

Energy Recovery from Wastes – Policy & Regulatory Frameworks and Successful Examples in India

by

VK JAIN

Adviser & NPC

Ministry of New & Renewable Energy

B- 14, CGO Complex, Lodhi Road

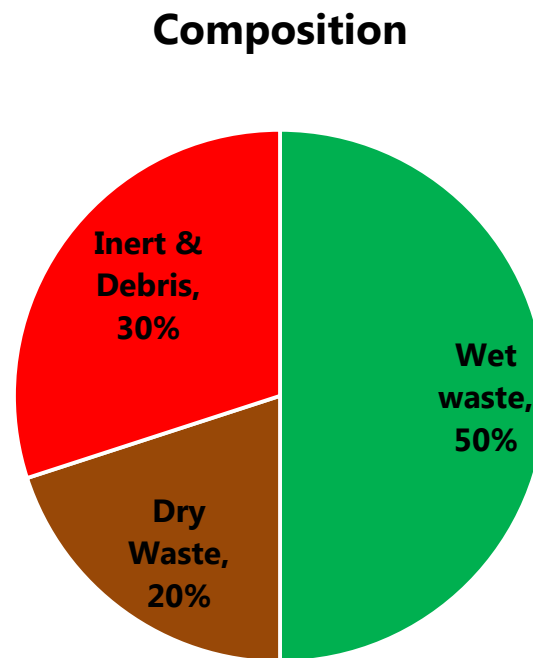
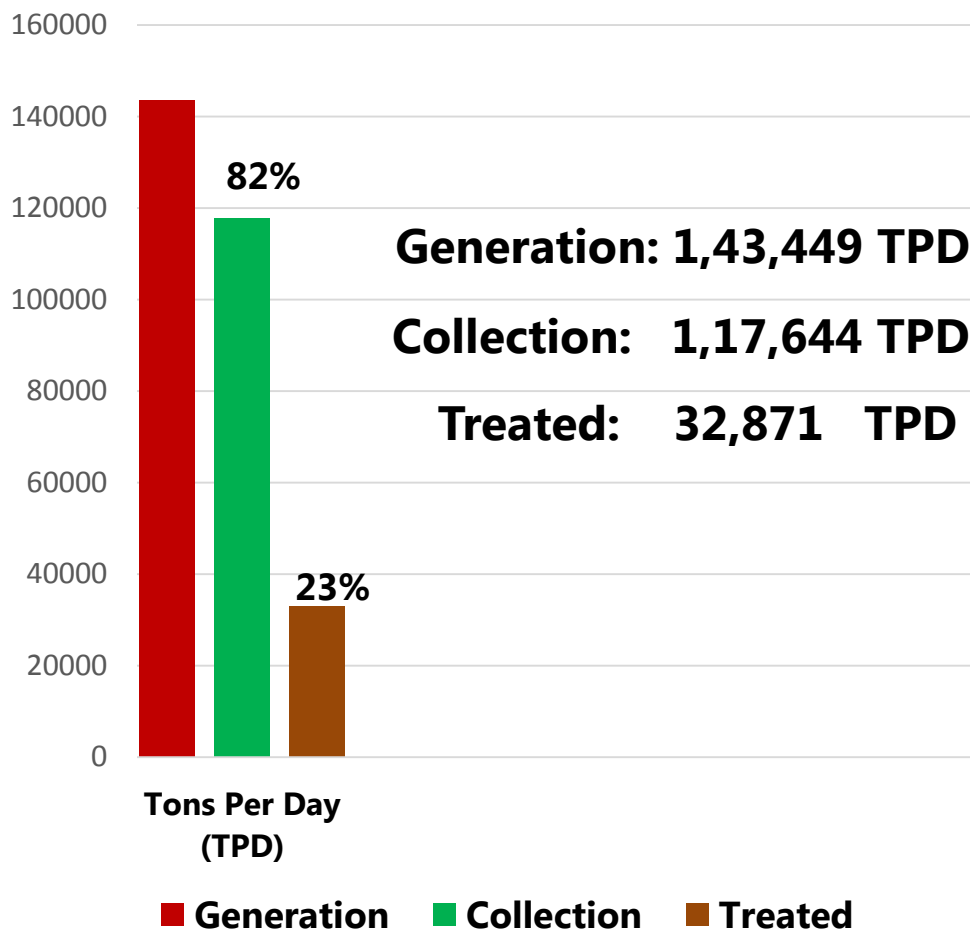
New Delhi -110003

Telefax – 91-11-24369788

Email – jainvk@nic.in

www.mnre.gov.in

Composition of Municipal Solid Waste



Source: CPCB (2013-14)

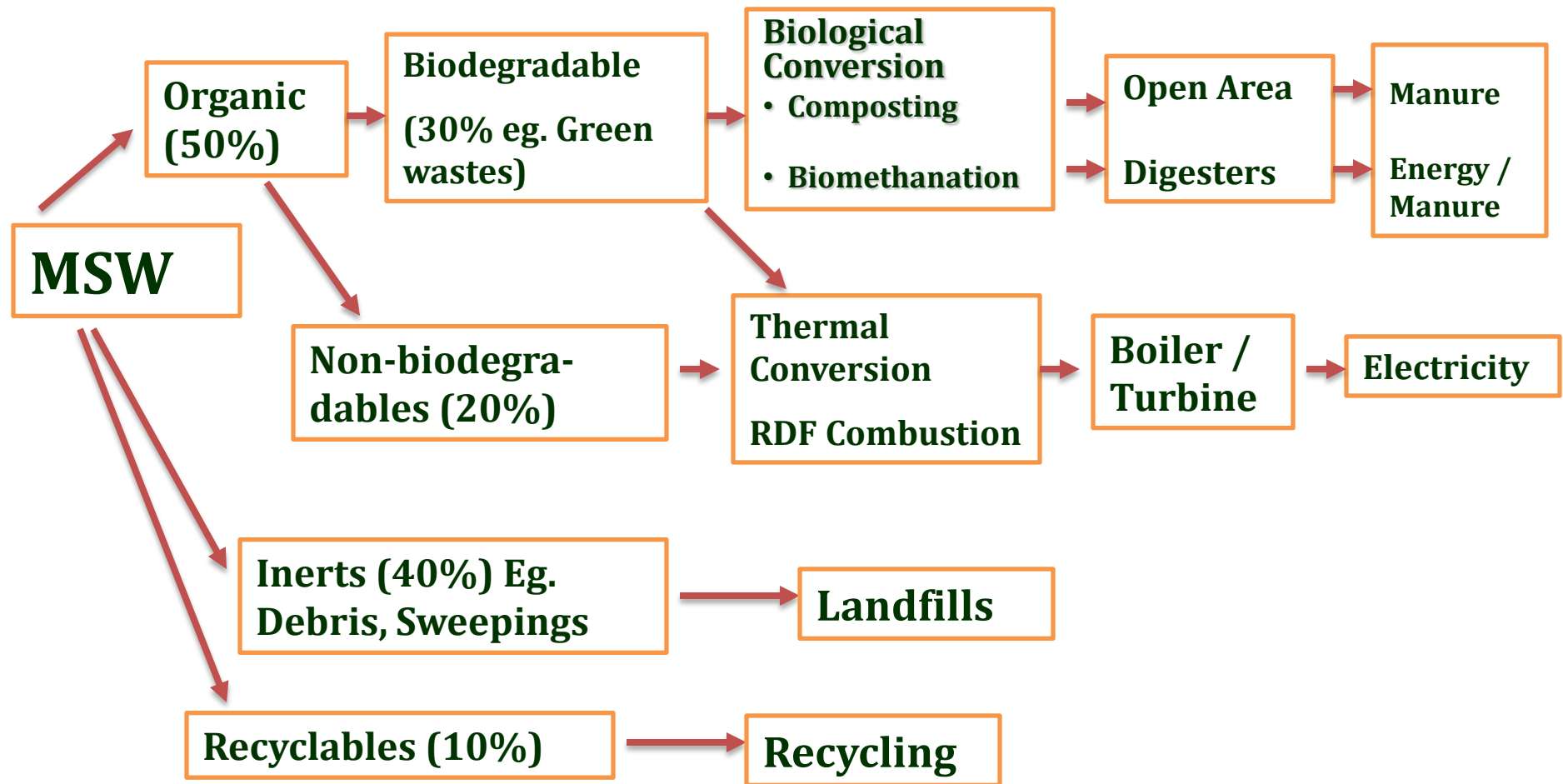
Potential for Power Generation from MSW

- ❖ Estimated Generation of MSW – 1.43 lakh MT/ day;
- ❖ More than 75 % of total waste is generated in 468 cities;
- ❖ Current practice : Dump MSW into unscientific landfills.



- ❖ As per MSW Management and Handling Rules 2015
 - ❖ Organic component of MSW is to be processed biologically;
 - ❖ Land filling of biodegradable waste is not allowed
- ❖ CPCB : estimated potential of MSW – 500 MW

Flowchart for Commercial MSW Processing Technologies



Potential for Power Generation from Industrial Waste

Potential Industrial Sectors are –

- **Effluent from Distillery , Pulp & Paper, Starch & Milk Processing, Food & Fruit Processing and Sugar Industries;**
- **Poultry Droppings;**
- **Slaughterhouse and Tannery Industries Wastes;**
- **Fermentation and Pharmaceutical Industries;**
- **Hotel Industry Wastes**
- **Agro Processing Industries**

Handling of Subject at Central Level

- **Ministry of Urban Development (MoUD)**
 - Policies, Guidelines & Financial Assistance
 - Swacch Bharat Mission (SBM) → aims at 100% Waste Management & Processing in all 4,041 cities/towns
 - 20% VGF for WTE Projects
- **Ministry of Environment, Forest and Climate Change (MoEF & CC)**
 - Framing Rules for MSW and Industrial Effluent Management & Disposal under the – i) Environment (Protection) Act; ii) Water (Prevention and Control of Pollution) Act; iii) Air (Prevention and Control of Pollution) Act; and iv) Central Pollution Control Board
- **Ministry of New and Renewable Energy (MNRE)**
 - Promotion Recovery of Energy from Wastes / Effluents

Programme on Energy Recovery from Urban, Industrial & Agricultural Wastes/ Residues

Objectives of the Scheme

- To promote setting up of projects for recovery of energy from urban, industrial and agricultural wastes;
- To create conducive conditions and environment, with fiscal and financial regime; and
- To develop, demonstrate and disseminate utilization of wastes and residues for recovery of energy

Type of Wastes

Sorted Organic MSW, Vegetable and Fruits Market Wastes, Slaughterhouse Waste, Poultry Droppings, Agricultural Residues and Industrial Wastes & Effluents (Distillery, Food & Starch Processing, Pulp & Paper)

Energy Recovery from Urban, Industrial & Agricultural Wastes/ Residues Central Financial Assistance

	Wastes/ Processes/ Technologies	Capital Subsidy
1	Power generation from Municipal Solid Waste	Rs. 2.00 crore/ MW (Max. Rs.10 crore/ project)
2	Power generation or Production of Bio-CNG for filling into gas cylinders from available Biogas at Sewage Treatment Plant or through bio-methanation of Urban and Agricultural Waste/ Residues including Cattle Dung	Rs. 2.00 crore/MW or bio-CNG from 12,000 m ³ biogas/day with Max. Rs 5 crore/project
3	Biogas Generation from Urban, Industrial and Agricultural Wastes/residues	Rs. 0.50 crore/ MW (12,000 m ³ biogas /day with maximum of Rs. 5 crore/ project)
4	Power Generation from Biogas (engine / gas turbine route) and/or production of bio-CNG for filling into gas cylinders	Rs. 1.00 crore/MW Or bio-CNG from 12,000 m ³ biogas with Max. Rs.5 crore/project
5	Power Generation from Biogas, Solid Industrial, Agricultural Waste/residues excluding bagasse through Boiler+ Steam Turbine Configuration	Rs. 0.20 crore/MW with Max. Rs. 1 crore/project

Energy Recovery from Urban, Industrial and Agricultural Wastes / Residues

Other Incentives and Support Measures

- Incentives to State Nodal Agencies - Service Charge @ Rs.1% of the Subsidy restricted to Rs.5.00 lakh per project,
- Financial Assistance for Promotional Activities - for Organizing Capacity Building Programmes, Awareness Creation Business Meets, Seminars / Workshops, Publication of Newsletters, Resource Assessment, Technology Validation and Performance Monitoring and Evaluation subject to a maximum of Rs.3.00 lakh per activity,
- In addition, providing concessional customs duty and excise duty exemption for initial setting up of grid connected projects for power generation and /or production of Bio-CNG from wastes
- Preferential Tariff announced by the CERC /SERC
- Energy Buyback, Wheeling & Banking

Regulatory Framework for WTE Projects

Generic Tariff for WTE Projects notified by CERC for FY 2015-16

Technology	Net Levelised Tariff (Rs /kWh)
MSW	6.50
RDF based MSW	7.59
Biogas	7.60

Tariff Policy – 2016 : Power from MSW based WTE plants

State Distribution Licensee **MUST** procure power from all the WTE plants in the State at the tariff determined by SERC on cost plus basis.

Notification for Usage of Biogas, in the form of Bio-CNG, in Motor Vehicles

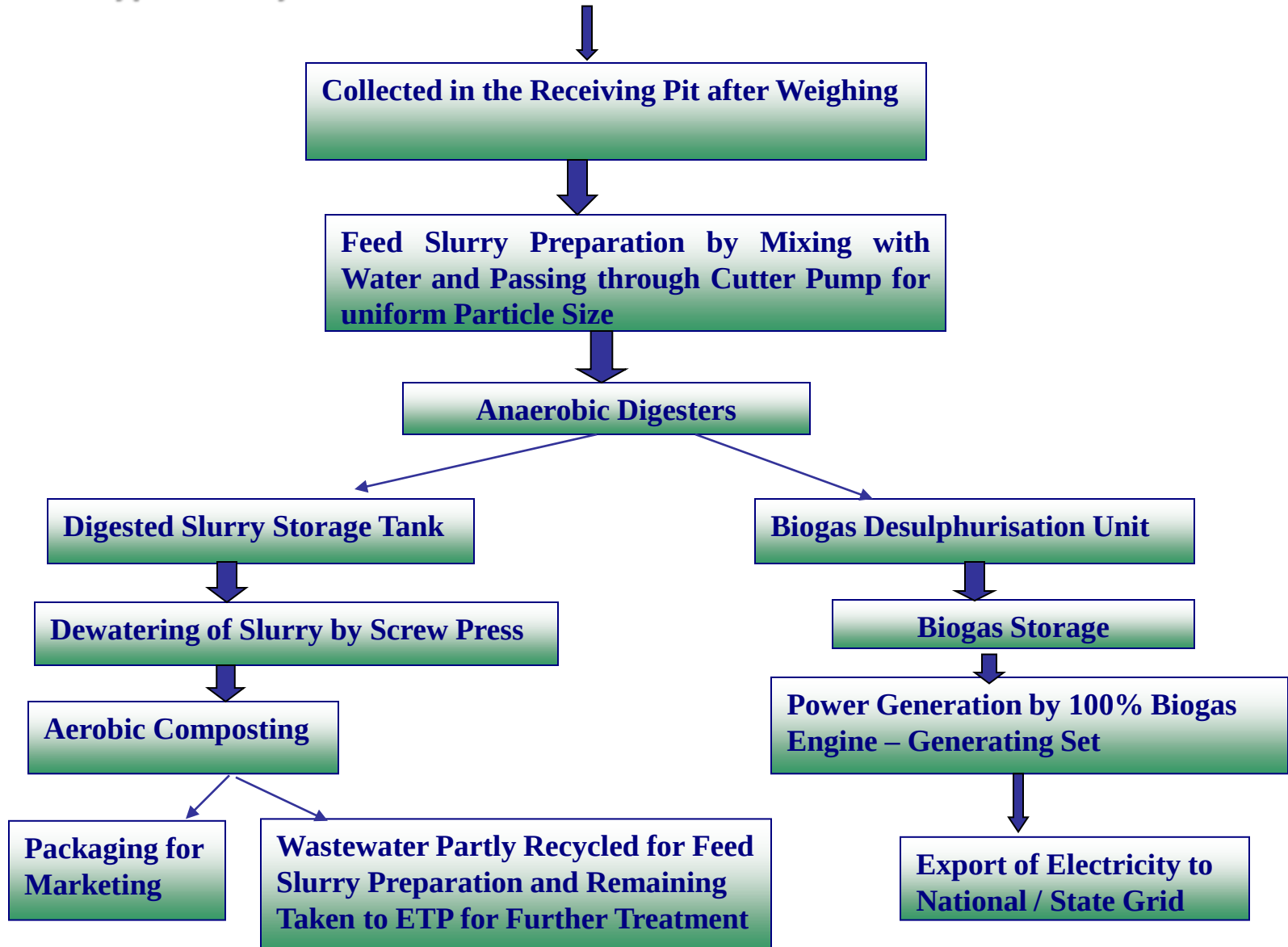
- Ministry of Road Transport and Highways, vide Notification dated 16th June 2015, has amended the Central Motor Vehicles Rules, 1989 and included the provisions for usage of biogas, in the form of bio-CNG, in motor vehicles as mentioned below :-
- Provided that bio-compressed natural gas (bio-CNG) shall be permitted for motor vehicles as an alternate composition of the compressed natural gas (CNG);
-
- Provided further that the mass emission standards applicable to compressed natural gas (CNG) vehicles under these rules shall be applicable to respective vehicles when they use bio-compressed natural gas (bio-GNG);
-
- Provided also that the bio-compressed natural gas (bio-CNG) composition meets the fuel specification for bio-compressed natural gas (bio-CNG) as per IS 16087 and meets the requirement of Siloxanes max 0.1 ppm (calculated as Si).

Indian Standard on Biogas (Bio-methane)

As per IS 16087-2013 Standard, the requirement for Biogas (Bio-methane) for Automotive Application and Piped Network is as under-

S.No.	Characteristic	Requirements	Method of Test Ref. to
i)	CH ₄ Percent, Min	90	IS 15130 (Part 3)
ii)	Moisture, mg/m ³ Max	16	IS 15641 (Part 2)
iii)	H.S. mg/m ³ Max	30.3	ISO 6326-3
iv)	CO ₂ +N ₂ +O ₂ Percent, Max (v/v)	10	IS 15130(part 3)
iv)	CO ₂ percent, Max (v/v) (when intended for filling in cylinders)	4	IS 15130 (Part 3)
v)	O ₂ percent, Max (v/v)	0.5	IS 15130(Part 3)

Typical Layout of the Biomethanation Plant for Power Generation



5 MW Biomethanation Plant at Lucknow

Processing 500 TPD of MSW to Recover 150 TPD of Sorted Organic Wastes
Generating 50,000 m³ of Biogas /day

Administrative Building & Sorting Plant



SORTING PLANT, WORK SHOP & WORKERS FACILITY



GAS HOLDERS AND CONTROL BUILDING



GAS HOLDERS, ENGINE ROOM & CHIMNEY





1X5 TPD SEGREGATED ORGANIC MUNICIPAL SOLID WASTE BASED BIOMETHANATION-CUM-POWER GENERATION PLANT AT MODEL COLONY, PUNE.



1 X 5 TPD BIOMETHANATION-CUM-POWER GENERATION PLANT AT MODEL COLONY, PUNE

1X5 TPD SEGREGATED ORGANIC MUNICIPAL SOLID WASTE BASED BIOMETHANATION-CUM-POWER GENERATION PLANT AT BAWDHAN, PUNE.



Installed by :- M/s. Enprotech Solutions, Pune.

POWER FROM VEGETABLE MARKET WASTE CMDA Vegetable Market Complex, Chennai, TN

Qty. and Type of Waste : 30 tons/day Vegetable Market Waste
Plant capacity : 0.25 MW Power



**0.15 MW Power Project
Utilizing Vegetable Market
and Slaughterhouse Wastes
at Vijayawada, A.P.**



Technology : Modified UASB Technology developed jointly by R &D Institution and Private Company

Technology Institution for Supervision : Central Leather Research Institute, Chennai

Implementing Agency : Vijayawada Municipal Corporation, Vijayawada

**1 MW power plant based on
cattle dung at a Dairy Complex
Ludhiana, Punjab**



Technology Supplier : BIMA of ENTEC, Austria, had tie up with local Engineering Company, Executed on Turnkey Basis and Given PPG

Technology Institution for Supervision : Chemical Engg. Deptt., IIT Roorkee

Implementing Agency : Punjab Energy Development Agency, Chandigarh

Revenue Streams : Sale of Electricity, Digested Manure, Effluent after removal of Residues, and CERs

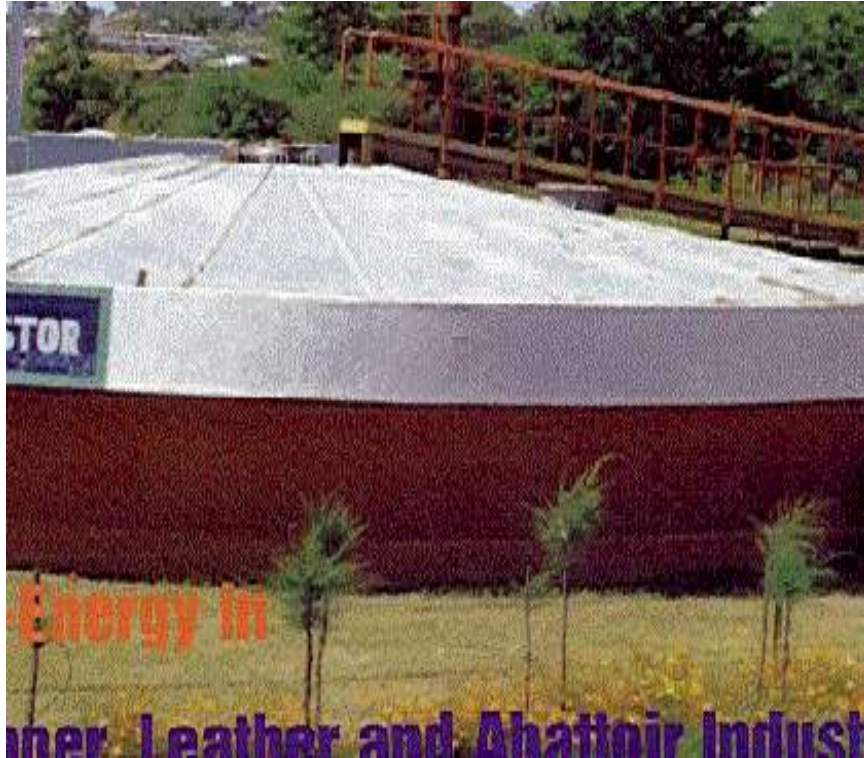
**5 Tonnes / Day BIOMETHANATION
PLANT BASED ON TANNERY
FLESHING AND CETP SLUDGE in
MELVISHARAM, TAMIL NADU**



Source of Technology - **Centre Technique Cuir Chaussure Maroquinerie (CTC) of France**
Central Leather Research Institute (CLRI), Chennai, an apex R&D Institution for leather sector, associated as Technology Institution for implementation of the demonstration project

UNIDO, Regional Programme Office and **Leather Technology Mission of Govt. of India**, participated in terms of identifying the appropriate technology and in sharing of cost of the project.

Plant was set up adjacent to CETP and was managed by **Visharam Tanners Enviro Control Systems Pvt. Ltd. (VISHTEC)**, a co-operative company formed by local Tanners



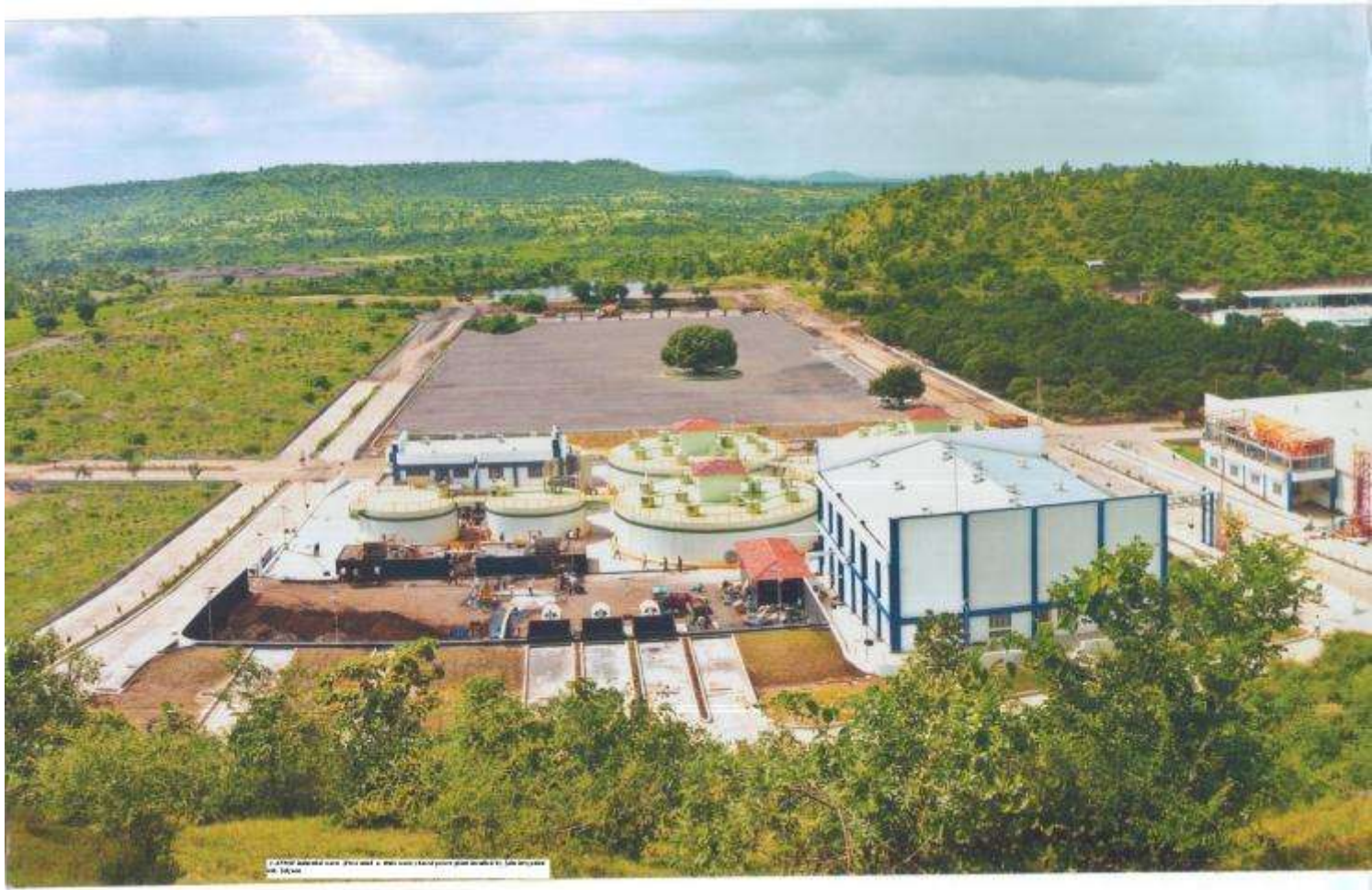
**2500 m³ of Biogas /day based 2000 m³
of Effluent**



**3000 m³ of Biogas /day based on 60 TPD
Solid Waste**

Biomethanation of Slaughterhouse Waste at M/s Al Kabeer, Medak, A.P.

1.66 MW Biogas based Power Plant at Jain Irrigation, Jalgaon, Maharashtra



2.4 MW Poultry Litter based Power Plant at Namakkal, TN





100% BIO GAS ENGINE

**BIO GAS TO 0.5 Mwe POWER PROJECT AT
SURAT MUNICIPAL CORPORATION**

Composition of Compressed Bio CNG

Sr.No.	Parameter	Raw Biogas	BioCNG
1	Quantity (SCMD)	8400	<3300
2	Pressure (bar(g))	0	0.5
3	Methane (%)	60	95
4	Hydrogen Sulfide (ppm)	<3,000	Less than 1 ppm
5	Carbon Dioxide (%)	35	5
6	Moisture(%)	2	- 40° C DP

8000 Kg/day Bio-CNG Plant and Filling Station at Warnanagar, Maharashtra



Bio-CNG Filled Cascades



Biomethanation of Mixed Wastes (Green Waste, Animal & Poultry Manure for | Production of Bio CNG at Anand , Gujarat



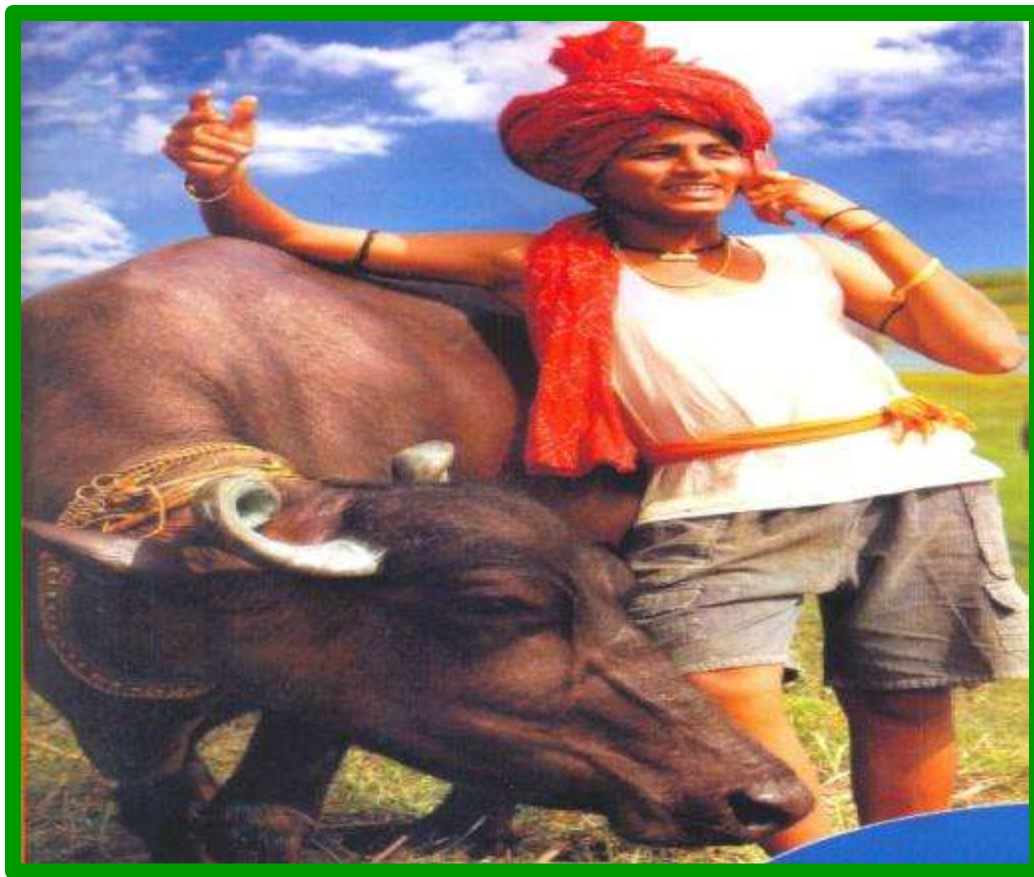
Production Bio CNG at Existing Sewage Treatment Plant Jaipur



End Use of CBG by Plastic Tank Manufacturer

End Use of CBG at Kitchen / Sweet Shop





Thank You for Your Attention