel use
- Community service in terms of waste management
- 25% TSR feasible as against 2% presently

For ULBs

- The mechanism helps in managing the waste in an environmentally sound method.
- Large quantities of segregated waste could utilized by cement kilns

RDF: Refuse Derived Fuel

Challenges in RDF Uptake

- Uncertainty in supply and quality of RDF
- Limited RDF processors located near the cement plants therefore large transportation distance
- Many earlier established plants are now non functional

The requirement therefore is:

- More RDF processors required in Tier I and Tier II cities
- Inclusion of co-processing as an option in municipal bye-laws
- Financial support for RDF processing and transportation costs
- Landfill tax to promote resource recovery

RDF: Refuse Derived Fuel

Issues Related to Quality of RDF

- The key concerns regarding quality of processed RDF is with respect of
  - Inconsistent calorific value mostly of lower side than desired due to high inert
  - High moisture content
  - High chlorine content
- This can be addressed by regular testing of incoming waste and outgoing processed RDF for
  - Moisture content
  - Ash content
  - Chlorine and Sulphur content
  - Net Calorific Value
  - Heavy metal analysis, reactive sulphide, reactive cyanide and reactive halide, if desired

RDF: Refuse Derived Fuel

Desired Quality of RDF

Parameters	SCF	RDF- Grade III	RDF- Grade II	RDF- Grade I
Intended use	W2E plants or RDF pre-processing facility	Direct co-processing with other wastes	Direct co-processing	Direct co-processing
Size	Above 400 mm	< 50 mm or < 20 mm depending on use in ILC of SLC		
Ash✞	< 20%	< 15%	< 10%	< 10%
Moisture✞	< 35%	< 20%	< 15%	< 10%
Chlorine✞	< 1.0%	< 1.0%	< 0.7%	< 0.5%
Sulphur✞	< 1.5%			
NCV (Kcal/Kg)	> 1500	> 3000	> 3750	> 4500
Odour	Any offensive odour needs to be controlled			

✞ - maximum permissible

Guidelines for usage of RDF in various industries, MoHUA, 2018

RDF: Refuse Derived Fuel

Typical Saving Using MSW based RDF

MSW Substitution	Quantity of MSW (Tons/Year)	Energy from MSW (Million Kcals/ Year)	Coal Savings (Tons of coal/ Year)	Carbon reduction potential Tons CO_2/Year
2%	9,51,489	19,02,978	3,80,596	7,64,862

- In fact, experience in Europe shows that 50-60% TSR is achievable with right kind of RDF
- Some of the German cement plant have operated at 100% TSR

RDF: Refuse Derived Fuel, TSR: Thermal Substitution Rate

Thank you