

ANIL AGARWAL DIALOGUE 2015:

**Poor in Climate Change: How the Co-Benefit Agenda of
Short-Lived Climate Pollutants can Work For or Against
People and the Planet**

(Organized by Centre of Science and Environment at IHC New Delhi)

**Is Biogas a Way out of the Biomass-burning
Trap: India's Experience with Biogas**

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Biogas/ Bio-methanation Technology providing a Way out of the Biomass-burning Trap

Tapping Biogas generation potential using Anaerobic Digesters (biogas plants) is a most suitable solution for processing cattle dung and other biomass wastes for:

- ✓ Generating clean gaseous fuel.**
- ✓ Providing bio-manure/ organic fertilizers for enriching soil for sustaining productivity, decreasing due to over-doing of chemical fertilizers, reducing irrigation water.**
- ✓ Preventing women & children from smoke induced diseases.**
- ✓ Reducing environmental pollution through processing of biomass wastes in urban and semi-urban and rural areas.**

Biogas vis-à-vis climate change Agenda

Biogas-Fertilizer Plants help in fighting climate change through:

- **Reducing CH₃ Emission by processing cattle dung/ biomass wastes.**
- **Reducing black carbon emission by replacing biomass & coal fuel burnt in traditional chulhas.**
- **Removing in-door and out-door pollution created through biomass and coal burning thereby improving health and hygiene specially for women and children.**
- **Providing bio-fertilizers as near total replacement of chemical fertilizers which also indirectly reduces pollution from chemical fertilizer factories thereby helping climate change agenda.**
- **Annual CER for a 2m³ biogas plant: 5**
- **Annual CO₂ emission per family from wood combustion: 4.7025 tonne**

Deliverables of Bio-methanation Plants

❑ Bio-methanation technology offers 3-in-1 solution as:

➤ Energy (biogas) Generation Plant.

➤ Organic/ bio-fertilizer Production Plant.

➤ Biomass waste Treatment Plant.

❑ It deserves govt. support and subsidy from the concerned Ministries: Energy, Fertilizer & Agriculture and Urban & Rural Development.

Provisions in Integrated Policy Report of Planning Commission

Section 8.3 of Chapter on “ Household Energy Security : Electricity and Clean Fuels for All” recommends to :

“Provide lifeline entitlement of 30 units of electricity and 6 kg of LPG or equivalent amount of Kerosene for one or both lifeline energy needs through a system of smart/ debit cards with varying levels of direct cash support to targeted households.....”

- Provision of 6 kg of LPG may require about 138 million kg of LPG per month for 23 million BPL families.**
- Biogas plant are one of the most suitable option for rural areas for supplying lifeline energy for cooking and lighting.**
- 1.5 to 2m³ capacity biogas plant per family can provide the recommended lifeline energy to BPL families.**

Bio-energy, Bio-fertilizer and Water Nexus

- **Input: Soil + Fertilizer + Water + Energy (Sun)**
- **Output: Biomass and Food Production**
- **Consumption/ Utilization of Biomass and Food leads to generation of Biomass waste**
- **Complete the Cycle by recycling/ Eco-friendly Disposal of Wet biomass waste to reproduce:**
 - **Bio-energy + Bio-fertilizer + Water**
 - **Send back to soil**
 - **Sustain Food Production and Ecology**

Biogas Technology Demonstration

- **Demonstration of Integrated Technology Package on Biogas-Fertilizer Plants (BGFP) for Generation, Purification/ Enrichment, Bottling and Piped Distribution of Biogas.**
- **Establishment of Business Model for Demonstration of an Integrated Technology Package for creation of smokeless villages using biogas/ bio-energy systems and meeting 'Life-line Energy' envisaged in 'Integrated Energy Policy'.**



Types of predominant fuels used for cooking

(As per census of India 2011)

Sl. No.	Type of fuel used for cooking	Total (%)	Rural (%)	Urban (%)
1.	Fire-wood	49.14	62.5	20.1
2.	Crop Residue	8.88	12.3	1.4
3.	Cow dung Cake	7.97	10.9	1.7
4.	Coal, Lignite, Charcoal	1.45	0.8	2.9
5.	Kerosene	2.91	0.7	7.5
6.	L.P.G.	28.64	11.4	65.0
7.	Electricity	0.1	0.1	0.1
8.	Biogas	0.4	0.4	0.4
9.	Any other	0.49	0.6	0.2
10.	No Cooking	0.3	0.2	0.5

Estimated Biogas Requirement for Replacing Firewood, Cattle Dung Cake and Crop Residue as Cooking Fuel

✓ Population in India:	1270 million
✓ Estimated No. of Households:	191 million
✓ Estimated Households using Firewood, Cattle Dung Cake and Crop Residue:	120 million
✓ Estimated Quantity of Biogas Required for Cooking @ 2 cum per Households per day:	240 million cum

Biogas-fertilizer Plant Potential in India

1. Cattle Dung based biogas Potential:

➤ Cattle population:	Over 299.9 million
➤ Dung collected: (@ 5kg per cattle per day)	1448.35 million kg/day
➤ Estimated Biogas Generation:	59.98 million m ³ /day
➤ <u>Estimated LPG equivalent:</u>	25.75 million kg/ day
➤ Bio-fertilizer:	1116.26 million kg/ day

2. Surplus crop residue/ biomass based potential:

➤ Surplus crop residue/ biomass:	38.52 million ton/ yr.
➤ Estimated biogas generation:	10.55 million m ³ /day
➤ <u>Estimated LPG equivalent:</u>	4.59 million kg/ day
➤ Bio-fertilizer:	28.96 million ton/ yr.

➤ Contd.

Biogas-fertilizer Plant Potential in India

3. De-oiled cake based biogas potential: (4,00,000 ha of Jatropha plantation)

- Estimated biogas generation: 0.263 million m³/yr.
- Estimated LPG equivalent: 0.114 million Kg/ yr.

4. Poultry Litter based potential:

- Total Poultry population (2012): 729.2 million
- Estimated bird litter production
(@20g/ bird/ day): 14.584 million kg/ day
- Estimated Biogas production
(@116 ltr/ kg): 1.69 million m³/ day
- Estimated LPG equivalent: 0.73 million kg/ day

Contd.

Biogas-fertilizer Plant Potential in India

5. Sheep, Goats, Pigs, Horses, Mules, Camel, Donkeys Population:

212 million No.

- **Dung collected:** 424 million kg/day
(@ 2kg per animal/ day)
- **Estimated Biogas Generation:** 16.96 million m³/day
- **Estimated LPG equivalent:** 7.37 million kg/ day
- **Bio-fertilizer:** 318.79 million ton/ day

- **Total Biogas Generation Potential:** 89.43 million m³/day
- Or By considering double dung collection:** 155.83 million m³/day

- 6. **Kitchen waste based potential:** Considerable.
- 7. **Urban Biomass Waste Potential:** Considerable.
- 8. **Industrial Biomass Waste Potential:** Considerable.

Biogas Dissemination Programmes

- **National Biogas and Manure Management Programme (NBMMP).**
- **Biogas Based Distributed/ Grid Power Generation Programme.**
- **Demonstration of use of Biogas from Kitchen Waste/ Effluent Treatment Plants.**
- **Recovery of Energy from Industrial Wastes.**
- **Recovery of Energy from Urban Wastes.**

Biogas Installations

1. NBMMP:

- **Launched as NPBD in 1981. Renamed as NBMMP in 2002-03.**
- **Estimated potential of biogas plants: 120 lakh Nos.**
- **Cumulative Biogas plants installed: 47.95 lakh (upto December 2014)**
- **Potential harnessed: about 40%.**

2. Biogas based Power/ Bio-CNG:

- **Biogas based Energy Systems: 4.07 MW**
- **Waste to Energy (Off-Grid): 141.27 MW**
- **Waste to Power (Grid connected): 107.58 MW**

Challenges



Indian Biogas Scenario

- ✿ Scattered market
- ✿ No established player at national level
- ✿ Market needs someone offering end to end solution
- ✿ Experienced and skilled workforce is lacking
- ✿ Government active intervention is needed
- ✿ Promotion of organic crops is lacking
- ✿ Different approach is needed for small, medium and large scale biogas plant promotion
- ✿ Supply chain management is to be streamlined

Establish Biomass Waste Resource Banks (BWRRBs) and Gandhi Committee and Treat biomass Wastes Young

- **Handle biomass wastes at the source of their origin immediately before they become dirty to handle requiring special manpower and transport to take them to landfills and STPs.**
- **Establish highly decentralized ‘Biomass Waste Resource Banks (BWRRBs)’ for collecting, sizing and storing biomass waste to feed bio-methanation, gasification, combustion based energy and bio-fertilizer producing plants.**
- **Establish Gandhi Committee in each village to facilitate sustenance of BEFCI.**

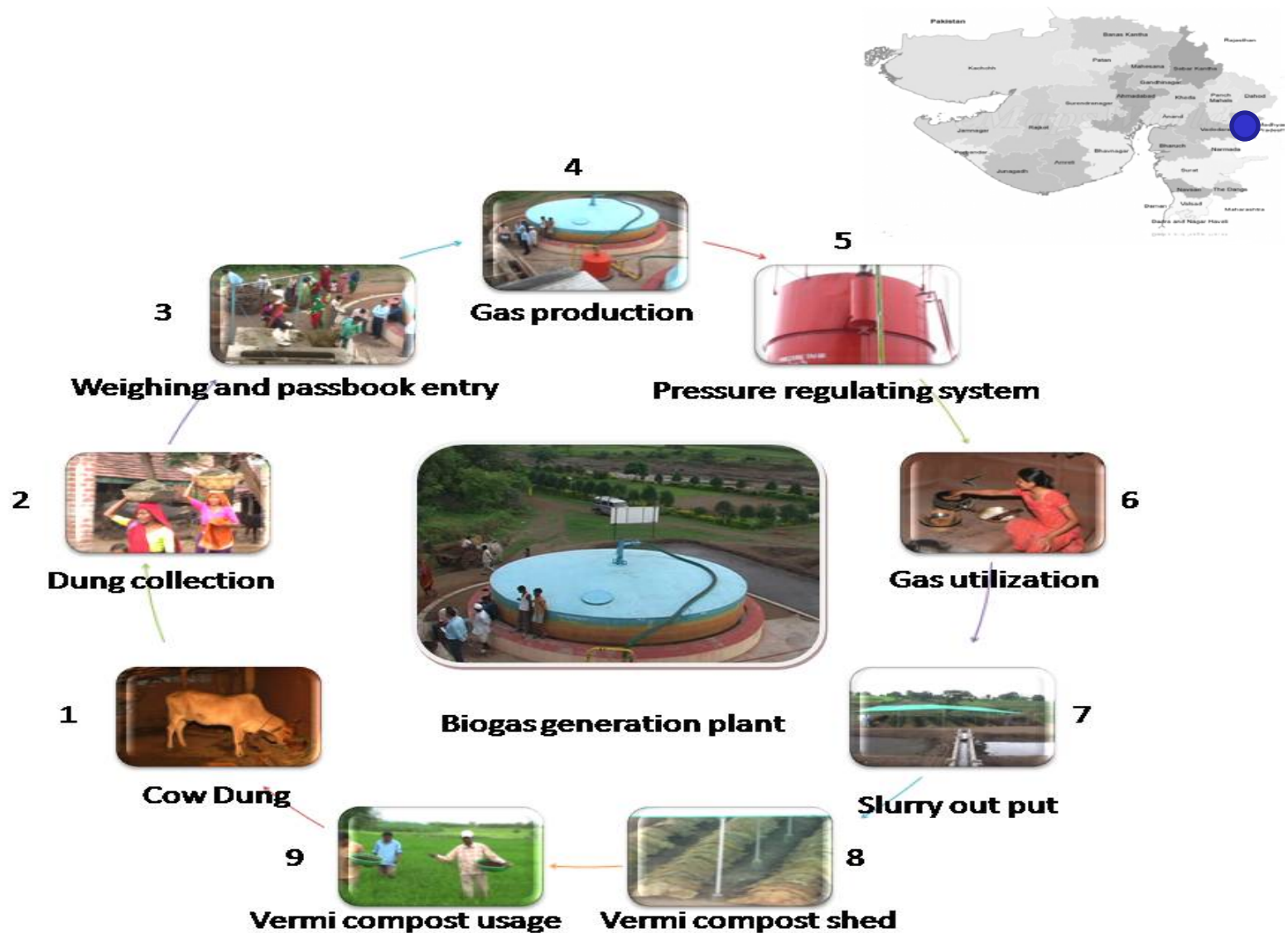
‘Hybridization’ of suitable renewable energy technologies with Bio-energy/ Biogas Technopologies

- ‘Hybridization’ of a set of suitable renewable energy technologies, generally nucleated around bio-energy/ bio-methanation technologies, for a location is to be the ‘mantra’ for sustainable energy and organic fertilizer supply for sustainable and environment friendly development.**
- Instead of competing for each other, strengths of one is to be used for overcoming weaknesses of the other renewable energy technology.**
- This requires good ‘technology integrators’.**

Limited biomass Production/ Managing 4 Fs

- Bio-energy/ Biogas sector has got a major constraint in the form of limited supply of biomass.**
- Biomass time cycle for production, huge land area requirement being used for fuel, food, fodder and fertilizer (organic fertilizer/ bio-fertilizer).**
- 4 Fs will have to be balanced to avoid controversies.**
- The policies, strategies and projects and programmes to be well knitted for meeting competing needs of land for industrial, energy, housing, institutional and agricultural sectors.**

Socio-economic model of Biogas: Gobar bank



Project Uniqueness

- Bhitbhudrak model showed the importance of social engineering along with technology to make biogas a success
- The design was kept very simple and yet robust
- The length of pipeline in the village is 2500 meters
- The villagers are facilitated with cleaner and consistent source of energy for cooking
- Improved economics of village:
 - By way of providing more earnings from dung
 - By way of improved crop production because of use of organic fertilizer
- Improved health and hygiene
- Providing smoke free atmosphere into kitchen
- Providing cleaner environment in to village
- Women empowerment

Entrepreneurial Opportunity in the Area of Biogas-Fertilizer Projects

- **Promoting installation of pre-fabricated biogas plants based on HDPE, RCC, FRP, ferro-cement, membrane based flexi, Metallic and combination thereof including in-situ construction using moulds.**
- **Development and registration of biogas-fertilizer companies/ entrepreneurs (BGFCOs)/ BGFES).**
- **Installation of biogas-fertilizer plants through CDM route.**
- **Development and registration of biogas-fertilizer companies/ entrepreneurs for providing interest free loans.**

Entrepreneurial Opportunity in the Area of Biogas-Fertilizer Projects

- **Financing and implementation of family type biogas plants through banks, IREDA and other financial institutions.**
- **Installation of biogas plants for meeting cold storage/ space cooling/ refrigeration requirements.**
- **Installation of prefabricated kitchen/ garden waste based $\frac{1}{4} \text{ m}^3$, $\frac{1}{2} \text{ m}^3$, $\frac{3}{4} \text{ m}^3$ and 1 m^3 biogas plants primarily as 'Waste disposal plants' in various households following locality/ cluster saturation approach.**

Entrepreneurial Opportunity in the Area of Biogas-Fertilizer Projects

- **Marketing and project generation on Medium size biogas plants for various applications.**
- **Creation of Workforce for execution and taking lifetime operational contracts for quality and timely execution and maintenance of biogas projects.**
- **Taking Projects on Built, Operate and Transfer (BOT) basis.**
- **Taking Projects on Built, Operate Lease and Transfer (BOLT) basis.**
- **Taking projects on Built, Own & Operate (BOO) basis.**

Suggestions for Promoting Biogas-Fertilizer Sector

- **Mandatory provision for installation of Biogas-Fertilizer plants.**
- **Introduction of financial incentives for Bio-fertilizers and Bio-pesticides similar to chemical fertilizers.**
- **Introduction of tariff based incentive for biogas production through gas companies like IGL, Indane, HP, etc.**
- **Introduction of Generation based Incentives for biogas based Power.**

Financial Viability of Biogas-Fertilizer Projects

- **Revenue sources from the project**
 - ✓ **Sale of Power**
 - ✓ **Sale of Biogas**
 - ✓ **Sale of Bio-fertilizer and Bio-pesticide**
 - ✓ **CERs**
 - ✓ **Sale of CO₂**
- **Government Support:**
- **Financial Incentives for installation of plants.**
- **Fiscal Incentives:**
 - **Customs and Excise Duty Exemption**
 - **Income Tax concessions**

Government Support for Biogas Programmes

- **CFA/ Subsidy for installation – 20-50% of cost**
- **Administrative costs**
- **Capacity building through:**
 - **Training of officials, plant operators/users**
 - **Information dissemination**
- **Sponsorship for Research and Development**
- **Provisions in the Electricity Act 2003**
 - **Open access to grid for RE power**
 - **Preferential tariffs by State regulators**
 - **Targets for RE power**
 - **Introduction of Renewable Energy Certificates**
 - **Captive generation decontrolled**

Suggestions for Promoting Bio-methanation Sector

- **Exemption from VAT and other taxes.**
- **Preparation of standards for compressed Biogas (CBG) and Bio-fertilizer and bio-pesticide.**
- **Acceptance CBG as vehicular fuel.**
- **Development of ABG cylinders.**

Central Financial Assistance under National Biogas and Manure Management Programme

Category	CFA (2-6 m³ Plant) (Rs.)	CFA (1 m³ Plant) (Rs.)
1. NER States	17,000/-	15,000/-
2. Plain areas of Assam	11,000/-	10,000/-
3. Notified hilly areas, J&K, SC & ST	11,000/-	7,000/-
4. All other States	9,000/-	5,500/-
5. Turn key Job-fee	1,500/-	

Potential Sites Generating Biomass Wastes in cities

- **All households – kitchen and garden wastes in housing colonies/ complexes .**
- **All the kitchens of hotels, restaurants, canteens, hostels of institutions, industries and organizations.**
- **All the parks, gardens, plantation/ green reserves.**
- **Sewage/ liquid effluents.**

Industrial origin

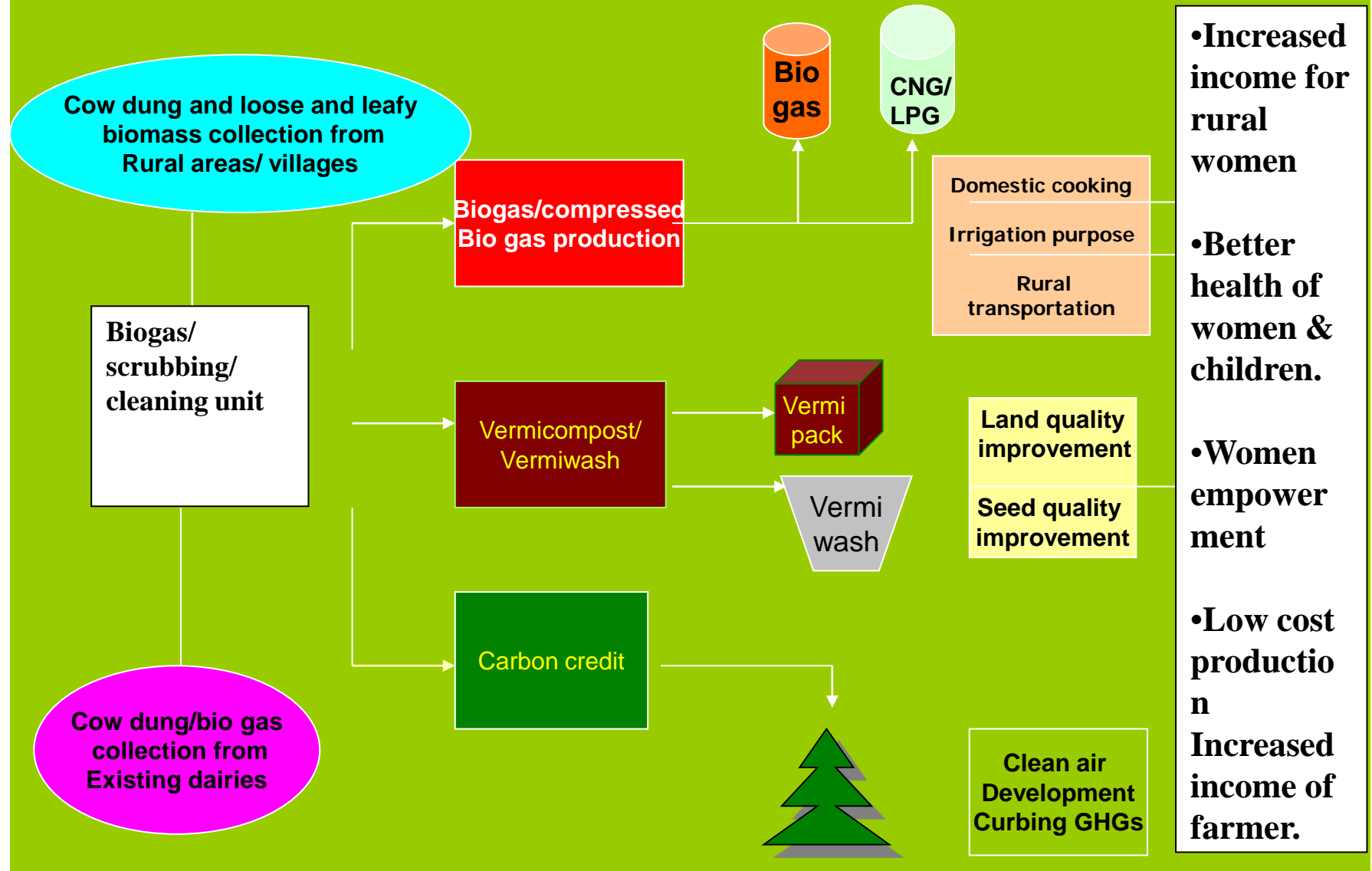
- Cow Dung, poultry litter
- Agricultural residues as rice straw, banana stem, maize stalks
- Sugar mill press mud, Distilleries spent wash, Sago plant effluent
- Municipal Solid Waste, slaughter house waste, vegetable market waste, kitchen waste
- Silage from agricultural crops as Napier grass, Sugar beet, Sugar cane, Maize



Prioritization/ earmarking Biomass wastes for various Bio-energy Plants

- **Need to priorities/ earmark biomass wastes for various bio-energy technologies-combustion, gasification, bio-methanation and bio-liquid fuels (bio-diesel and bio-alcohol).**
- **Loose and leafy and wet biomass wastes (including cattle dung) to be supplied for bio-methanation plants (for production of gaseous energy and organic/ bio-fertilizer) instead of combustion and gasification.**
- **The hard and woody biomass wastes may be supplied for combustion and gasification.**

Schematic Diagram for Hybridization of Bio-energy: Biogas-Fertilizer Plants



Central Financial Assistance under Biogas based Distributed/ Grid Power Generation Programme (BPGP)

Power generating capacity	Biogas plant capacity	CFA/subsidy limited to the following ceiling or 40% of the cost of the system whichever is less.
3 -20 kW	25 cu. m to 85 cu.m	Rs. 40,000 per kW
>20 kW to 100 kW	Any combination of above plants or alternate capacity /design	Rs. 35,000 per kW
>100 kW to 250 kW	Any combination of above plants or alternate capacity / design	Rs. 30,000 per kW

Sintex make Small Capacity prefabricated kitchen waste based biogas plant, New Delhi



Pre-fabricated Biogas Plant for Urban and Semi-urban areas



Pre-fabricated Biogas Plant for Urban and Semi-urban areas



Prefabricated high rate digester for rapid biogas production developed by IICT



Biogas in Use for Cooking

Biogas Flame



Biogas Burner in Use





**Biogas based power generation at Sanjivini,
Nagpur**

BGFP Plant at Ashoka Biogreen, Talwade, Nasik (Maharashtra)



Purified and Bottled Biogas from MNRE Project being used in a School at Nashik, Maharashtra

Purified Biogas Cascade



Biogas Burner in Kitchen



Biogas, Enrichment and Bottling unit



Capacity:
20 Nm³ raw biogas per hr
End use:
Vehicular and Thermal



Purified and Bottled Biogas from MNRE Project being used in a School at Nashik, Maharashtra

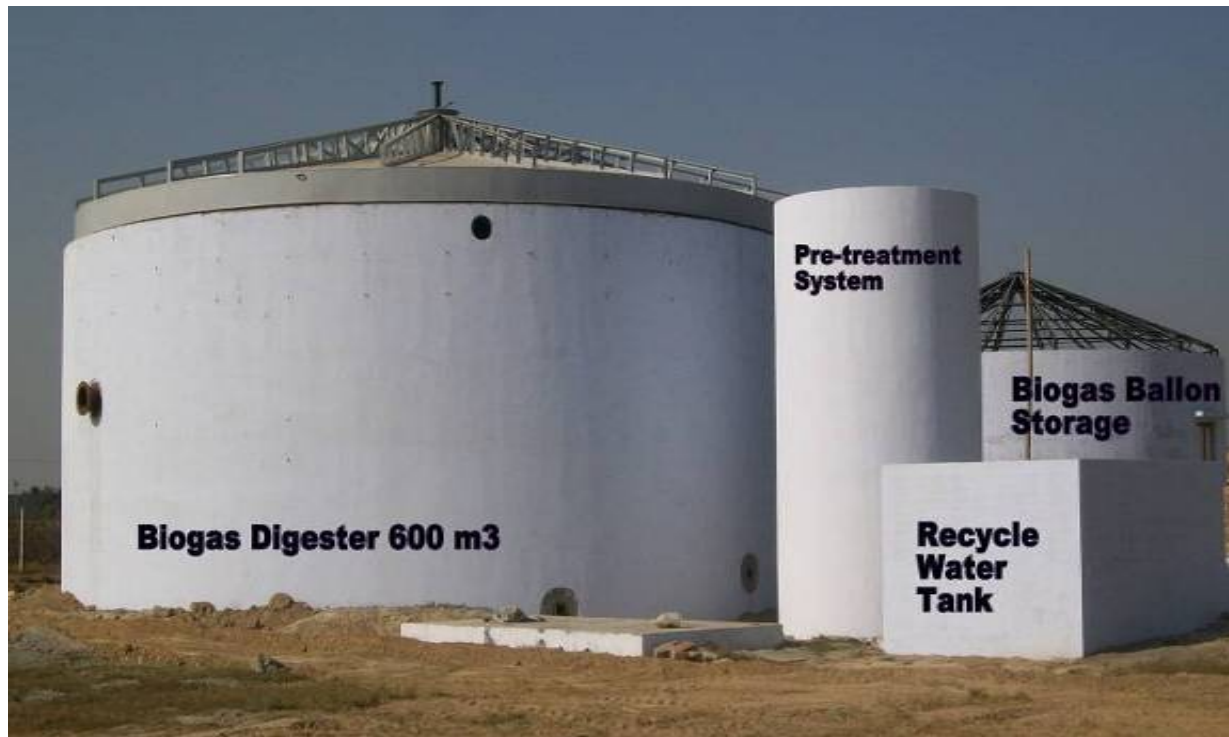
LPG Bank being replaced



Biogas Supply Regulator



BGFP project at Abohar, Ferozepur, Punjab, India





Highlights

- Developed on a BOOT (Build, Own, Operate and Transfer) basis
- Daily capacity of approximately 100 tons, or 35,000 annual tons, of sugarcane waste (pressmud)
- Daily production of approximately 7,000 to 9,000 kg's of Bio-CNG per day
- PESO (Petroleum and Explosives Safety Organization) License for storage and filling of Bio-CNG in high pressure cylinders
- Daily production of organic manure/soil conditioner after further processing for commercial sale
- NOCA (National Organic Certification Association) approved organic manure for further sale to farmers
- MNRE (Ministry of New and Renewable Energy) approved investment subsidy received in early 2013
- Substantial cost savings for industrial customers due to low-cost Bio-CNG use

Biogas, Enrichment and Bottling unit at Jaipur - I



Indigenously developed LPSA system

Biogas, Enrichment and Bottling unit at Jaipur - II



Buffer balloons

PEDA 1 MW Biogas Plant, Ludhiana







**Biogas cylinders
at
Bakrol, Dist Vadodara**



**Biogas used in community cooking at
Muni Seva Ashram, Hospital kitchen,
Goraj District- Vadodara**



Biogas flame

Bio-fertilizer



THANK YOU
For your attention!

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Central Financial Assistance under Energy Recovery from Industrial Wastes Programmes

Bio-methanation of Low Energy Density & Difficult Wastes: Rs. 1 crore/ MWeq (12000 Cu.m. biogas per day)	Power generation from Solid Industrial Waste (Boiler + Steam Turbine): Rs. 20 lakh/ MW	Power generation from Biogas (Boiler + Steam Turbine): Rs. 20 lakh/ MW
Bio-methanation of other Wastes: Rs. 50 lakhs/ MWeq (12000 Cu.m. biogas per day)	Power generation from Biogas (Biogas Engine/ Turbine): Rs. 1 crore/ MW	
*Limited to 20% of Project cost	*Limited to Rs. 5.0 crore per Project	*For Special Category States: 20% higher than that of other States

Application-wise Biogas Plants installed, Estimated Biogas Production and Power Generation capacity

Sl. No.	Type of Biogas Plants	No. of Biogas Plants installed	Estimated Biogas Production capacity	
			In million m ³ per day	Power Generation
1.	Family size Biogas Plants for cooking applications.	4.655 million	9.31	For cooking
2.	Small size Biogas plants for electricity generation.	191 (327*)	0.031775 (0.058125*)	3.15 MW (5.932 MW*)
3.	Large size Biogas power generation Plants based on Urban and Industrial wastes	123	1.2697	156.113 MW
	Total	46,55,450	10.6097	159.363 MW

* sanctioned.