



# Waste-to-Energy and other Renewable Energy Opportunities for Dairy Industry

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# Methane Recovery in Dairy Industry

- Energy Recovery through Biomethanation of:
  - Dairy industry effluents
  - Livestock Waste: 280 Million cattle
- Also leads to reduction in emission of GHGs



# Livestock waste based Biogas Plants

- 4 M household plants
- About 2000 small and medium size biogas plants based on cattle manure for heat, electricity or motive power (5-25 kW)
- 1 MW Cattle manure based biogas project at a dairy colony in Ludhiana, Punjab



# Technology Constraints for cattle dung based plants

- Digesters are unstirred and unheated, causing:
  - Low gas yields in non-summer months
  - Sedimentation and scum formation
- Total dependence on cattle dung, which is not a rich material although easy to work with
- Emphasis has been on low cost systems which were not the best for larger capacities



# 1 MW Cattle manure based biogas project – Case Study

- Demonstration project for power generation from cattle manure
- About 20,000 kWh and 70 TPD organic manure from 235 TPD cattle manure
- Cost – Rs. 13.6 crore
- Based on technology obtained from Austria
- Project commissioned on 4<sup>th</sup> November'04
- Has operated at PLF of upto 90%



**1.0 MW power project based on cattle dung at Haebowal Dairy Complex Ludhiana, Punjab**



# Biogas Potential from Agro-industrial wastes (in MW)

Sugar	363
Pulp and paper	58
Starch	129
Distillery	503
Dairy / Milk processing	69
Slaughterhouse	94
Poultry	65
<b>Total</b>	<b>1281</b>



# Biogas from different wastes

## Likely WTE Capacities

- Distilleries effluent : 1 MW / 30 kL
- Dairies (milk processing) : 100 kW / 3 lakh litres
- Poultry droppings : 1 MW / 0.5 - 1 Million birds
- Cattle dung : 100 kW / 25 TPD



# Some Projects for Energy from Industrial Wastes

- 4000 cum. biogas from Slaughterhouse Wastes
- A number of plants in food processing industries
- 25000 cum. biogas from bagasse wash-water
- 5000 cum. biogas from wheat straw wash-water
- Over 250 distilleries generating biogas for heat and/or power from their wastes/effluents with about 40 MW power generation



## Biomethanation of bagasse wash-water at Tamil Nadu Newsprint and Papers Limited, Karur



## 3000 cum biomethanation project for solid waste at Slaughterhouse in Andhra Pradesh



# Biomethanation of Tapioca Processing wastewater at Varalaxmi Starch, Salem



## 2 MW biogas power at Kanoria Chem, Ankleshwar



# AD of Dairy wastewater: Social and Env benefits

- Generation of heat / electricity or both from waste for use within the dairy industry
- Reduction in CO<sub>2</sub> emissions from fossil fuels
- Production of bio fertilizer



# Advantages of Anaerobic Digestion

1. **Less energy requirement**

*0.5-0.75 KWh energy is needed for removal of 1 kg of COD by aerobic process*

2. **Energy generation in the form of biogas**

*1.2 kWh energy can be produced from 1 kg of COD removed by anaerobic process*

3. **Less biomass (sludge) generation**

*Anaerobic process produces only 20% of sludge produced through aerobic process*



# Wastewater of Typical Milk Processing Plants

<b>Products Manfd</b>	<b>BOD (ppm)</b>	<b>COD (ppm)</b>
Milk Processing	731 – 1,100	1,250 – 3,045
Butter	810-11,595	2,751 – 4,749
Ghee	800-4,500	3,480-13,780
Cheese	8,333 – 50,000	19,504 – 96,000
Powder Plant	2,027-5,999	4,480 -10,854
Integrated Dairy	1,654-4,953	3800-8,631



# Case Study for a typical dairy in Maharashtra

Wastewater generation	: 1000 m <sup>3</sup> /day
COD	: 2000-3000 mg/lit
Biogas generation potential	: 823 m <sup>3</sup> /day
Electricity generation	: 1317 units/day
Initial investment	: Rs.50 lakh (approx.)
Net Saving potential	: upto Rs.16.5 lacs/yr
Simple payback	: 3 years



# Financial Viability of Biogas Projects

- Revenue sources

- Sale of Power
- Sale of Manure / compost
- CER trading under CDM

AND / OR

Treatment Cost / Fee

- Subsidies

- Direct subsidy
- Higher price for power or manure



# Programme on Waste-to-Energy

## Coverage

- Municipal Solid Waste
- Other Wastes : cattle dung, vegetable market waste, slaughterhouse wastes, agricultural wastes and residues
- Biogas generated at Sewage Treatment Plants
- Industrial Wastes and effluents



# Government Support for Biogas Programme in India

- Subsidy for installation – 20-40% of cost
- Preferential tariff for sale of power
- Capacity building through:
  - training of officials and constructors
  - Information dissemination
  - Training of plant users
- Sponsorship for Research and Development
- Monitoring and evaluation



# Government Support (Contd.)

- **Provisions in the Electricity Act 2003**
  - Open access to grid for RE power
  - Preferential tariffs by State regulators
  - Targets for RE power
  - Captive generation decontrolled
- **Fiscal Incentives / Concessions**
  - Customs duty for imports
  - Excise duty for manufacture of RE devices
  - Income Tax



# Programme on Biomass Energy and Co-generation

## COVERAGE

- Biomass gasifiers for thermal and electrical applications in industry.
- Biomass Co-generation Projects.
- Promotional Activities.



# Biomass Co-generation Projects Installed in Paper Mills

- 2.5 MW rice-husk based co-generation power project at M/s K.R. Pulp & Papers Ltd., Shahjahanpur.
- 5.0 MW rice-husk based co-generation power project at M/s Shamli Paper Mills Ltd., Muzaffarnagar.
- 12.0 MW biomass based co-generation power project at M/s Shakumbhari Straw Product Ltd., Moradabad.
- 5.0 MW biomass based co-generation power project at M/s Yash Papers Limited, Darshan Nagar, Faizabad.
- 5.0 MW Biomass based co-generation project at M/s Satia Paper Mills, Muktsar Punjab.



# 12 MW Biomass Co-generation Project at Shakumbhari Straw Products, Moradabad

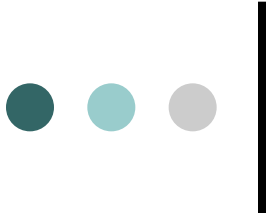


# Other Renewable Energy Options

- Solar Water Heating
- Solar Steam Generation







# THANK YOU

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# Financial Assistance for Biomass Gasifier / Co-gen

- **Thermal and Electrical Applications in Industries**

Rs. 2.0 lakh / 300 KWth for thermal applications.

Rs. 2.5 lakh / 100 KWe for power through dual fuel engines.

Rs. 10 .00 lakh /100 KWe for 100% producer gas engine with gasifiers

- **Electrical Applications in Institutions**

Rs. 15 .00 lakh / 100 KWe for 100% producer gas engine with gasifier

Rs. 10 .00 lakh / 100 KWe for 100% producer gas engine.

- **Biomass Co-generation in industry**

Rs. 20.00 lakh / MWe for installation of Biomass Co-generation projects, including captive projects.



# 1 MW Power Project (Contd.)

## **Imported Components**

- Gas Engine
- Macerator
- Screw Presses
- Gas Holder

## **Spares of imported components indigenised**

- Macerator shaft and mechanical seals
- Sieve cylinders of screw press



# Analysis of methane potential of Indian dairies

<b>Production Capacity (LPD)</b>	<b>No. of units</b>	<b>Biogas potential (m<sup>3</sup>/day)</b>	<b>Emission reduction from treatment power generation (tCO<sub>2</sub>e/d)</b>
50,000	127	8654	250
50,000-100,000	71	22299	643
100,000-200,000	78	54823	1581
200,000-400,000	47	74917	2161
400,000	19	58716	1694
No data	179	80732	2329
<b>Total</b>	<b>521</b>	<b>300,141</b>	<b>8,658</b>